UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

August 6, 2007

CAPT Kevin Slates, CEC, USN
Commanding Officer
NAVFAC Washington
Washington Navy Yard, D.C. 20374-5018

Re: Five Year Review Report, Multi-Site NSWC White Oak

Dear Captain Slates:

The U.S. Environmental Protection Agency (EPA) Region III has reviewed the report entitled "Final Five-Year Review For OU 2 & OU 3 (Apple Orchard Landfill and Surface and Groundwater), Site 4 (Chemical Burial Area), Site 5/13 (Open Burn and Oil Sludge Disposal Areas), Site 7 (Ordnance Burn Area), Site 9 (Industrial Wastewater Disposal Area), Site 11 (Industrial Wastewater Disposal 100 Area), Site 49 (TCE Groundwater Plume in the 400 Area), and SWMU 87". The report was prepared to address the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 (c) five-year review requirements. EPA has reviewed this five-year review report and has compared it to the OSWER Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance* (EPA, June 2001). EPA concurs with the Navy's determination that the remedies in place are protective of human health and the environment.

EPA's Region 3 would like to congratulate the Navy in preparing a multi-site five-year review report that meets the intent of EPA's Five-Year Review Guidance Document.

If you have any questions, please contact Bruce Beach at (215) 814-3364.

Sincerely,

James Burke

James Burke, Director
Hazardous Site Cleanup Division

cc: Mr. John Fairbank, Maryland Dept of the Environment
Mr. David Steckler, NAVFAC Washington

Final Five-Year Review

For

OU 2 & OU 3 (Apple Orchard Landfill and Surface - and Groundwater)
Site 4 (Chemical Burial Area)
Site 5/13 (Open Burn and Oil Sludge Disposal Areas)
Site 7 (Ordnance Burn Area)
Site 9 (Industrial Wastewater Disposal Area)
Site 11 (Industrial Wastewater Disposal 100 Area)
Site 49 (TCE Groundwater Plume in the 400 Area)
SWMU 87

Former Naval Surface Warfare Center
White Oak, Maryland

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington

Contract Number N62477-03-D-0163

Contract Task Order 0011

April 2007

Navy Five-Year Review Signature Cover
Key Review Information

Site Identification	
Environmental Restoration Sites: Operable Units 2 and 3 (Apple Orchard Landfill and Surface- and Groundwater); Site 4 (Chemical Burial Area); Site 5/13 (Open Burn and Oil Sludge Disposal Area); Site 7 Ordnance Burn Area; Site 9 (Industrial Wastewater Disposal Area); Site 11 (Industrial Wastewater Disposal Area 100 Area); Site 49 (TCE groundwater Plume 400 Area); and Solid Waste Management Unit 87	EPA ID: MD0170023444

Region: 3	State: MD	City/County: Silver Spring/Montgomery

Fund: BRAC	Lead Agency: Department of the Navy, NAVFAC, Washington
NPL Status: Not Listed	
Review Conducted by: NAVFAC Washington	Next Review: 2011

Protectiveness Statement

The remedies for the Sites identified above are currently protective of human health and ecological receptors. Land Use Controls have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. At OU 2/3, Site 5/13, Site 7, Site 9, and Site 11, the source and groundwater treatment systems are effective in reducing the concentrations of contaminants that may migrate off-site. At Site 4, Site 49, and SWMU 87, where the remedies are under construction, the active components of the remedies need to be installed to ensure long-term protectiveness. Groundwater monitoring and five-year reviews also help to ensure that the remedial actions continue to remain protective of human health and the environment.

23 APR 2007

Kevin Slates, CAPT, CEC, USN
Commanding Officer
NAVFAC Washington

Robert Lewandowski
BRAC Environmental Coordinator
BRAC Program Management Office

OU 2

Final Five-Year Review

For

OU 2 and OU 3
Apple Orchard Landfill and
Surface- and Groundwater

Former Naval Surface Warfare Center
White Oak, Maryland

Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington

Contract Number N62477-03-D-0163

Contract Task Order 0011

April 2007

Final Five-Year Review

For

OU 2 and OU 3 (Apple Orchard Landfill and Surface- and Groundwater)

Former Naval Surface Warfare Center White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
JM Waller Associates
9249 Old Keene Mill Road
Burke, VA 22015

CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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FIGURES

LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
EBS	Environmental Baseline Survey
EISB	Enhanced In-situ Bioremediation
EOS	Emulsified Oil Substrate
NSWC-WO	Naval Surface Warfare Center – White Oak
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls – Remedial Design
MCL	Maximum Contaminant Level
MCS	Media Clean-up Standard
MDE	Maryland Department of the Environment
MSL	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCOC	Potential Contaminant of Concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision

RPM	Remedial Project Manager
SI	Site Inspection
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedies for Operable Unit (OU) 2 and OU 3 at the former Naval Surface Warfare Center – White Oak (NSWC-WO) in Silver Spring, Maryland, are protective of human health and the environment. The methods, findings, and conclusions of the OU 2 and OU 3 Five-Year Review are documented in this report. In addition, issues found during the review and recommendations to address them are also included in this document.

Site 1 (Parking Lot Landfill) and Site 2 (Apple Orchard Landfill) are both landfills which were investigated simultaneously and portions of Site 1 were remediated along with Site 2. The OU 2 ROD includes the soil, waste and sediment at both sites 1 and 2. The OU 3 ROD includes the groundwater underlying and surface water adjacent to Sites 1 and 2. All references to OU 2 and OU 3 in this Five-Year Review include both Sites 1 and 2.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore, the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of OU 2 and 3 on June 21, 2006. This is the first Five-

Year Review for the former NSWC-WO sites. The triggering action for this statutory review was the initiation of remedial actions at OU 2. The Five-Year Review is required for OU 2 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. OU 2 – APPLE ORCHARD LANDFILL

OU 2 was identified as a Navy Installation Restoration Program (IRP) site in an Initial Assessment Study (IAS) conducted by the Navy's Naval Energy and Environmental Support Activity (NEESA) in 1984.

The IAS found that Site 1 was used for waste disposal from 1948 to 1953. Material disposed of included trash, metal scrap, construction debris, lubricating oil, storage batteries, metal plating wastes, and vehicle maintenance shop wastes. Other than reports that 60 automobile batteries were disposed, the IAS reports no information regarding the quantity of wastes disposed. It is estimated that Site 1 contains a total of 10,000 cubic yards of fill and waste.

The IAS found that OU 2 was used from 1948 to 1982 for waste disposal. Wastes reportedly disposed of included fill dirt, construction rubble, polychlorinated biphenyls (PCBs), various solvents (including xylene, acetone, dry cleaning solvents, and lacquer thinner), paint residue, acids, phenols, and other waste chemicals. The IAS estimated that approximately 2,300 gallons of these materials were disposed of at OU 2 during each year of disposal. Additionally, the IAS found that carbon tetrachloride and methyl ketone may have been disposed of at the Apple Orchard Landfill and that between 500 and 1,000 gallons of oil containing PCBs were deposited in the landfill in 1957-58. In addition, an unknown quantity of ordnance shapes (metal vessels used during research at the former facility), were disposed in the landfill. Ordnance shapes are not likely to contain hazardous substances and are considered to be inert, low-hazard military wastes. It is estimated that OU 2 contains a total of 75,000 cubic yards of fill and waste.

The findings of initial soil, surface water, groundwater, and sediment investigations are reported in a Confirmation Study/Verification Phase Report (Malcolm Pirnie, 1987). These investigations were conducted to confirm the findings of the IAS and to further characterize site conditions.

A remedial investigation (RI) was performed at OU 2 which included two phases of investigations in January 1989 and March 1992 and resulted in a draft RI in March 1992. Additional surface and subsurface soil, groundwater sediment and surface water samples were collected and a soil gas survey was performed during these investigations.

An additional investigation of OU 2 was completed as part of a Design Verification Study (HNUS, 1995), which included record reviews, terrain conductivity surveys, test pit placement, and subsurface soil and sediment sampling.

In June 1996, the Navy, GSA, and the Army agreed on the disposition of the Federal Research Center (FRC) (formerly the Dahlgren Division, White Oak Detachment, Naval Surface Center) at White Oak in Silver Spring, Maryland, from the Navy to GSA (662 acres) and to the Army (48 acres).

The results of additional investigations of OU 2 completed between November 1998 and April 1999 are included in a RCRA Facility Investigation (RFI) report (TtNUS, 2000). The RFI included further characterization of soil (primarily surface), groundwater, surface water, and sediment.

The final investigation related to OU 2 was completed as part of a Base-wide Ecological Risk Assessment (BERA) (TtNUS, 2001a).

A Corrective Measures Study (CMS) for OU 2 (TtNUS, March 2001) was completed in 2001 and developed alternatives for eliminating unacceptable risks identified by the RI. The CMS also meets the requirements of a CERCLA Feasibility Study (FS).

The Record of Decision (ROD) for OU 2 soil, waste and sediment was signed in July 2001.

A Memorandum of Understanding (MOU) was signed between the Navy and GSA in June 2005, which defines the rights and responsibilities of each party as they apply to the OU 2 landfill.

2.2. OU 3 – SURFACE WATER AND GROUNDWATER RELATED TO OU 2

OU 3 addresses the groundwater underlying OU 2 and the surface water adjacent to it. A remedial investigation (RI) was performed to characterize the soils, groundwater, and surface water at OU 2. The investigation, performed in two phases, January 1989 and March 1992, resulted in a draft RI in March 1992.

A facility-wide groundwater investigation was completed in the spring and summer of 1997. The investigation included the sampling of all existing groundwater monitoring wells and piezometers and the installation and sampling of new temporary and permanent groundwater monitoring wells in the areas of the base proposed for reuse. The groundwater quality was similar to that found during previous studies (B&R Environmental, 1997).

A Corrective Measures Study (CMS) for OU 2, which included groundwater, was completed in 2001 and developed corrective measures for eliminating unacceptable risks identified during the RI. Based on the CMS recommendation, a Proposed Plan was developed for the remedial action, and a public meeting was held in March 2001 to solicit comments.

The ROD for OU 3 groundwater and surface water was signed in September 2004. The selected remedy includes natural attenuation, institutional controls, and long-term monitoring of surface water and groundwater.

3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 OU 2 and OU 3 Physical Characteristics

The OU 2 landfill source area is approximately 5.5 acres in size. The geology underlying OU 2 has been characterized based on the results of borings located around the perimeter of the landfill and test pits along its northern edge. The physical features of OU 2 are shown in figure 3-1. The thickness of the landfill was estimated by comparing the topography prior to landfill activities to the present topography. The depth of the landfill thickens from approximately 4 feet at Perimeter Road, which is at the northern boundary of former NSWC-WO, to about 36 feet at the edge of the landfill plateau. Test pits along the northern perimeter and northeastern corner of the landfill revealed sand with silt and gravel and concrete and asphalt as the fill material (Halliburton NUS, 1995c).

The native material surrounding OU 2 consists of a thin mantle of soil resting on the saprolite of the Wissahickon gneiss. The shallow surface material is variable, ranging from clayey silt to sandy silt to gravel with a thickness of 2 to 6 feet. The saprolite ranges in thickness from 8 feet along the unnamed tributary to greater than 49 feet along the northern edge of the site. Bedrock was encountered along the southern perimeter of the landfill approximately 10 feet below ground surface (bgs), and 30 feet in the northwestern corner of OU 2.

Groundwater at OU 3 is unconfined and present in the saprolite, bedrock and, to a lesser extent, the surface soils along the surface drainage pathways. The depth to the water table at OU 3 ranges from approximately 3 to 4 feet bgs along the toe of the landfill to 32.5 feet bgs along Perimeter Road. Based on a comparison of available groundwater elevations and predevelopment topographic maps of OU 2, it is unlikely that groundwater would be in contact with wastes within the OU 2 landfill. Groundwater flows radially from the northwestern corner of the site to the southeast, discharging at least in part to the unnamed stream to the south. The mean hydraulic conductivity of the saprolite has been calculated to be 9.58 feet/day and 7.66 E-2 feet/day for the bedrock.

3.2. LAND AND RESOURCE USE

Currently, the majority of property occupied by Sites 1 and 2 is wooded and/or open space with a small, paved parking area at Site 1. The property is owned by the GSA. GSA has used part of Site 1 for the construction of a power plant to support future buildings and tenants and the property is not anticipated to be used for residential purposes. Adjacent property is to be developed for commercial/industrial purposes. The buildings constructed as part of this development will be leased to the FDA. The anticipated future use of Sites 1 and 2 is also commercial/industrial use. Private property immediately north of the former NSWC-WO is used for residential purposes. An apartment complex is located on private property less than 100 feet to the north of OU 2.

Groundwater at OU 3 is not used as a potable water supply at this time and there is no known plan to use the impacted groundwater. In addition, water for occupants of the former NSWC-WO and the surrounding properties is, and is expected to continue to be, supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable wells where a public supply is readily available.

3.3. NATURE AND EXTENT OF CONTAMINATION

Twenty surface soil samples were collected at OU 2 for EPA TCL and TAL analysis. An additional nine samples were analyzed for PCBs. Ten subsurface soil samples were collected at OU 2. No contaminants of concern (COCs) were identified in OU 2 soils for the anticipated commercial/industrial use of the property. While residential use is not anticipated, PAHs and PCBs were determined to be COCs under this use. PAHs have been determined to be COCs for ecological receptors. Lead has been detected at a maximum concentration of 1,510 mg/kg in Site 1 surface soils and has been determined to be a COC under the planned industrial use of the property. Arochlor 1260, PAHs, mercury and zinc are COCs for ecological receptors in Site 1 soil, while the PAHs are COCs for ecological receptors in OU 2 soils.

A total of nine groundwater monitoring wells at OU 3 have been sampled. The results of the groundwater sampling indicate that hazardous substances disposed in both the Site 1 and Site 2 landfills have migrated to downgradient groundwater.

Thirteen Volatile Organic Compounds (VOCs) were detected in groundwater and three of them (trichloroethene (TCE), 2-butanone and acetone) exceeded both MCLs and tap water RBCs for one or more rounds of sampling. TCE was consistently detected at up to 35 ug/L in two wells (02GW32 and 02GW102) during the first four rounds of sampling in 1999. Since then, only one TCE exceedance has been detected at one location (02GW32) during the first round of post-closure monitoring.

Six Semi-volatile Organic Compounds (SVOCs) were detected in groundwater samples, and only bis (2-ethylhexyl) phthalate exceeded both its MCL and tap water RBC for one round of sampling.

No pesticides or PCBs were detected in groundwater samples.

Four explosives were detected in groundwater samples and one of these (RDX) exceeded its tap water RBC concentration.

Eighteen metals were detected in groundwater samples and six of these (aluminum, arsenic, iron, lead, manganese and thallium) exceeded both their MCL and tap water RBC for one or more rounds of sampling.

Perchlorate was detected in one well during the first round of sampling at a concentration of 5.89 ug/L, which is higher than its tap water RBC of 22.5 ug/L.

A total of fourteen sediment samples were collected for TCL/TAL analysis and an additional nine samples were collected for PCB analysis. The results of sediment sampling indicate that Arochlor 1260 and PAHs have migrated from Site 1 and/or 2 to sediment within a drainage swale and intermittent stream and that these compounds are COCs for ecological receptors. The maximum detected concentrations for Arochlor 1260 and total PAHs in sediment are 143 mg/kg and 41 mg/kg, respectively. Sediments requiring remediation as part of this action are limited to a drainage swale and an intermittent stream which are part of OU2. This intermittent stream is a tributary of Paint Branch, which is designated as Class III – Natural Trout Waters [Code of Maryland Regulations (COMAR) 26.08.02]. Based on the conceptual site model, the sediment COCs could eventually migrate to Paint Branch.

Eight VOCs were detected in surface water samples and only one, tetrachloroethene (PCE) at 5.6 ug/L, exceeded both its MCL and tap water RBC for one round of sampling.

A single detection of perchlorate (5.6 ug/L) exceeded the provisional tap water RBC of 22.5 ug/L. No other explosives were detected in surface water samples.

Twelve metals were detected in surface water samples and three of them (iron, lead and manganese) exceeded both their MCL and tap water RBC for one or more rounds of sampling.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

A streamlined risk assessment was performed for the landfill source areas consisting of an evaluation of surface and subsurface soil data for OU 2 to determine which hazardous substances may present an unacceptable risk to human health. Per EPA Military Landfill Guidance , a detailed assessment of risk posed by these source areas and identification of COCs within a landfill source area is not required because any unacceptable risks posed by the source area will be mitigated by the presumptive containment remedy. However, in this case, part of the landfill source area will likely be excavated for consolidation under the planned containment area. As a result, COCs have been identified below based on an evaluation of available surface and subsurface soil data.

Based on available data, lead is the only known COC for human health in soils within the OU 2 landfill source areas. While residential use of the property is not reasonably anticipated, Site 1 landfill source area soils have been found to present an unacceptable carcinogenic risk under this use where the primary contributors to the risk are PAHs, Arochlor 1260, dieldrin, and heptachlor epoxide, and Site 2 landfill source area soils were found to present an unacceptable carcinogenic risk for this residential use where the primary contributors were PAHs, PCBs, dieldrin, and arsenic, see Table 3-1.

There were no COCs for human health identified in sediment under the anticipated commercial/industrial future use scenario. However, manganese in sediment was found to present an unacceptable non-carcinogenic risk under potential residential use.

Table 3-1
Summary of OU 2 Human Health Risk

Receptor	**Medium**	**COC**	**Cancer Risk**	**Non cancer Risk**
Adult resident	Soil and sediment	Benzo(a)pyrene, Arochlor 1260, dieldrin, arsenic	**1.3 E-04**	**5.3 E-02**
Child resident	Soil and sediment	Benzo(a)pyrene, Arochlor 1260, dieldrin, arsenic, manganese	**1.4 E-04**	**4.1 E+00**
Full-Time Worker	Soil	Benzo(a)pyrene, Arochlor 1260	1.1 E-05	
Maintenance Worker	Soil and sediment	Benzo(a)pyrene, Arochlor 1260	6.1 E-06	
Construction Worker	Sediment	Benzo(a)pyrene, Arochlor 1260	3.2 E-06	
Recreational User	Soil and sediment	Benzo(a)pyrene, Arochlor 1260	6.5 E-06	
Adolescent Trespasser	Soil and sediment	Benzo(a)pyrene, Arochlor 1260	6.6 E-06	
Day Care Child	Soil	Benzo(a)pyrene, Arochlor 1260	1.3 E-05	

Bold values exceed EPA health risk criteria of 1.0 E-6 to 1.0 E-4.

The following chemicals were retained as potential contaminants of concern (PCOCs) in groundwater:

- Chlorinated VOCs: TCE
- Other VOCs: 2-butanone and acetone
- SVOCs: bis(2-ethylhexyl) phthalate (BEHP)
- Explosives: RDX, perchlorate
- Metals: aluminum, arsenic, iron, lead, manganese, and thallium

Table 3-2 summarizes the groundwater risk results for various exposure populations.

Table 3-2
Summary of Health Risk for OU 3 Groundwater

Hazard index for OU 3 Groundwater in Coastal Plain/Saprolite						
	Full Time Worker	Maintenance Worker	Construction Worker	Day Care Child	Adult Resident	Child Resident
Total HI - RME	0.0082	0.15	0.76	0.018	14	33
Total HI - CTE	0.0036	0.076	0.76	0.081	6.6	21
	Full Time Worker	Maintenance Worker	Construction Worker	Day Care Child	Adult Resident	Child Resident
Total ILCR - RME	1.5 E-7	2.2 E-7	4.5 E-8	8.3 E-8	1.2 E-4	6.9 E-5
Total ILCR - CTE	2.4 E-8	4.0 E-8	4.5 E-8	1.8 E-8	1.6 E-5	1.5 E-5

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Under current conditions, there is no unacceptable human health risk associated with contaminants in groundwater and surface water because groundwater and surface water at OU3 is not being used as a potable water source.

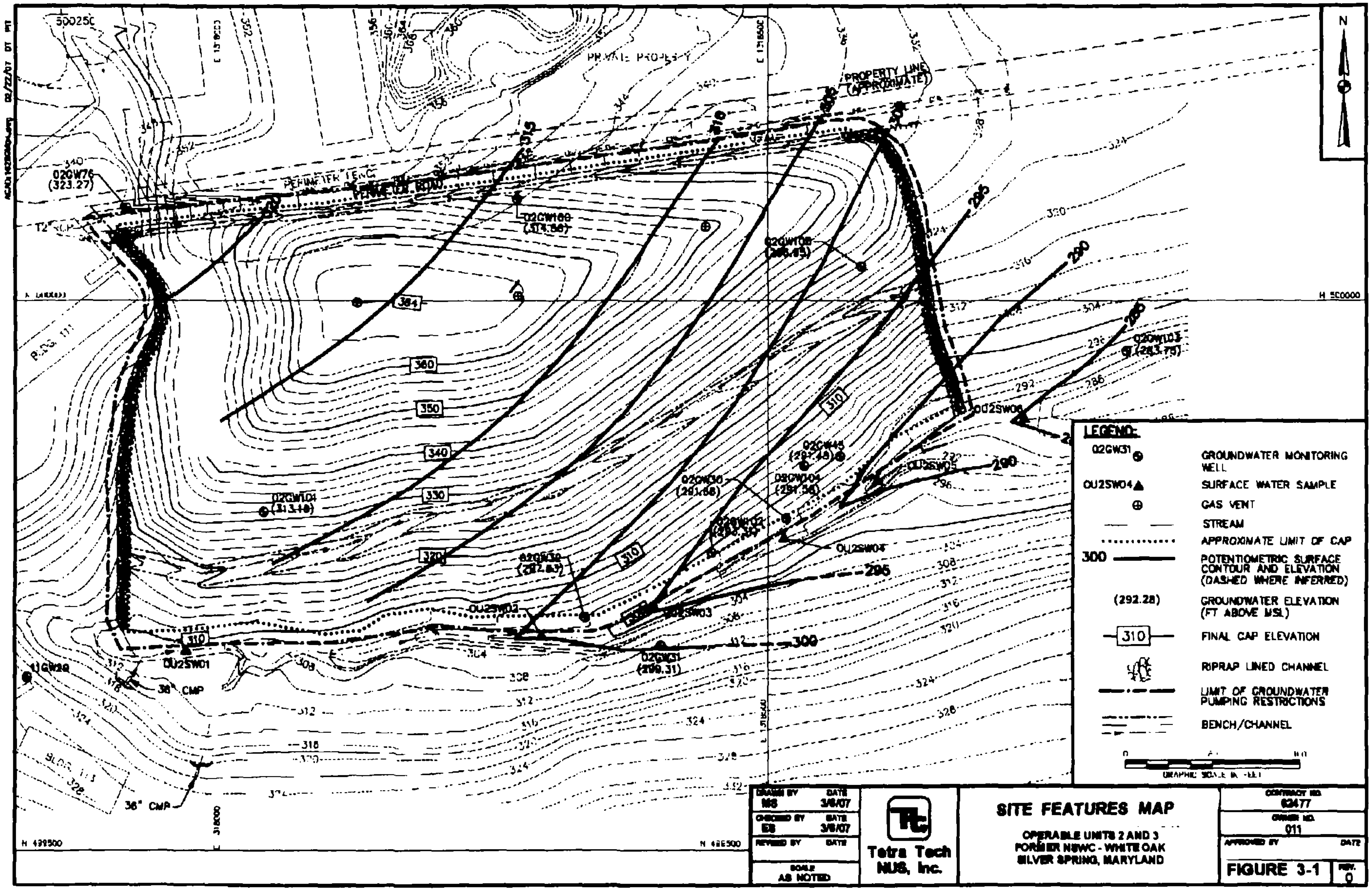
Non carcinogenic HIs associated with exposure to OU3 groundwater and surface water under a construction or hypothetical future residential scenario exceeded the EPA's acceptable target of unity. In addition, the ILCRs associated with exposure to groundwater under a hypothetical future residential scenario were above the 1.0 E-4 upper limit of EPA's acceptable range. The presence of non-carcinogenic risk warrants that an evaluation of remedial alternatives be conducted to determine if action or institutional controls are needed to reduce groundwater concentrations or mitigate exposure.

3.4.2 Ecological Risk Assessment

A Base-wide Ecological Risk Assessment (BERA) was developed for base wide soil and sediment risk-based levels for several chemicals (TtNUS, 2001a). At Site 1, the maximum detected total PAHs, total PCBs, mercury (only via the food chain pathway), and zinc exceed the risk-based levels. Therefore, potential risk to soil invertebrates and wildlife exist from these contaminants in the surface soil. None of the PCOCs were detected in the OU 2 soils at concentrations that exceed the risk-based levels. Therefore, potential risk to soil invertebrates and wildlife from these contaminants in the surface soil is expected to be low.

Arochlor 1260 and PAHs in sediment have been determined to present unacceptable risk to ecological receptors and are COCs in sediment. PCB, PAH, mercury and zinc concentrations in soils within the Site 1 landfill source area also have been determined to present an unacceptable risk to ecological receptors and are COCs in soils within the Site 1 landfill source area.

Actual or potential releases of hazardous substances from the OU 2 landfills and associated sediment, if not addressed by a remedial action, may present an imminent and substantial endangerment to public health, welfare and the environment.


LEGEND:
02GW31 GROUNDWATER MONITORING WELL
OU2SW04 SURFACE WATER SAMPLE
GAS VENT
STREAM
APPROXIMATE LIMIT OF CAP
300 POTENTIOMETRIC SURFACE CONTOUR AND ELEVATION (DASHED WHERE INFERRED)
(292.28) GROUNDWATER ELEVATION (FT ABOVE MSL)
310 FINAL CAP ELEVATION
RIPRAP LINED CHANNEL
LIMIT OF GROUNDWATER PUMPING RESTRICTIONS
BENCH/CHANNEL
PRIVATE PROPERTY
PROPERTY LINE (APPROXIMATE)
PERIMETER FENCE
02GW76 (323.27)
02GW100 (314.86)
02GW105 (305.65)
02GW103 (283.75)
02GW101 (313.18)
02GW45 (291.45)
02GW30 (291.68)
02GW104 (291.56)
02GW32 (292.83)
02GW31 (299.31)
OU2SW01
OU2SW02
OU2SW03
OU2SW04
OU2SW05
OU2SW06
36" CMP
DRAWN BY MS DATE 3/6/07
CHECKED BY ES DATE 3/6/07
REVISED BY DATE
SCALE AS NOTED
Tetra Tech NUS, Inc.
SITE FEATURES MAP
OPERABLE UNITS 2 AND 3
FORMER NSWC - WHITE OAK
SILVER SPRING, MARYLAND
CONTRACT NO. 02477
OWNER NO. 011
APPROVED BY DATE
FIGURE 3-1
REV. 0

4.0 REMEDY IMPLEMENTATION

Corrective measures for soil and sediment potentially impacted by Sites 1 and 2 are presented in the OU 2 ROD. Corrective measures for groundwater and surface water potentially impacted by Sites 1 and 2 are presented in the OU 3 ROD.

4.1. REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for OU 2 have been developed assuming the site will be used for commercial/industrial purposes. The RAOs for the soil, waste and sediment at Sites 1 and 2, as presented in the ROD (USEPA, July 2001), include the following:

- Prevent direct contact with landfill contents/soil
- Minimize infiltration and resulting contaminant migration to groundwater
- Control surface water runoff and erosion
- Eliminate exposure of ecological receptors to sediments

The RAOs for groundwater for OU 3, as presented in the ROD (USEPA, September 2004), include the following:

- Prevent human exposure through ingestion, inhalation, and dermal contact to groundwater having contaminants at concentrations in excess of maximum concentration standards (MCSs).
- Comply with ARARs, and TBCs as appropriate.

Because it is not USEPA's policy to require a remedial action for groundwater beneath a landfill cap, no MCSs were developed and the following minimum RAOs were developed:

- Prevent human exposure through ingestion, inhalation, and dermal contact to groundwater with COC concentrations greater than screening criteria.
- Mitigate further migration of COCs.

Meeting the RAOs for groundwater is largely based on achieving the criteria in the following table.

Table 4-1
Criteria for COCs at OU 3

GROUNDWATER		
COC	**CRITERIA (ug/L)**	**Basis**
TCE	5	MCL
acetone	610	Region III RBC
2-butanone	1,900	Region III RBC
Bis-2 ethylhexyl phathalate	4.8	Region III RBC
RDX	0.61	Region III RBC
perchlorate	3.6	Region III RBC
Aluminum	50-200	NSDWR
Arsenic	10	MCL
Iron	300	NSDWR
Lead	15	MCL
Manganese	50	NSDWR
Thallium	2	MCL

MCL = Maximum Contaminant Level
RBC = Risk Based Concentration
NSDWR = National Secondary Drinking Water Regulation

4.2. SELECTED REMEDY

The selected remedy for the OU 2 landfill consists of seven major components:

- Excavation, regrading, and consolidation of soil and waste at Sites 1 and 2
- Treatment and disposal, as necessary, of any incompatible waste encountered during excavation and regarding of soil, waste, and of wastewater generated during excavation and/or regarding of waste, soil and sediment
- Restoration of disturbed areas
- Construction of engineered multimedia cap components for Sites 1 and 2
- Installation of surface water controls and vegetation of landfill cap
- Institutional controls
- Surface water and groundwater monitoring

The selected remedy for OU 3 consists of three major components:

- Natural attenuation
- Institutional controls
- Groundwater and surface water monitoring

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan has been prepared for the OU 2 landfill. Based on the site visit conducted on June 21, 2006, it does not appear that any O&M activities, except for possibly mowing, have been conducted in recent years. See section 6.5 for additional details.

The only O&M activities associated with OU 3 are inspection and maintenance of the monitoring wells. See section 6.5 for additional details.

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5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for OU 2 and OU 3 at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document for the Navy under contract N62477-03-D-0163, Delivery Order 011.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan, RI and the CMS for OU2 became available for review by the public on March 28, 2001, and are among the documents that comprise the Administrative Record file for former NSWC-WO, which is maintained by NAVFAC Washington at the Washington Navy Yard, Washington, DC. These documents are also located in the information repository for the NSWC-WO, which is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of the availability of these documents, the public comment period, and a public meeting was published in the *PG Journal, Silver Spring Gazette*, *College Park Gazette*, and *Burtonsville Gazette* on March 28, 2001. The public comment period was held from March 28, 2001 to April 27, 2001, and a public meeting was held on April 17, 2001.

The Proposed Plan for OU 3 was released for public comment on January 2, 2004. The plan identified natural attenuation, institutional controls, and monitoring for groundwater as the preferred alternative. The Navy reviewed all comments received during the public comment period, January 2, to February 1, 2004, and at the public meeting held January 13, 2004. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the Restoration Advisory Board (RAB) members at their next meeting. The results of the five-year review and the report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation, decision-making, and remediation documents, including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

Six rounds of groundwater sampling (June 2002, October 2002, December 2002, March 2003, June 2004 and September 2005) have been performed during the post-closure monitoring period. Groundwater and surface water monitoring is now conducted every 15 months. A comparison of the maximum concentrations of those compounds detected in the long-term monitoring program during the six rounds of sampling are presented on Table 6-1. Groundwater criteria, based on Federal MCLs and EPA Region 3 Tap Water RBCs, are also provided. A review of the potential contaminants of concern (PCOCs) detected in the downgradient wells yields the following observations.

Five VOC PCOCs (1,2-dichloropropane, 2-butanone, acetone, TCE, and chlorodibromomethane) were detected in downgradient groundwater samples above the groundwater criteria. TCE was detected at a concentration in excess of its federal MCL and Region 3 Tap Water RBC in Rounds 1 – 6. 1,2-dichloropropane and chlorodibromomethane were detected at concentrations in excess of their respective Region 3 Tap Water RBCs in Rounds 1, 2 and 5.

TCE was detected in 02GW032 and 02GW045 (all rounds), 02GW031 (Round 4), and 02GW103 (Rounds 2, 3, and 5). TCE was detected at concentrations ranging from 0.7 to 9.1 µg/L in these wells. All of the detections exceeded the Region 3 Tap Water RBC (0.026 µg/L). Detections in well 02GW32 during Rounds 1 and 5 and well 02GW045 during Rounds 5 and 6 exceeded the MCL of 5 ug/L.

Region 3 Tap Water RBCs for 2-butanone and acetone were revised from 1,900 to 7,000 µg/L and from 610 to 5,500 µg/L, respectively, since Round 1. Although there was one RBC exceedance each for 2-butanone and acetone during Round 1, based on the new RBCs, both constituents were below the screening levels in the downgradient wells.

RDX was the only energetic which exceeded the EPA Region III RBC in two wells during three different rounds (02GW103 in Rounds 2, 5, and 6 and 02GW045 in Rounds 4, 5, and 6). The concentrations detected in 02GW103 during Rounds 2 and 5 (0.73 and 1.31 µg/L, respectively) exceeded the Region 3 Tap Water RBC (0.61 µg/L). Several laboratory reporting limits for RDX slightly exceeded the Region 3 Tap Water RBC.

During Rounds 1 through 5, concentrations of three inorganics (arsenic, lead, and mercury) exceeded federal MCLs, and concentrations of five inorganics (arsenic, iron, lead, manganese, and vanadium) exceeded Region 3 Tap Water RBCs. During Round 6, thallium was detected in excess of its federal MCL (2 µg/L) and Region 3 Tap Water

RBC (2.6 µg/L) in wells 02GW032 and 02GW45. Thallium had not been detected in any well during any of the prior sampling rounds. Manganese was detected in wells 02GW032 and 03GW045 in excess of the Region 3 Tap Water RBC during Round 6.

A summary of the PCOCs reveals the following: the groundwater TCE concentrations remained relatively stable ranging from 3.6 ug/L to 9.1 ug/L and remained above the MCL of 5 ug/L in Round 6. Concentrations of acetone and 2-butanone exceeded the RBC criteria in rounds 1 and 2 and were below the RBC criteria in rounds 3 through 6. There are no MCLs for acetone and 2-butanone. RDX exceeded the RBC of 0.61 ug/L, which is very conservative, in rounds 2, 4 and 5 but met the RBC in round 6. Arsenic, iron and lead exceeded the RBC criteria in round 2 but not in rounds 1 or 3 through 6. Manganese and thallium tended to be sporadic and showed no discernable pattern. In summary, none of the organics or metals showed any significant increase or decrease.

Surface water monitoring is conducted concurrently with groundwater monitoring and contaminant concentrations within the adjacent stream have decreased to levels that do not pose a significant risk to human health and the environment.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of OU 2 and OU 3 on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

The landfill cover appears to be in very good condition and there were no signs of erosion, cracks, ponding or seeps. There was no physical sign of slope failure on any of the sides of the landfill. No bare spots were noted and there were no signs of depression or settlement.

Vegetation appeared to be full and in good condition. In fact, the vegetation is more than waist high in places and it appeared that no mowing had occurred during the current growing season. Mowing should be performed annually to reduce the potential for tree growth. The cut height should be greater than 6 inches to ensure that the vegetation does not burn out during the summer.

The drainage structures consist of two main rip-rap drainage channels (one on the east side and one on the west side of the landfill), one culvert on the west side of the landfill, and several smaller rip-rap areas. All drainage structures appeared to be in good condition and functioning as intended. The west side drainage channel had significant vegetation growing within it probably due to accumulated silt in the bottom of the channel. Although this vegetative growth does not currently impede storm water runoff, a good housekeeping measure would be to remove the vegetation, particularly if any saplings are present. This measure will continue to keep the channel clear so that surface water may runoff freely through the channel. The east rip-rap channel was relatively free from vegetation and no maintenance is necessary.

Two monitoring wells (one was MW-32 and the other was unidentifiable due to its age) along the south side of the landfill between the landfill and the unnamed tributary were in poor condition, see photo in Appendix B. Both of them had missing covers and were very rusted and one of them was sealed with duct tape. It is recommended that these wells either be repaired or abandoned due to their poor physical condition and their inability to be secured. In addition, all the other monitoring wells should be reinspected for their physical condition and their ability to be locked.

The passive gas vents were briefly inspected and there were no signs of damage, cracking or leakage.

A double wire strand fence exists on three sides of the landfill (north, east and west sides); however there is no fence along the south side of the landfill, which provides an easy access point to the landfill. OU 2 is located in an unsecured portion of the base and is therefore subject to entry by nearby construction workers or trespassers.

Land Use Controls (LUCs) include restrictions which prohibit the use of groundwater for potable use. In addition, there are land use controls in the form of deed restrictions to prohibit residential use of the property and to ensure that the integrity of the cap is maintained through restrictions on any excavation within the landfill cap boundary. At the time this Five-Year Review was prepared, the exact wording of the LUCs was still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site. Based on the site inspection on June 21, 2006, there was no evidence that any of these LUCs have been violated.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August and September 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

Institutional controls will be implemented to further reduce the potential for exposure to contaminants and to ensure maintenance of the cap. The controls for OU 2 consist of:

- Land use restrictions and/or deed notifications to prohibit residential use of the property and to ensure the integrity of the cap is maintained.

- In addition, access to the area of OU2 outside the cap will be restricted to exclude day-care children unless a post-excavation risk assessment demonstrates that there is no unacceptable risk for this use.

Institutional controls for OU 3 include:

- Ensure no withdrawal of groundwater for any purpose (including drinking water) from within the restricted area shown until PRGs are met and risks from groundwater are reduced to acceptable levels.

- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells in the restricted area.

- Ensure adequate notification or pertinent use restrictions to current and future owners.

No violations of any of the above LUCs were observed during the June 21, 2006 site inspection. The Navy has submitted the draft final Land Use Control – Remedial Design describing the specific nature of the institutional controls and how they will be implemented to EPA and MDE.

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TABLE 6-1
OU2 MAXIMUM GROUNDWATER MONITORING RESULTS
NSWC-WHITE OAK

PARAMETER	FEDERAL MCL (ug/L)	REGION III RBC (ug/L)	ROUND 1 JUN-02 MAX	ROUND 2 OCT-02 MAX	ROUND 3 DEC-02 MAX	ROUND 4 MAR-03 MAX	ROUND 5 JUN-04 MAX	ROUND 6 SEP-05 MAX
Volatile Organics (ug/L)								
1,1-DICHLOROETHANE	NL	800	0.5 U	1 U	1.9	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE	NL	NL	0.5 U	NA	NA	0.5 U	0.5 U	0.37 J
1,2,4-TRICHLOROBENZENE	70	7.2	0.5 U	1 U	1 U	0.5 U	0.5 U	0.32 J
[redacted]	5	[redacted]	0.5 U	[redacted]	1 U	0.5 U	[redacted]	0.5 U
1,4-DICHLOROBENZENE	75	0.47	0.5 U	1 U	1 U	0.38 J	0.5 UT	0.37 J
[redacted]	NL	[redacted]	[redacted]	[redacted]	150	5 U	5 U	5 U
[redacted]	NL	[redacted]	[redacted]	[redacted]	5 U	1.9 J	5 UJ	5 U
[redacted]	5	[redacted]	[redacted]	[redacted]	1 U	0.5 U	0.5 UT	0.5 U
CARBON DISULFIDE	NL	1000	0.5 U	3.5 J	1 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	100	110	6.4	6.1	5.8	6.4	2.1	2.2
[redacted]	80	[redacted]	[redacted]	1 U	1 U	0.5 U	[redacted]	0.5 U
[redacted]	80	[redacted]	0.5 U	1 U	[redacted]	0.5 U	0.5 UT	[redacted]
CHLOROMETHANE	NL	190	0.5 U	1 U	1 U	0.5 U	0.5 U	3.3
CIS-1,2-DICHLOROETHENE	70	61	0.56	0.6 J	0.9 J	1 J	2.2	1.7
METHYL TERT-BUTYL ETHER	NL	2.6	0.5 U	1.3	1 4	1.5 J	0.88	1.4
TOLUENE	1000	750	11	2.5	1 U	0.5 U	0.5 U	0.5 U
[redacted]								
TRICHLOROFLUOROMETHANE	NL	1300	97	22 J	100	69	110	150
Explosives (ug/L)								
HMX	NL	1800	NA	12	9.2	6.6 J	4.44 J	3
[redacted]	NL	[redacted]	0 11 U	[redacted]	0.23 U	[redacted]	[redacted]	0.46
Total Inorganics (ug/L)								
ALUMINUM	NL	37000	3340	35800	45.7 U	2740	1740	1070
[redacted]	[redacted]	[redacted]	3 U	[redacted]	2.8 U	3 U	3 0 UT	3 U
[redacted]	[redacted]	2600	1700 J	1060	[redacted]	1760	355	351
BERYLLIUM	4	73	2.5	0.71 U	0.96 L	0.82	2.1 B	2.8
[redacted]	[redacted]	18	2 U	[redacted]	0.3 U	1.6	4.2	3.7
CHROMIUM	100	110	3.7	63	4	4.9	0.68	1.5
COBALT	NL	730	15.8	28.6	9 L	8.8	39.0	38.8
COPPER	1300	1500	3 U	72.1	0.7 U	4 U	4.0 U	11.6
[redacted]	NL	[redacted]	2450	[redacted]	1530	5550	2130	2690
[redacted]	[redacted]	[redacted]	5.9	[redacted]	1.5 U	4 U	4.0 U	2 U
[redacted]	NL	[redacted]	[redacted]	[redacted]	[redacted]	490	[redacted]	[redacted]
[redacted]	[redacted]	11	0.28 L	[redacted]	0.15 L	0.15	0.16 U	0.19
NICKEL	NL	730	44.6 J	66.9	63.4	49.6	93.3	105
SELENIUM	50	180	8 U	2.8 L	2.3 U	9 U	9.0 U	4 U
SILVER	NL	180	2.5 L	0.4 U	3.1	2 U	10.0 B	2 U
[redacted]	[redacted]	[redacted]	4 U	4 U	3.6 U	3 U	3 U	[redacted]
VANADIUM	NL	260	20 8	108	0.51	2.8	3.2 B	0.7 U
ZINC	NL	11000	45.7	191	50.4 L	58.4	104	77.8
Dissolved Inorganics (ug/L)								
BARIUM	2000	2600	NA	NA	NA	1770	NA	NA
CADMIUM	5	18	NA	NA	NA	1.5	NA	NA
COBALT	NL	730	NA	NA	NA	5.8	NA	NA
MANGANESE	NL	730	NA	NA	NA	350	NA	NA
NICKEL	NL	730	NA	NA	NA	40.2	NA	NA
ZINC	NL	11000	NA	NA	NA	47.6	NA	NA
Miscellaneous Parameters (mg/L)								
PERCHLORATE, METHOD 314	NL	3.6	NA	8 U	20 U	8 U	NA	5 U
TOTAL ORGANIC CARBON	NL	NL	NA	240	2.7	6 U	6 U	10000 U
TOTAL ORGANIC HALIDES	NL	NL	NA	0.11 J	0.05	0 284	0.184 J	46
Miscellaneous Parameters, Filtered (ug/L)								
PERCHLORATE, M 8321A	NL	26	NA	NA	NA	NA	15	NA

Highlighted values indicate exceedances of either screening criteria
B Field blank contamination
J Estimated value
L Biased low
U Not detected at indicated analytical detection limit
MCL USEPA Maximum Contaminant Level (USEPA 2000)
NA Not analyzed
NL Not listed
RBC USEPA *Region III tap water Risk Based Concentrations* (USEPA 2003)

7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents, monitoring results, and the site inspection indicate that the final remedy consisting of a multimedia cap, monitored natural attenuation (MNA), institutional controls, and groundwater and surface water monitoring is functioning as intended by the RODs. The multimedia cap is effective in preventing direct contact between the landfilled waste and any human and ecological receptors. The cap also minimizes any infiltration of rainwater or runoff into the landfill and therefore minimizes the amount of leachate coming out of the landfill.

The institutional controls are responsible for controlling access to the landfill area and protecting human receptors from any direct contact with contaminated soil or ingestion of groundwater. The site inspections did not identify any disturbances of the ground surface at OU 2 or signs of any residential use, which would have violated the institutional controls.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the RODs are still valid, except for perchlorate. The PRG for perchlorate has changed from 3.6 ug/L to 22.5 ug/L, which should expedite reaching the PRG and satisfaction of the cleanup RAOs that involve perchlorate.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced to question the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The multimedia cap, MNA, institutional controls, and groundwater and surface water monitoring are effective in protecting human receptors from any direct contact with or ingestion of groundwater. The multimedia cap is also minimizing the amount of leachate generated, which could potentially enter the surface water and sediments of the unnamed steam south of the landfill.

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8.0 ISSUES

The multimedia cap, MNA, institutional controls and monitoring at OU 2 and OU 3 are functioning as intended by restricting exposure to groundwater and soil contaminants by human and ecological receptors. However, the following items were identified based on the site inspection and a review of the monitoring results:

- There is no fence along the south side of the landfill, which provides an easy access point to the landfill. Since OU 2 is located in an unsecured portion of the facility, it is subject to entry by nearby construction workers or trespassers.

- Two monitoring wells (MW-32 and an unidentified well) are in poor condition and are unsecured.

- The height of the vegetation on the cap is excessive and if no mowing is performed, could lead to the establishment of large brush or trees in the long term.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the issues identified in the previous sections, the following recommendations are provided:

- GSA should consider extending the existing fence along the south side of the landfill and any other locations along the landfill perimeter where there is currently no fence.

- The two monitoring wells (MW-32 and an unidentified well) between the south side of the landfill and the unnamed stream should either be repaired or abandoned due to their poor condition and inability to be secured. The remainder of the monitoring wells should be inspected for their physical condition and ability to be secured.

- Groundwater monitoring should be continued at 15 month intervals to determine the type and concentration of contaminants leaving the landfill and to meet state and federal regulations.

- The landfill cover and drainage structures should be inspected following major storm events to identify any obstructions or erosion.

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11.0 NEXT REVIEW

The next Five-Year Review for OU 2 and OU 3 is required by 2011, five years from the date of this review.

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REFERENCES

- Environmental Field Activity Chesapeake, Record of Decision for OU 2 Soil and Sediment, July 2001.
- Environmental Field Activity Chesapeake, Record of Decision for OU 3 Groundwater, September 2004.
- Malcolm Pirnie, Remedial Investigation Report for IRP OU 2, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, 1992.
- Naval Energy and Environmental Support Activity, Initial Assessment Study (IAS), 1984.
- Shaw Environmental and Infrastructure, Landfill Closure for Operable Unit 2, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, April 2001.
- Tetra Tech NUS, Inc., RCRA Facility Investigation for OU 2, former Naval Surface Warfare Center, White Oak, Silver Spring, 2000.
- Tetra Tech NUS, Inc., Corrective Measures Study for OU 2, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, 2001.
- Tetra Tech NUS, Inc., Base-wide Ecological Risk Assessment, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, 2001a.
- Tetra Tech NUS, Inc., Post-Closure Report for Operable Unit 2, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, April 2002.
- Tetra Tech NUS, Inc., Round 6 Long Term Monitoring Report for OU 2, former Naval Surface Warfare Center, White Oak, Silver Spring, December 2005.

Final Five-Year Review

For

Site 4 (Chemical Burial Area)

Former Naval Surface Warfare Center
White Oak, Maryland

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

SITE 4

Final Five-Year Review

For

Site 4 (Chemical Burial Area)

Former Naval Surface Warfare Center
White Oak, Maryland

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

Final Five-Year Review

For

Site 4 (Chemical Burial Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
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CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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TABLES

FIGURES

LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
DVS	Design Verification Study
EBS	Environmental Baseline Survey
EISB	Enhanced In-Situ Bioremediation
EOS	Emulsified Oil Substrate
NSWC-WO	Naval Surface Warfare Center – White Oak
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls – Remedial Design
MCL	Maximum Contaminant Level
MCS	Media Clean-up Standard
MDE	Maryland Department of the Environment
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCOC	Potential Contaminant of Concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	RCRA Facility Assessment
RFI	Remedial Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision

RPM	Remedial Project Manager
SI	Site Inspection
SVOC	Semivolatile Organic Compound
TCE	Trichoroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
ug/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedy at Site 4 (Chemical Burial Area) at the former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland is protective of human health and the environment. The methods, findings, and conclusions of the Site 4 Five-Year Review are documented in this report. In addition, Five-Year Reviews identify issues found during the review, if any, and identify recommendations to address them. Site 46 refers to the most downgradient portion of contaminated groundwater associated with Site 4. Any references to groundwater associated with Site 4 include the site 46 groundwater.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore the NCP 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of the Navy and JMWA conducted an inspection of Site 4 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review is the initiation of remedial actions at OU 2. The Five-Year Review is required for Site 4 because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. SITE 4 – CHEMICAL BURIAL AREA

Site 4 was identified as a Navy Installation Restoration Program (IRP) site in an Initial Assessment Study (IAS) conducted by the Navy's Naval Energy and Environmental Support Activity (NEESA) in 1984. The purpose of the IAS was to identify sites at NSWC-WO that would undergo potential environmental investigation.

A Confirmation Study Verification Phase for NSWC-WO was conducted in 1985 (Malcolm-Pirnie, April 1987). This study was performed to confirm the findings of the IAS and to obtain additional information in characterizing site hazards.

A RCRA Facility Assessment (RFA) was conducted by Kearney/Centaur Division, November 1990. The RFA identified 97 SWMUs and 19 areas of concern (AOCs) at NSWC-WO.

An RI was conducted in two phases between January 1989 and March 1992 (Malcolm-Pirnie, October 1992). The results of the RI confirmed the presence of soil and groundwater contamination at Site 4.

A Design Verification Study (DVS) was conducted in 1995 to prepare remedial designs for Sites 2, 3, 4, 8, 9, and 11. Activities included record reviews, terrain conductivity surveys, test pit excavation, and subsurface soil and sediment sampling. In conjunction with the Design Verification Study, a wetlands delineation and forest stand inventory were conducted for Sites 2, 3, 4, 8, 9, and 11.

In 1995, former NSWC-WO was selected for closure on the BRAC IV list. A Phase I Environmental Baseline Survey (EBS) was conducted by EA Engineering Science and Technology (EA) to assess the existing environmental information related to storage, release, treatment, or disposal of hazardous substances or petroleum products and to document the environmental condition of the property.

In 1997, a site investigation (SI) was conducted at Site 46 to investigate the nature and extent of chlorinated VOCs detected in this area which is situated downgradient of Site 4.

An RFI was conducted for the immediate area around Site 4 (and five other sites) that further characterized the nature and extent of contamination in soil and groundwater at Site 4 (TtNUS, October 2000). The RFI concluded that elevated risks were present from exposure to Site 4 soil contaminated with chlorinated VOCs, most notably trichloroethene (TCE).

A feasibility study (FS) was conducted for OU-1 in 2003 (CH2M HILL, June 2003). The FS included an evaluation of remedial alternatives for Site 4 soil and groundwater. A soil interim removal action was conducted at Site 4 in the summer of 1999. During the removal action, approximately 23,000 tons (18,000 cubic yards) of contaminated soil and solid waste were removed and transported to a municipal solid waste landfill for disposal. The cleanup goals, which were based on industrial use standards, were met.

As a result of the findings from the various groundwater investigations, three interim measures were implemented to address contamination in the Site 46 area located on the Army property downgradient of Site 4.

- An air stripper was also added to the storm water outfall for the Army Building 500 area by the Navy in 1997.

- A groundwater extraction trench and treatment system (air stripper) were constructed near the government property line in 1998 to intercept the VOC plume and prevent contaminated groundwater from migrating offsite and discharging to the Site W Swale.

- In 1999, a system of three groundwater extraction wells was installed further upgradient in this VOC plume in order to reduce contaminant concentrations and contain contaminated groundwater closer to the source.

The Site 4 Record of Decision was finalized in September 2005.

3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 Site 4 Physical Characteristics

Site 4 is relatively flat and surrounded by a rising slope to the east, south and west. There are no surface water features near the former burial pits. Surface water runoff from the immediate vicinity of the site flows toward the center of the site and infiltrates the soil overlying the area of the former burial pits and migrates into the subsurface soils. Figure 3-1 shows the layout of the Site 4 features.

The three primary stratigraphic units underlying the former NSWC-WO are the Coastal Plain sediments, saprolite, and bedrock. The Coastal Plain deposits consist of silty sand, sand and gravel underlain by clayey sand with gravel. Results of the surface geophysical survey and soil borings indicate Coastal Plain deposits vary between 50 and 100 feet throughout the majority of Site 4 and OU-1 but abruptly reduce in thickness near the streams, and are completely weathered away in the major stream valleys. Furthermore, the deposits are thickest in the northern portion of the site and become thinner in a southerly direction. Site data also show the Coastal Plan/saprolite contact to be an undulating surface.

Groundwater flow in the vicinity of the plume is to the south-southeast. The average hydraulic gradient between the Site 4 source area and the toe of the plume is 0.013. However the gradient is slightly lower near the source area (approximately 0.008) compared to the midpoint of the plume (0.017). The geometric mean hydraulic conductivity for the Coastal Plain deposits is 5.25 feet per day based on recent aquifer pumping tests. Using the average hydraulic gradient (0.013) and the geometric mean hydraulic conductivity and assuming a porosity of 0.25, the average groundwater flow velocity is estimated at 100 feet per year.

3.2. LAND AND RESOURCE USE

The General Services Administration (GSA), which owns the property overlying the groundwater containing the highest concentrations of contaminants, has no immediate plans to use this area. The Army property is currently being used for industrial purposes.

The private properties overlying the far southern extent of the plume cover approximately 16 acres. There are no drinking water supply wells located on these properties and all of the properties are provided with water from a public source. Groundwater at Site 4, and throughout the former NWSC-WO, is not used as a potable water source at this time and is unlikely to be used for such purposes in the future. Local ordinances prevent the installation of new private potable supply wells without a permit. Nonetheless, for the purposes of the site assessment, the site was evaluated assuming the possibility of residential use for the entire area including the use of groundwater as a primary drinking water source (U.S. Navy, Site 4 Record of Decision, September 2005).

3.3. NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination at Site 4 can be summarized as follows:

The source of trichloroethene (TCE) and 1,1,2,2 Tetrachloroethene (1,1,2,2 PCA) contamination was waste and contaminated soil in the Site 4 chemical burial area. These source materials were excavated at Site 4 as part of a non-time critical removal action conducted in June through August 1999. The excavation extended to a depth of 27 feet below the former ground surface in many locations. TCE and 1,1,2,2-PCA concentrations after removal presented an unacceptable risk to receptors from contact with the soil, and represented a potential source of groundwater contamination through leaching.

Confirmation soil samples collected from the bottom and the side walls of the excavation indicated that polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and volatile organic compounds (VOCs), namely TCE, remain in the soil at depths of approximately 14 feet below the current ground surface. Of these contaminants, only TCE was also present in the groundwater at concentrations that exceed the preliminary remediation goals (PRGs). PAH contaminated soils remain in-place primarily in the northern half of the excavation (Burial Area 1), although several spots in the central and southern part of the excavation (Burial Area 2) also contained detectable concentrations. The concentrations of TPH in soil samples ranged from 170 mg/kg on the bottom of the Burial Area 1 excavation to 5,900 mg/kg on the bottom of the Burial Area 2 excavation. TCE was only detected in soil samples from the bottom of the excavation in Burial Area 2.

The contaminated soil and waste have resulted in a plume of contaminated groundwater that averages 800 feet wide from east to west and extends approximately 3,300 feet south of Site 4 where the groundwater discharges into several surface water streams. The thickness of the plume is estimated to be the entire saturated zone within the Coastal

Plain deposits, approximately 25 feet. The plume is generally defined by groundwater containing TCE at concentrations greater than 5 ug/L. The COCs in this area and maximum concentrations found since the 1999 removal action at Site 4 consist of (in order of prevalence):

- TCE – 4,300 ug/L
- 1,1,2,2 PCA – 317 ug/L
- Vinyl chloride – 73 ug/L
- cis-1,2-DCE – 402 ug/L
- 1,2-DCA – 285 ug/L
- 2-amino-4,6-DNT – 0.8 ug/L
- 4-amino-2,6-DNT – 1.0 ug/L
- Iron – 38,500 ug/L
- Benzene – 1,710 ug/L (detected in one well)
- Toluene – 2,490 ug/L (detected in one well)
- Perchlorate – 76 ug/L

Contamination is believed to be limited to the Coastal Plain hydrogeologic unit within the majority of the Site 4 plume. This conclusion is based on the lower hydraulic conductivity of the saprolite compared to the Coastal Plain deposits, the absence of contamination in wells screened in the saprolite downgradient of Site 4, and the absence of contamination in bedrock wells in the vicinity of Site 4, Building 500, and well nest 46GW213S.

Although Site 4 contaminants have been detected in surface water streams, the concentrations are below risk-based screening levels for all applicable exposure routes. No site-related contaminants have been detected in sediments in the receiving surface water streams.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

It was assumed that the only exposure scenarios that might result in unacceptable risks from groundwater at Site 4 are those where unacceptable risks are present for OU-1 as a whole, i.e. residential child, adult, and age-adjusted. The potential contaminants of concern (PCOCs) for groundwater were selected by identifying those OU-1 PCOCs that are present at concentrations corresponding to a cancer risk of 5.0 E-06 or higher, or an *HI of 0.1 or above, and were detected in monitoring wells within the Site 4 source area* and plume. The following chemicals were retained as PCOCs in Site 4 groundwater:

- Eight VOCs: 1,1,2,2 PCA, TCE, cis-1,2-DCE, 1,1-DCE, 1,2- DCA, vinyl chloride, benzene and toluene

- Three explosive compounds: 2,4,6-trinitrotoluene, 2-amino-4,6-DNT and 4 amino 2,6-DNT
- Arsenic, cadmium and iron
- Perchlorate

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for Site 4 Groundwater

Hazard index for Site 4 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total HI - RME	30	48	NA
Total HI - CTE	5.7	9.7	NA
Incremental Lifetime Cancer Risk for Site 4 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total ILCR - RME	6.6 E-04	NA	5.5 E-03
Total ILCR - CTE	5.5 E-05	NA	1.0 E-03

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

3.4.2 Ecological Risk Assessment

The Navy conducted a Base–wide Ecological Risk Assessment (BERA) at former NSWC-WO. The BERA also concluded that the soil following the interim removal action, and sediment and surface water in the streams do not present unacceptable risks to ecological receptors. As groundwater exposure is not associated with ecological receptors, Site 4 groundwater poses no unacceptable ecological risks.

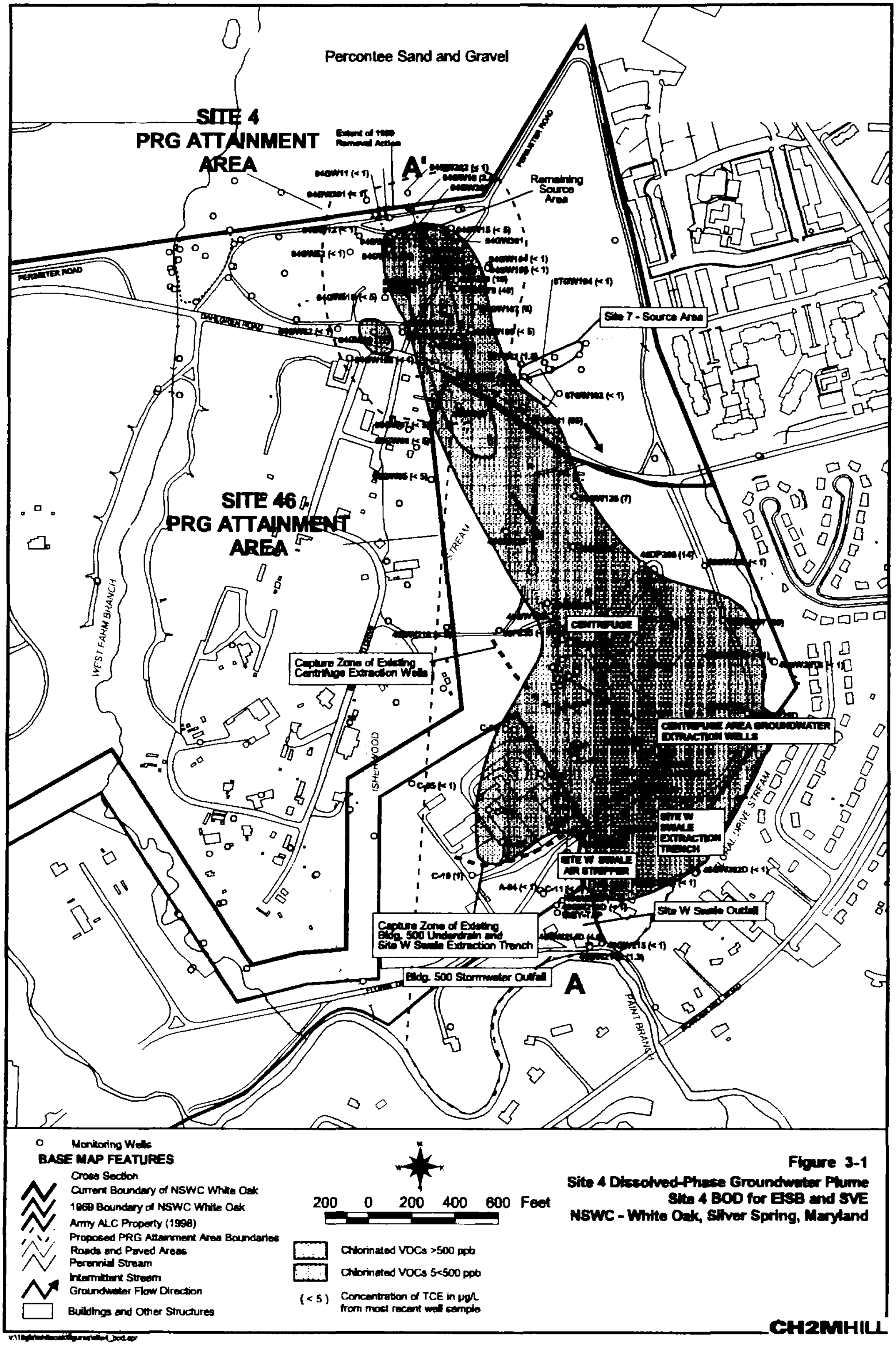

Figure 3-1
Site 4 Dissolved-Phase Groundwater Plume
Site 4 BOD for EISB and SVE
NSWC - White Oak, Silver Spring, Maryland

CH2MHILL

4.0 REMEDY IMPLEMENTATION

The selected soil remedial action, soil vapor extraction (SVE), and the enhanced bioremediation of the groundwater have not yet been implemented and only the active groundwater remedial action will be discussed here.

4.1. REMEDIAL ACTION OBJECTIVES

The Chemical Burial Area Remedial Action Objectives (RAOs) for groundwater, as presented in the ROD (USEPA, September 2005), include the following:

- Prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.

- Where practicable, restore contaminated groundwater to a quality amenable to beneficial use (i.e., meet the Preliminary Remediation Goals (PRGs) identified).

Meeting these objectives for Site 4 is based upon achieving the PRGs for Site 4, which are shown in the following Table:

Table 4-1
PRGs for COCs in Site 4 Attainment Area

COC	PRG (ug/L)	Basis
TCE	5	MCL
1,1,2,2 PCA	3	RBC
cis-1,2-DCE	70	MCL
1,2-DCA	5	MCL
Vinyl chloride	2	MCL
Iron (dissolved)	4,600	RBC

Source: ROD, USEPA, September 2005

4.2. SELECTED REMEDY

The primary components of the selected remedy are:

- Enhanced In-situ Bioremediation (EISB) to treat dissolved phase groundwater contamination.
- Continued operation of the existing groundwater extraction wells and trench and associated treatment system.
- Long-term monitoring of the in-situ reductive dechlorination area, existing extraction system areas and downgradient portions of the plume.
- Preparation of annual technical memoranda and 5-year reports.
- Implementation of institutional controls until PRGs are met.

The remedial design and remedial action work plan have been developed for the source area at Site 4 and the remedial action (EISB) is planned for 2007.

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

The groundwater component of the remedy for Site 46 includes the operation of three interim groundwater extraction and treatment systems including the Centrifuge Extraction System, Site W Swale, and the Building 502 Treatment Systems. Although these three systems comprise the Site 46 treatment systems, they are addressing the contaminated plume from Site 4. These systems are inspected monthly and repaired/replaced as necessary. The first of these systems was put into operation in 1997. The near-term goal is to shut down the Centrifuge Extraction wells but to continue to operate the Building 500 Underdrain and treatment system. The long-term goal is to shut down operation of all three extractions and treatment systems. A detailed discussion of the performance of the groundwater treatment systems is provided in section 6.4.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for the Site 4 Chemical Burial Area at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document under contract N62477-03-D-0163, Delivery Order 011 to the Navy.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan for Site 4, the RI and FS for OU-1 (including Site 4) and other documents relevant to the remedy selection for Site 4 groundwater and soil were made available to the public in June 2003 in an information repository for NSWC-WO that is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of the availability of these documents, the public comment period, and a public meeting was published in the *Washington Post* on June 19, 2003, and in the *Silver Spring Gazette*, *College Park Gazette*, and *Burtonsville Gazette* on June 18, 2003. The public comment period was held from June 24, 2003 to July 24, 2003, and a public meeting was held on July 8, 2003.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the RAB members at the next meeting. The results of the review will be made available to the public at the local Information Repository at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation and decision documents including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

A review of the selected soil remedial action is not included in this Five-Year Review since the soil remedy has not been implemented.

Groundwater monitoring has occurred from the first quarter of 1999 until July 2006. With the exception of the recent gap between November 2004 and July 2006, groundwater monitoring has been performed approximately every 3 months to track contaminant concentrations within the Site 46 groundwater plume and downgradient of the target remediation zone. This data, along with treatment system influent and effluent data is used to determine the effectiveness of the treatment systems in place. Approximately 12 wells have been sampled quarterly for VOCs and a smaller number are also sampled for explosives and perchlorate.

<u>Building 502 Treatment System Findings</u>

The overall operation of the air stripper treatment system appears to be functioning adequately. Some of the more significant findings and maintenance include: replacement of bag filters, cleaning air inlet filters, and the replacement of the sump pump electrical contactor. In addition, several adjustments were made including air pressure in the system, and water level controls. The contact information signs on the outside of the treatment building, showing contact personnel and their phone numbers are faded and should be replaced. Monthly inspections of this system should continue to identify any problems and allow their repair in a timely manner. Monthly inspections should also minimize and down time in system operation. These findings are considered normal based on the age of the system and the wear and tear of the mechanical equipment over the operational period of the system.

<u>Site W Swale Treatment System Findings</u>

The overall operation of the treatment system appears to be functioning adequately. Some of the more significant observations and findings include: replacement of bag filters, cleaning and replacing air filters, and replacement of water filters. In addition, the wood at the bottom of the south wall of the shed is beginning to rot and will need replacement. The wood is rotting due to accumulation of water from condensation buildup. The technician has drained the water during each monthly inspection. Monthly inspections of this system should continue to identify any problems and allow their repair in a timely manner. Monthly inspections should also minimize any down time in system operation. These findings are considered normal based on the age of the system and the wear and tear of the mechanical equipment over the operational period of the system.

<u>Centrifuge Area Extraction System Findings</u>

The overall operation of the extraction system appears to be functioning but is somewhat less than adequate. Some of the more significant observations and findings include: the electrical contactors for extraction wells EW4, EW-5, and EW-6 were replaced with contactors from wells EW-1, EW-2, and EW-3, which had been shut down after a meeting of the Partnering team. In addition, replacement of extraction well discharge hoses, replacement of level control relay for pump number 3, and replacement of a flow meter were also performed during one of the O&M inspections. Voltage overage continues to be a chronic problem – the single phase voltage during a recent inspection was 129.7volts. Phase to phase voltage was 223.9 volts. The main issue with an overage is tripping of the circuit breakers and causing one or more of the pumps to shut down. These findings are considered normal based on the age of the system; however failures can be expected to occur more frequently due to the age of the components.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of the Site 4 Chemical Burial Area and the Site 46 groundwater treatment area on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs), and the condition of the groundwater extraction and treatment systems. Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

The building 502 and W Swale treatment buildings were locked and therefore were not included as part of this site inspection; however, they are monitored monthly by TtNUS.

A voltage problem continues to exist at the Centrifuge Area Extraction System. A check of the electrical system input voltage indicated that the single phase voltage was 129.7 volts. Phase to phase voltage was 224.5 volts. This is an ongoing issue that has been raised in the past and appears to be a result of an outdated power distribution system in the area. There also appears to be some discrepancy as to who (Navy, Army or GSA) is responsible for fixing the problem.

The monitoring wells were all locked and appeared to be in good condition at the time of inspection; however, there was insufficient time to inspect all the wells during the site visit.

The Land Use Controls (LUCs) for Site 4 appear to be functioning as intended. Although there is no fence around Site 4, the site is located within a secured area of the facility, which in effect controls access to the site. A fence exists between the perimeter road (upgradient of Site 4) and Percontee Sand and Gravel. The fence in the vicinity of Site 4 appeared to be in good condition. Due to time constraints, the entire fenceline was not inspected. In addition there were no physical signs of any residential use or disturbance of the ground surface during the site inspection.

LUCs also include written restrictions, which control the conduct of activities on the site. These restrictions are typically found in documents such as deeds and other property transfer documents. At the time this Five-Year Review was prepared, the LUCs were still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure no withdrawal of groundwater for any purposes from within the restricted area until the PRGs are met and risks from groundwater use are shown to be reduced to acceptable levels.
- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.
- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.
- Ensure adequate notification of pertinent use restrictions to current and future owners.

Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated.

Table 6-1
Building 502 and Site W Swale Treatment Systems Historical Results
TCE Concentrations (ug/L)
Page 1 of 2

Date	9/25/98	9/30/98	10/30/98	11/30/98	12/30/98	1/29/99	2/26/99	3/26/99	4/30/99
Building 502 Treatment System									
Stripper Influent		15.2	22	31	25.1	35	32	37	31
Stripper Effluent		ND	ND	ND	ND	ND	ND	ND	ND
Outfall	8.3		ND	13	ND	ND	ND	1.8	ND
Site W Swale Treatment System									
Stripper Influent				242	283.5	270	310	220	310
Stripper Effluent				3	1.8	6.9	2.6	3.6	5.8
Outfall				2	1.2	3.5	1.9	ND	2.6

Date	5/27/99	6/24/99	7/29/99	8/27/99	9/27/99	10/29/99	11/30/99	12/28/99	1/28/00
Building 502 Treatment System									
Stripper Influent	40	50	31	37	37	26	31	41	32
Stripper Effluent	ND	ND	ND	ND	ND	ND	ND	NS	0.8
Outfall	0.6	2	1.2	2.3	2.3	ND	ND	20	ND
Site W Swale Treatment System									
Stripper Influent	240	430	320	320	270	310	290	290	270
Stripper Effluent	5.2	8	6.8	6.2	4.2	1.7	1.8	1.4	2.8
Outfall	1.9	4	1.8	2.7	2.1	2.2	2.1	2.3	2.1

Date	2/22/00	3/30/00	4/27/00	5/24/00	6/26/00	7/31/00	8/31/00	9/28/00	10/30/00
Building 502 Treatment System									
Stripper Influent	40	34	40	23	31	37	34	27	20
Stripper Effluent	ND	0.5	ND	ND	ND	0.61	ND	ND	ND
Outfall	ND	1.1	ND	13	1.6	3.4	0.91	1.4	ND
Site W Swale Treatment System									
Stripper Influent	270	210	230	220	240	280	220	210	190
Stripper Effluent	6.6	1.5	4.1	3.9	0.7	0.9	1.9	2.5	0.8
Outfall	3.1	9	1.9	2.2	2.3	0.7	0.9	ND	ND

Table 6-1
Building 502 and Site W Swale Treatment Systems Historical Results
TCE Concentrations (ug/L)

Date	11/28/00	1/5/01	2/2/01	2/26/01	3/29/01	4/26/01	5/24/01	6/27/01	7/30/01
Building 502 Treatment System									
Stripper Influent		22	25	21	32	23	24	27	17
Stripper Effluent	28	ND	ND	ND	ND	ND	ND	ND	ND
Outfall	14	ND	ND	ND	ND	2.1	1.3	1.0	ND
Site W Swale Treatment System									
Stripper Influent	200	170	190	140	170	220	200	170	160
Stripper Effluent	1.3	1.9	2	2	57	1.4	1.4	1.8	1.1
Outfall	0.6	1	1.1	2.1	0.9	0.8	1.4	ND	ND

Date	8/24/01	9/25/01	10/30/01	11/26/01	1/2/02	1/31/02	2/19/02	5/14/02	8/19/02
Building 502 Treatment System									
Stripper Influent	21	16	15	26	18	17	16	20	20
Stripper Effluent	0.7	ND	ND	ND	ND	0.8	16	18	ND
Outfall	ND	ND	ND	1.5	ND	6.4	6.6	8.7	1.3
Site W Swale Treatment System									
Stripper Influent	150	110	160	130	170	160	NS	150	140
Stripper Effluent	0.8	0.7	0.7	0.9	0.8	0.8	NS	1.5	1.7
Outfall	0.8	0.5	ND	6.4	ND	0.7	47	4.6	1.4

Date	11/4/02	2/10/03	5/19/03	8/18/03	11/18/03	2/23/04	5/18/04	8/16/04	11/1/04	7/12/06
Building 502 Treatment System										
Stripper Influent	17	40	23	22	16	21	15	10	11	13
Stripper Effluent	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Outfall	ND	7.3	1.1	1.4	ND	1.2	5.9	ND	ND	0.6
Site W Swale Treatment System										
Stripper Influent	150	140	95	120	83	120	63	62	150	170
Stripper Effluent	1.4	1.7	1.9	1.2	1.1	2.7	1.6	0.9	2.2	1.8
Outfall	0.6	0.9	1	0.6	0.6	8.4	0.7	0.7	1.1	1.3

Table 6-2
Centrifuge Area Extraction Wells Historical Results
TCE Concentrations (ug/L)
Page 1 of 2

Well \ Date	8/27/99	9/23/99	10/28/99	11/30/99	12/28/99	1/28/00	2/22/00	3/30/00	4/27/00
EW-1	710	740	640	590	620	490	550	400	450
EW-2	610	670	580	600	600	480	490	450	420
EW-3	510	560	510	520	540	410	410	420	430
EW-4								500	520
EW-5								380	330
EW-6								450	390

Well \ Date	5/24/00	6/26/00	7/31/00	8/31/00	9/28/00	10/30/00	11/28/00	1/5/01	2/1/01
EW-1	310	290	380	270	220	240	240	190	230
EW-2	400	410	460	480	400	340	350	320	270
EW-3	440	350	380	360	360	240	260	250	200
EW-4	640	510	600	510	450	370	340	310	310
EW-5	390	290	290	320				210	190
EW-6				410	420	370	250	310	230

Well \ Date	2/26/01	3/29/01	4/26/01	5/24/01	6/27/01	7/30/01	8/24/01	9/25/01	10/30/01
EW-1	160	250	280	260	190	190	200	220	250
EW-2	230	230	360	340	260	230	NS	280	250
EW-3	99	250	260	240	220	190	NS	210	180
EW-4	190	240	370	390	310	300	360	330	300
EW-5	140	240	230	240	180	160	190	200	190
EW-6	200	310	340	330	290	210	280	220	240

NS = Not sampled

Table 6-2
Centrifuge Area Extraction Wells Historical Results
TCE Concentrations (ug/L)
Page 2 of 2

Well \ Date	11/26/01	1/2/02	1/31/02	2/19/02	5/13/02	8/19/02	11/14/02	2/10/03	5/19/03
EW-1	280	280	290	300	270	315	400	190	200
EW-2	280	290	260	280	270	380	350	280	190
EW-3	190	180	170	190	170	200	180	180	130
EW-4	340	310	300	310	325	400	440	345	360
EW-5	190	200	210	210	250	340	320	210	210
EW-6	200	220	210	190	200	270	340	240	240

Well \ Date	8/18/03	11/18/03	2/25/04	5/18/04	8/17/04	11/4/04	7/12/06		
EW-1	140	160	180	150	250	190	110		
EW-2	190	160	210	150	250	275	170		
EW-3	150	130	180	270	250	260	200		
EW-4	290	220	330	340	310	290	290		
EW-5	190	190	230	260	240	210	210		
EW-6	210	190	270	380	300	320	280		

Table 6-3
Site 46 Area Monitoring Wells Historical Results
TCE Concentrations (ug/L)
Page 1 of 2

Well	1st Qtr 1999	2nd Qtr 1999	3rd Qtr 1999	4th Qtr 1999	1st Qtr 2000	2nd Qtr 2000	3rd Qtr 2000	4th Qtr 2000
46GW123	NS	400	380	74	1.3	0.56	0.6	1.5
46GW130	NS	400	740	450	410	140	380	300
46GW131	NS	190	420	290	250	230	160	110
46GW133	600	330	610	480	140	72	200	280
46GW134	680	480	530	440	400	190	250	230
46GW135	290	210	300	110	71	1.3	83	40
C6	NS	55	76	75	36	23	36	34
C7	NS	280	560	370	130	250	320	250

Well	1st Qtr 2001	2nd Qtr 2001	3rd Qtr 2001	4th Qtr 2001	1st Qtr 2002	2ND Qtr 2002	3rd Qtr 2002	4rd Qtr 2002
46GW123	7.8	0.86	2	8.5	NS	NS	NS	470*
46GW127	40	98	89.5	71	59	59	44	46
46GW130	200	280	340	380	410	380	330	540
46GW131	58	17	54	22	41	94	140	9.7
46GW133	230	270	180	310	240	280	260	440
46GW134	160	380	240	270	230	250	180	230
46GW135	41	13	9.1	31	7.2	12	25	29
46GW208	60	96	98	70	51	46	43.5	42
46GW210	67	100	88	77	71	67	57	65
C6	25	17	40	50	63	64	190	170
C7	150	250	250	300	280	300	240	200
C8	NS	NS	NS	NS	NS	83	270	230
Stork Spring	50	87	60	69	26	35	29	27

NS - Not sampled
Note - Well 46GW123D sampled in place of 46GW123 starting in the 4th quarter of 2002.

Table 6-3
Site 46 Area Monitoring Wells Historical Results
TCE Concentrations (ug/L)
Page 2 of 2

Well	1st Qtr 2003	2nd Qtr 2003	3rd Qtr 2003	4th Qtr 2003	1ST Qrt 2004	2nd Qtr 2004	3rd Qtr 2004	4TH Qtr 2004	3rd Qtr 2006
46GW123D	340	160	140	200	165	150	150	230	310
46GW127	45	41	32	25	27	23	20	25	NS
46GW130	300	0.9	0.8	3.1	ND	0.5	1	1.4	NS
46GW131	24	66	44	63	110	160	150	96	220
46GW133	270	0.6	ND	.6	ND	2.7	8.4	13	NS
46GW134	310	25	ND	1.8	8.9	3.8	16	6.5	NS
46GW135	8.1	3.5	2.8	1.2	1	1.5	1.8	2.6	NS
46GW208	33	24	37	18	17	19	32	45.5	NS
46GW210	47	44	35	28	29	24	24.5	20	NS
C6	59	44	48	49	20	11	19	10	NS
C7	90	2	14	20	9.2	91	24	180	NS
C8	120	34	54	29	35	34	15	32	NS
Stork Spring	33	27	18	15	16	16	9.7	1.1	NS

NS - Not sampled
Note - Well 46GW123D sampled in place of 46GW123 starting in the 4th quarter of 2002.

7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents, monitoring results, and site inspection indicate that the final remedy, which includes enhanced in-situ bioremediation (EISB) at the Site 4 source area, continued operation of downgradient treatment systems, land use controls (LUCs), and long-term monitoring as constructed so far, is functioning as intended by the ROD. The site inspections did not identify any problems or disturbances of the source area or the downgradient groundwater extraction/treatment areas. The land use controls are responsible for controlling access to the source area and protecting human receptors from any direct contact with contaminated soil and from ingestion of groundwater. The groundwater treatment systems are responsible for limiting the off-site migration of contaminated groundwater. No evidence of any activities of an intrusive, residential, or disturbance nature were observed during the site inspection that would have violated any of the land use controls.

Several volatile organics were detected, most notably TCE. Concentrations of TCE found were comparable to previous sampling results and indicate that the extraction and treatment systems continue to limit the amount of TCE migrating downgradient of the treatment system and the TCE levels and other VOCs are below the PRGs at the outfalls.

In summary, the EISB when implemented, continued groundwater treatment, land use controls, and long-term monitoring are successfully preventing human exposure to the site-related contaminants from the Chemical Burial Area.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, and RAOs used at the time of remedy are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced to question the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The final remedy consisting of EISB, existing groundwater treatment, land use controls, and long-term monitoring, are closer to achieving the RAOs in the ROD by restricting exposure to site-related contaminants. Analytical data from long-term monitoring of groundwater indicates that the PRG for TCE has not yet been attained at all monitoring wells. The LUCs are effective in controlling access to the source area and protecting human receptors from any direct contact with contaminated soil and from ingestion of groundwater.

8.0 ISSUES

The Site 4 and 46 remedies of EISB, groundwater treatment, land use controls, and long-term monitoring have been partially implemented and are functioning as intended by restricting exposure to contaminants by human and ecological receptors.

The following items have been identified based on the site inspection and routine O&M inspections of the Site 46 treatment units. These items are not critical to the functionality of the remedy but will enhance the maintenance and performance of the remedy.

- A check of the electrical system input voltage at the Centrifuge Area Extraction System indicated that the single phase voltage was 129.7 volts for the centrifuge extraction system, which is out of sync with the phase to phase voltage.

- The contact information sign, showing contact personnel and their phone numbers, on the outside of the building 502 was worn and should be replaced.

- The wood on bottom portion of south wall of Site W Swale treatment building was wet and is beginning to rot.

The main issue at Site 4 is the need to implement the EISB component of the remedy. This action is planned for 2007.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the issues identified in the previous section, the following recommendations are provided:

- Continue the routine O&M inspections of the Building 502 and Site W Swale on a monthly basis, given the age of the system.

- All the rotted wood pieces or panels on the Site W Swale treatment building should be replaced.

- Replace the contact information sign on the outside of Building 502.

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10.0 PROTECTIVENESS STATEMENT

The remedy for the Site 4 Chemical Burial Area is protective of human health and ecological receptors in the short-term. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. The existing groundwater treatment systems located in the down-gradient area of the contaminant plume, are effective in reducing the concentrations of contaminants that may migrate off-site via the groundwater pathway. However, in order for the remedy to be protective in the long-term, the EISB component of the remedy needs to be implemented. Long-term monitoring of groundwater and five-year reviews help to ensure that the remedial actions are functioning as intended and that an overall reduction in groundwater contamination is being achieved.

11.0 NEXT REVIEW

The next Five-Year Review for the Site 4 Chemical Burial Area is required by 2011, five years from the date of this review.

REFERENCES

- CH2M Hill, Basis of Design for Site 4 Enhanced In-Situ Bioremediation and SVE, NSWC – White Oak, December 2004
- Naval Facilities Engineering Command, Record of Decision for Site 4 Soil and Groundwater. September 2005.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, April 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, May 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, June 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, July 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, August 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, September, 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Sampling Memorandum Former Naval Surface Warfare Center, White Oak, MD, October 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, October, 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, November, 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, December, 2006.
- Tetra Tech, NUS, Inc., Site 46 Groundwater Remediation Systems Field Report, January, 2007.

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SITE 5/13

Final Five-Year Review

For

Site 5 (Open Burn Area)
Site 13 (Oil Sludge Disposal Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington

Contract Number N62477-03-D-0163

Contract Task Order 0011

April 2007

Final Five-Year Review

For

Site 5 (Open Burn Area)
Site 13 (Oil Sludge Disposal Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
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CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
EBS	Environmental Baseline Survey
EISB	Enhanced In-situ Bioremediation
EOS	Emulsified Oil Substrate
NSWC-WO	Naval Surface Warfare Center – White Oak
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls-Remedial Design
MCL	Maximum Contaminant Level
MCS	Media Clean-up Standard
MDE	Maryland Department of the Environment
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCOC	Potential Contaminant of Concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager

SI	Site Inspection
SWMU	Solid Waste Management Unit
SVOC	Semi-volatile Organic Compound
TCE	Trichoroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedies for Sites 5 (Open Burn Area) and 13 (Oil Sludge Disposal Area) at the former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland, are protective of human health and the environment. The methods, findings, and conclusions of the Site 5/13 Five-Year Review are documented in this report. In addition, Five-Year Reviews identify issues found during the review, if any, and identify recommendations to address them.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of Site 5/13 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review is the initiation of remedial action at OU 2. The Five-Year Review is required for site 5/13 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. SITE 5/13 – OPEN BURN AREA AND OIL SLUDGE DISPOSAL AREA

Both Sites 5 and 13 were identified as Navy Installation Restoration Program (IRP) sites in an Initial Assessment Study (IAS) conducted by the Navy's Naval Energy and Environmental Support Activity (NEESA) in 1984. The purpose of the IAS was to identify sites at NSWC-WO that would undergo potential environmental investigation.

NSWC-WO operated under RCRA interim status for on-site storage of hazardous waste. The Navy first submitted an application for a final Part B permit to Maryland in 1985 and made subsequent resubmissions and modifications.

A RCRA Facility Assessment (RFA) was conducted by Kearney/Centaur Division in November 1990. The RFA identified 97 Solid Waste Management Units (SWMUs) and 19 areas of concern (AOCs) at NSWC-WO. Forty SWMUs were recommended for further investigation in an RFI to assess the presence and migration of potential contaminants of concern (PCOCs). SWMU 32 is associated with Site 5 while SWMU 7 is associated with Site 13. Both sites were recommended for investigation in an RFI.

In September 1992, Malcolm-Pirnie completed an RFA review for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual SWMU. Site 5 and 13 were identified as sites of low to moderate priority based upon potential risk.

In 1995, former NSWC-WO was selected for closure on the BRAC IV list. A Phase I Environmental Baseline Survey (EBS) was conducted by EA Engineering Science and Technology (EA) to assess the existing environmental information related to storage, release, treatment, or disposal of hazardous substances or petroleum products and to document the environmental condition of the property.

Investigation activities specific to Sites 5 and 13 were first conducted in 1997 at part of the Site Screening Investigation for Sites 1, 5, 6, 12, 13, 28, 29, 31, 32, and 33 and AOC 100. The site screening investigation consisted of collecting a number of surface and subsurface soil samples at Sites 5 and 13 and installing and sampling 6 monitoring wells.

The groundwater impacted by Sites 5 and 13, as well as several other sites in this part of the NSWC White Oak was investigated further between 1999 and 2001 as part of the OU-1 RI (CH2M Hill, August 2002). OU-1 includes the groundwater beneath IR sites in the eastern portion of White Oak, including the Site 5 and 13 areas. The OU-1 RI showed that Site 13 groundwater contamination was separate from Site 4 and 46 and delineated the extent of contamination migrating northwestward from Site 13 onto the adjoining private property by installing and sampling 19 multi-depth monitoring wells.

A soil removal action was conducted in 2000, during which the circular soil berms were removed and used as clean backfill at nearby Site 3 and the top three feet of contaminated soil that made up the floor of the three burn rings was excavated and disposed of in an off-site landfill.

An RFI was conducted on the soil at Sites 5 and 13 in 2003. The RFI concluded that there were no risks presented by the Site 5 and 13 soil to either human or environmental receptors and that the soil did not represent a continuing source of contamination to the underlying groundwater.

A Feasibility Study (FS) was conducted for OU-1 in 2003 (CH2M HILL, June 2003). The FS included the evaluation of remedial alternatives for Site 13 groundwater.

The Site 5 and 13 Record of Decision was finalized in September 2004.

3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 Site 5/13 Physical Characteristics

The ground surface at Site 5 slopes generally to the south and southwest toward Dahlgren Road, and the maximum difference in elevation is approximately 30 feet. There are no surface water bodies within Site 5. The closest surface water body is a small, southward-flowing tributary (West Farm Branch) of Paint Branch located approximately 420 feet west of BR-1. During rain events, surface water infiltrates into the surface soil or drains off-site toward drainage ditches along Dahlgren Road and ultimately to West Farm Branch. Figure 3-1 shows the layout of the Site 5 and 13 features.

The ground surface at Site 13 slopes gently to the west and consists of a relatively flat area. The maximum elevation relief across the site is approximately 5 feet, and the elevation of the site is approximately 260 feet. The topography immediately adjacent to Site 13 to the northwest, west and southwest drops steeply at a grade of approximately 33 percent into the valley formed by West Farm Branch approximately 300 feet west of the site. The steep slope between the Sites 5 and 13 area and West Farm Branch is the former location of Site 3, the Pistol Range Landfill, which was excavated in its entirety in 2000.

The soil underlying Sites 5 and 13 consists of a layer of silty sand and gravel (Coastal Plain deposits) ranging in thickness from 40 feet at the higher elevations on the east side of Site 5, to 10 feet on the west side of Site 13. The Coastal Plain is underlain by a 10 to 20-foot layer of decayed rock (saprolite). It grades from a micaceous silt or silty sand with varying amounts of clay and schist fragments to a severely weathered schist with relief texture. Fractured rock underlies the saprolite, the competent bedrock is primarily a garnet schist; however, in the borings for the deep wells at NSWC-WO, interbedded quartzites were observed.

The depth to the groundwater table varies from 25 feet on the east side of Site 5 to twelve feet at Site 13. While the upper portion of the water table aquifer resides in the relatively permeable Coastal Plain deposits on the east side of Site 5, the water table at Site 13 is present in the much-less permeable saprolitic soil. Groundwater flow beneath Site 5 is primarily to the south and southwest, while the flow beneath Site 13 is primarily to the northwest, toward and into West Farm Branch.

3.2. LAND AND RESOURCE USE

The combined area of Sites 5 and 13 consists of open field and woodlands approximately 3.5 acres in size. The area surrounding the field to the east, west and south is wooded property owned by the US Government. The property bounding the site to the north is an industrial property formerly operated as a sand and gravel quarry. The land overlying the groundwater contaminant plume originating in the Site 13 area and extending west and northwest to West Farm Branch consists of federal land owned by GSA and private property currently operated as a sand and gravel quarry.

The General Services Administration (GSA), which owns the property overlying the groundwater containing the highest concentrations of contaminants, has no immediate plans to use this area. The affected portion of the adjoining private property amounts to less than 1 acre and consists of an undeveloped and steeply sloped wooded hillside and floodplain of West Farm Branch.

There are no water supply wells located on the property in the area within or downgradient of the plume. Groundwater at and downgradient of Sites 5 and 13, and throughout the former NSWC-WO, is not used as a potable water source at this time and is unlikely to be used for such purposes in the future. Water for occupants of the former NSWC-WO and the surrounding properties is (and is expected to continue to be) supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable supply wells without a permit.

3.3. NATURE AND EXTENT OF CONTAMINATION

3.3.1 Soil

The site screening investigation, conducted in 1997 and 1998 before the Site 5 soil removal action, identified miscellaneous fill material, discolored soil, and soil contaminated with petroleum hydrocarbons and SVOCs in the area of BR-1. The majority of the discoloration, odors, and elevated SVOC concentrations in the soil were in the top 2 to 3 feet. Contaminants that were still present in the Site 5 soil after the 2000 removal action consisted of low levels of SVOCs, PCBs, pesticides, explosives, and metals. Ten compounds slightly exceeded the risk-based screening criteria used by EPA Region 3 to identify potential risks to people in residential settings. These compounds were benzo(a)pyrene, dibenzo(a,h)anthracene, Arochlor 1260, dieldrin, 2-amino-4,6-dinitrotoluene, RDX, copper, selenium, and thallium.

At Site 13, soil samples were collected from above the water table during the 1997 Site Screening Investigation and as part of the 2002 RFI. The only contaminants that were detected above the EPA Region 3 risk-based screening criteria for residential soil were benzo(a)pyrene, dibenzo(a,h)anthracene, and several metals. While low levels of chlorinated VOCs (1,1,2,2-tetrachloroethane, TCE, and 1,2-dibromo-3-chloropropane) were detected near the water table, they were not present at concentrations in excess of the risk-based criteria nor did they represent potential sources of groundwater contamination.

3.3.2 Groundwater

The Sites 5 and 13 groundwater contamination is centered in the area between the historically recognized area of Site 13 and the northern property line of the White Oak facility. The practices that led to this contamination and the exact location of the source are unknown. Based on groundwater screening data collected in 2001, the contaminants consist primarily of VOCs, which are 1,1,2,2-PCA, TCE, and cis-1,2-DCE, with lesser concentrations of PCE, trans-1,2-DCE and vinyl chloride. The well that consistently contains the highest VOC concentrations is well 13GW02, located on the north side of Site 13. A complete set of Sites 5 and 13 groundwater data collected since 1999 can be found in the FS for OU-1 (CH2M Hill, June 2003).

The COCs in this plume, and the maximum concentrations of each, detected since 2000 are:

- 1,1,2,2-Tetrachloroethane – 1,100 ug/L
- cis-1,2-Dichloroethene – 581 ug/L
- Trichloroethene – 420 ug/L
- Tetrachloroethene – 150 ug/L
- Vinyl chloride – 20 ug/L
- RDX – 110 ug/L
- Iron (dissolved) – 18,900 ug/L

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

Site specific risks were estimated for combined Sites 5 and 13 groundwater using the results of the OU-1 wide risk assessment. Because the Sites 5 and 13 area is a sub-area of OU-1 and many of the PCOCs identified for OU-1 are not found in Sites 5 and 13 groundwater, it is assumed the risks from Sites 5 and 13 will be less than those from the entire OU-1 area. Also, it is assumed that the only exposure scenarios that might experience unacceptable risks from groundwater at Sites 5 and 13 are those where unacceptable risks are present for a residential child, adult, and age-adjusted resident. The PCOCs for Sites 5 and 13 were selected by identifying those OU-1 PCOCs that are present at concentrations corresponding to a cancer risk of 5.0 E-06 or above, or an HI of 0.1 or above, and were detected in monitoring wells within the Site 13 source area and plume. The levels were selected to ensure that the overall risk from COCs across OU-1 does not exceed a carcinogenic risk of 5.0 E10-05 or noncancer hazard index of 1.

Inorganic compounds found in the groundwater at Sites 5 and 13 at concentrations that do not exceed base-wide background levels were excluded as PCOCs for Sites 5 and 13 based on the background comparison conducted in the OU-1 RI. The maximum detected chemical concentrations in groundwater were compared to the 95 percent upper tolerance limits calculated for the background data. Based on the Mann-Whitney U test; cobalt, manganese, and nickel are also present in the site groundwater at similar concentrations to the background groundwater.

The following chemicals were retained as PCOCs in Sites 5 and 13 groundwater:

- Five chlorinated VOCs: 1,1,2,2-PCA, tetrachloroethene (PCE), TCE, cis-1,2-dichloroethene (DCE), and vinyl chloride
- RDX
- Iron

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for Site 5/13 Groundwater

Hazard index for Site 5/13 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total HI - RME	9	21	NA
Total HI - CTE	0.6	1.9	NA
Incremental Lifetime Cancer Risk for Site 5/13 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total ILCR - RME	5.0 E-04	NA	1.7 E-03
Total ILCR - CTE	3.7 E-05	NA	2.8 E-04

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

3.4.2 Ecological Risk Assessment

At Site 5, one surface soil sample was collected for toxicity testing during the Base-wide Ecological Risk Assessment (BERA) due to elevated levels of PAHs in that sample. After a removal action was conducted at Site 5, the soil from the location of the toxicity test was no longer present. No other samples from Site 5 had chemical concentrations that exceeded the risk-based levels developed during the BERA; therefore risks to ecological receptors at Site 5 are expected to be within acceptable levels.

All chemical concentrations in surface soil samples collected at Site 13 were below the risk-based levels developed during the BERA; therefore risks to ecological receptors at Site 13 are expected to be within acceptable levels.

As groundwater exposure is not associated with ecological receptors, Sites 5 and 13 groundwater poses no ecological risks. No site-related chemicals were detected in the surface water or sediment in West Farm Branch and therefore, risks to ecological receptors were not evaluated for this media relative to Sites 5 and 13.

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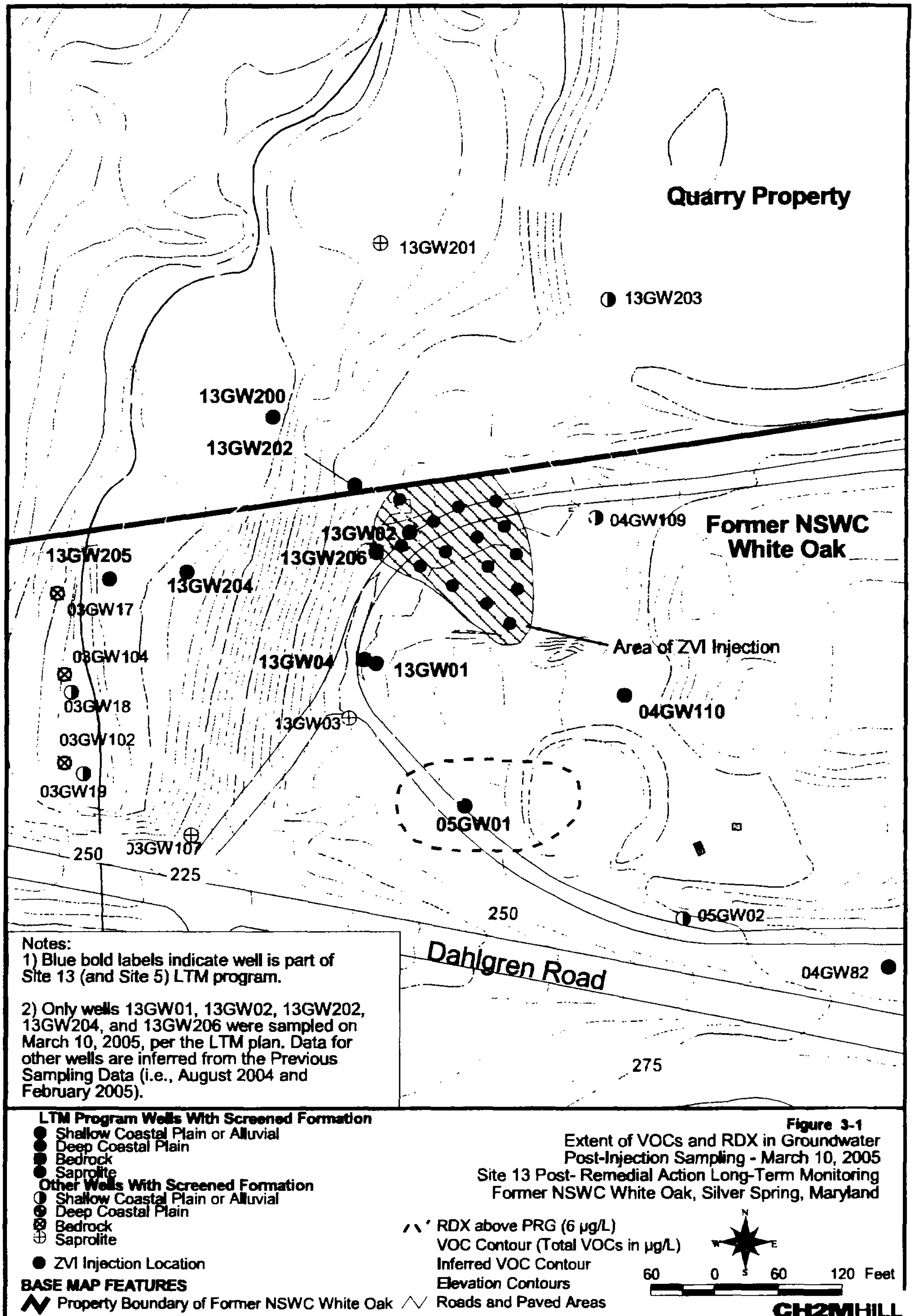

Figure 3-1
Extent of VOCs and RDX in Groundwater
Post-Injection Sampling - March 10, 2005
Site 13 Post- Remedial Action Long-Term Monitoring
Former NSWC White Oak, Silver Spring, Maryland

4.0 REMEDY IMPLEMENTATION

An interim removal action was performed for soil prior to submittal of the ROD and no further action is required for soil. Only the groundwater remedial actions will be discussed here.

4.1. REMEDIAL ACTION OBJECTIVES

The Open Burn Area and the Oil Sludge Disposal Area Remedial Action Objectives (RAOs) for groundwater, as presented in the ROD (USEPA, September 2004), include the following:

- Prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.

- Where practicable, restore contaminated groundwater to a quality amenable to beneficial use (i.e., meet the Preliminary Remediation Goals (PRGs) identified).

Meeting these objectives for Site 5/13 is based primarily upon achieving the PRGs, which are shown in Table 4-1.

Table 4-1
PRGs for COCs in Site 5/13 Attainment Area

COC	PRG (ug/L)	Basis
TCE	5	MCL
PCE	5	MCL
1,1,2,2 PCA	3	RBC
cis-1,2-DCE	70	MCL
Vinyl chloride	2	MCL
RDX	6	RBC
Iron (dissolved)	4,600	RBC

Source: ROD, USEPA, September 2004

4.2. SELECTED REMEDY

The primary components of the selected remedy are:

- Zero-valent iron injection (In-situ chemical reduction)
- Monitored Natural Attenuation
- Preparation of annual technical memoranda and 5-year review reports
- Implementation of institutional controls until PRGs are met.

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

The remedial action consisting of zero-valent iron injection is complete. The only ongoing activity is monitored natural attenuation; therefore the only O&M activity is inspection and maintenance of the groundwater monitoring wells.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for the Site 5/13 area at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review for the Navy under contract N62477-03-D-0163, Delivery Order 011.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan for Sites 5 and 13, the RI and FS for OU 1 (including Sites 5 and 13 groundwater), and the RFI for Sites 5 and 13 soil, became available to the public in September 2003 and are among the documents that comprise the Administrative Record file for NSWC-WO , which is maintained by NAVFAC at the Washington Navy Yard, Washington, DC and are also in the information repository for the NSWC-WO, which is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of the availability of these documents, the public comment period, and a public meeting was published in the *Washington Post* on September 25, 2003, and in the *Silver Spring Gazette*, *College Park Gazette,* and *Burtonsville Gazette* on September 24, 2003. The public comment period was held from September 30, 2003 to October 30, 2003, and a public meeting was held on October 14, 2003.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the RAB members at their next meeting. The results of the five-year review and the report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation and decision documents including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

From January 10, through February 3, 2005, ARS Technologies Inc. conducted pneumatic fracturing and zero valent iron (ZVI) injection into injection wells (IW)-1 through IW-15. After removing the temporary casing, the saprolitic bedrock was pneumatically fractured in 3.5 foot intervals by applying high pressure nitrogen gas for about 10 seconds. The range of influence was monitored via pressure gauges installed on nearby monitoring wells and injection boreholes. A total of 77,150 pounds of ZVI mixed with 23,506 gallons of water were injected into the subsurface at Site 5/13. Based on the elevated pressure readings in the monitoring wells, pneumatic fracturing and ZVI were successful.

Groundwater monitoring has been performed at various frequencies from February 1999 to February 2006 for two purposes: (1) remedial action monitoring was performed to document performance during the zero-valent iron injection phase and shortly thereafter; and (2) long-term groundwater monitoring is being performed to track the effect of ZVI on the downgradient groundwater concentrations and the performance of monitored natural attenuation. Table 6-1 is provided to highlight how ZVI has reduced contaminant concentrations at monitoring well 13GW02 by showing the groundwater monitoring data before and after ZVI injection.

A more detailed analysis of the data in Table 6-1 yields the following trends for the COCs for which PRGs have been developed. PCA decreased from 1,000 ug/L in Feb 99 to 700 ug/L in Aug 04, then to 99 ug/L in Feb 05, and to 8 ug/L in Feb 06. The Aug 04 and Feb 05 dates were chosen to show a before and after ZVI injection comparison (the injection occurred in Jan/Feb 2005. Table 6-1 shows similar trends in concentration for all the COCs as well.

In summary, the monitoring data indicate that the ZVI injection has significantly reduced the contaminant concentrations and the following observations can be made:

- For 4 of the 6 COCs, the concentrations have met the PRGs.
- PCA has shown the greatest reduction in concentration, which is to be expected because PCA was the source compound and has four chloride ions subject to the dechlorination process.
- There was a significant reduction in contaminant concentrations between Aug 04 and Feb 05 indicating a direct relationship between ZVI injection and contaminant reduction.
- Based on the contaminant reduction between Feb 99 and Aug 04 (prior to ZVI injection), some of the contaminant reduction is likely due to natural attenuation.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of Site 5/13 on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

The monitoring wells appeared to be in good condition at the time of inspection.

The Land Use Controls (LUCs) for Site 5/13 appear to be functioning as intended. Although there is no fence around Site 5/13, the site is located within a secured area of the facility, which in effect controls access to the site. A fence exists between the perimeter road (upgradient of Site 5/13) and the Percontee Sand and Gravel property. There is a gap between the fence and gate in the vicinity of monitoring well 13GW202 that appears large enough for a person to enter the former NSWC-WO. Due to time constraints, the entire fenceline was not inspected.

LUCs also include written restrictions, which control the conduct of activities which could disturb the ground surface of the site. In addition, there are restrictions on the use of groundwater for consumption. There were no physical signs of any residential use or disturbance of the ground surface during the site inspection. At the time this Five-Year Review was prepared, the exact wording of the LUCs were still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, CH2M Hill, the Army and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure no withdrawal of groundwater for any purposes from within the restricted area until the PRGs are met and risks from groundwater use are shown to be reduced to acceptable levels.

- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and future owners.

Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated. These institutional controls will be maintained until the concentrations of hazardous substances in the groundwater are at such levels to allow for unrestricted use and exposure.

Table 6-1
Sites 5/13
Monitoring Well 13GW02 Historical Results

	PRG (µg/L)	Monitoring Well 13GW02								
Sample ID		13GW020001	13GW020002	13GW020003	13GW020004	013GW0020005	013GW0020006	13GW02	13GW02-052301	013GW0020008
Sample Date		02/16/99	04/30/99	08/04/99	10/26/99	02/06/00	04/16/00	03/05/01	05/23/01	09/25/01
Volatile Organic Compounds (µg/L)										
1,1,2,2-Tetrachloroethane (PCA)	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1,1,2-Trichloroethane	no PRG	[redacted]	100 U	100 U	100 U	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1,2-Dichloroethane	no PRG	1 U	100 U	100 U	100 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	no PRG	1 U	100 U	100 U	100 U	1 U	1 U	1 U	[redacted]	1 U
Chloroform	no PRG	[redacted]	100 U	100 U	100 U	0.3 B	1 U	1 U	[redacted]	[redacted]
Chloromethane	no PRG	1 U	100 U	100 U	100 U	1 U	1 U	1 U	1 U	[redacted]
cis-1,2-Dichloroethene (cis-DCE)	70	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dichlorodifluoromethane (Freon-12)	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	no PRG	2 U	200 U	28 U	200 U	2 U	0.8 B	2 U	2 U	1 B
Tetrachloroethene (PCE)	5	[redacted]	[redacted]	[redacted]	[redacted]	44.5 B	[redacted]	[redacted]	[redacted]	[redacted]
Toluene	no PRG	1 U	100 U	100 U	100 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	no PRG	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Trichloroethene (TCE)	5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Vinyl chloride	2	[redacted]	100 U	100 U	100 U	[redacted]	1 U	[redacted]	1 U	[redacted]
RDX	6	4 6	6	5	4.7	4.9	3.1	NA	NA	NA
Filtered Metals (µg/L)										
Aluminum	no PRG	NA	NA	170 U	NA	108 B	204 B	NA	NA	NA
Antimony	no PRG	NA	NA	1.7 U	NA	3.1 U	2.9 U	NA	NA	NA
Barium	no PRG	NA	NA	[redacted]	NA	[redacted]	72.6 B	NA	NA	NA
Beryllium	no PRG	NA	NA	0.48 U	NA	[redacted]	0.76 B	NA	NA	NA
Cadmium	no PRG	NA	NA	3 U	NA	1.2 B	[redacted]	NA	NA	NA
Calcium	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Chromium	no PRG	NA	NA	2.4 UL	NA	1.3 B	[redacted]	NA	NA	NA
Cobalt	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Copper	no PRG	NA	NA	[redacted]	NA	19.6 B	[redacted]	NA	NA	NA
Iron	**4,600**	NA	NA	25.9 U	NA	23.9 U	25.2 B	NA	NA	NA
Lead	no PRG	NA	NA	1 U	NA	[redacted]	[redacted]	NA	NA	NA
Magnesium	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Manganese	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Nickel	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Potassium	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Selenium	no PRG	NA	NA	2.7 U	NA	2.3 U	2.2 UL	NA	NA	NA
Sodium	no PRG	NA	NA	[redacted]	NA	[redacted]	[redacted]	NA	NA	NA
Thallium	no PRG	NA	NA	3.7 UL	NA	3.4 B	3.3 UL	NA	NA	NA
Zinc	no PRG	NA	NA	[redacted]	NA	193 B	[redacted]	NA	NA	NA

NA - Not analyzed
B - Blank contaminated
E - Exceeded calibration range
J - Estimated
K - Biased high
L - Biased low
R - Rejected, unusable
U - Not detected
UJ - Not detected, estimated detection limit

6-5

Table 6-1
Sites 5/13
Monitoring Well 13GW02 Historical Results

	PRG (µg/L)	Monitoring Well 13GW02									
Sample ID		13GW02-112701	13GW02-022002	013GW0020804	13GW0020205	013GW0020305	013GW9000305 (Duplicate)	013GW0020505	013GW0020805	013GW002-1105	013GW002-0206
Sample Date		11/27/01	02/20/02	08/04/04	02/17/05	03/10/05	03/10/05	05/09/05	08/24/05	11/10/05	02/15/06
Volatile Organic Compounds (µg/L)											
1,1,2,2-Tetrachloroethane (PCA)	3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	2 U	2 U
1,1,2-Trichloroethane	no PRG	[redacted]	[redacted]	50 U	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1,2-Dichloroethane	no PRG	1 U	1 U	50 U	[redacted]	1 UJ	1 UJ	[redacted]	[redacted]	[redacted]	[redacted]
1,2-Dichloropropane	no PRG	1 U	1 U	NA	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	2 UJ	2 UJ
Chloroform	no PRG	1 U	1 U	NA	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	2 UJ	2 UJ
Chloromethane	no PRG	1 U	1 U	50 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	2 UJ	2 UJ
cis-1,2-Dichloroethene (cis-DCE)	70	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dichlorodifluoromethane (Freon-12)	no PRG	NA	NA	NA	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	2 UJ	2 UJ
Methyl acetate	no PRG	NA	NA	NA	[redacted]	1 UJ	[redacted]	[redacted]	1 UJ	2 UJ	[redacted]
Methylene chloride	no PRG	2 U	2 U	NA	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	2 UJ	2 UJ
Tetrachloroethene (PCE)	5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	2 U	2 U
Toluene	no PRG	1 U	1 U	NA	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	2 UJ	2 UJ
trans-1,2-Dichloroethene	no PRG	[redacted]	[redacted]	50 U	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	2 UJ	[redacted]
Trichloroethene (TCE)	5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	2 U	2 U
Vinyl chloride	2	[redacted]	[redacted]	50 U	[redacted]	1 UJ	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
RDX	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Filtered Metals (µg/L)											
Aluminum	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	4,600	NA	NA	61.6 B	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Lead	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not analyzed
B Blank contaminated
E Exceeded calibration range
J Estimated
K Biased high
L Biased low
R - Rejected, unusable
U Not detected
UJ Not detected, estimated detection limit

7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents, monitoring results, and site inspection indicate that the final remedy, which includes zero-valent iron injection, land use controls (LUCs), and monitored natural attenuation is functioning as intended by the ROD. The site inspections did not identify any problems or disturbances of Site 5/13. The land use controls are responsible for controlling access to the source area and protecting human receptors from ingestion of groundwater. No evidence of any activities of an intrusive, residential, or disturbance nature, that would have violated any of the land use controls, was observed during the site inspection.

Groundwater monitoring showed significant decreases for all the VOCs and in some cases the PRGs have been attained. In addition, the LUCs prevent use of groundwater at Site 5/13. In summary, the ZVI injection, land use controls, and monitored natural attenuation are in place to successfully prevent human exposure to the site-related contaminants from the Open Burn and the Oil Sludge Disposal Areas.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the ROD are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced to question the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The final remedy consisting of ZVI injection, land use controls, and monitored natural attenuation is successful towards achieving the RAOs in the ROD. Analytical data from long-term monitoring of groundwater indicates that four of six COCs have met the PRGs and concentrations of the other COCs, except iron, have decreased dramatically. The LUCs are effective towards controlling access to the source area and protecting human receptors from any direct contact with contaminated soil and from ingestion of groundwater.

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8.0 ISSUES

The Site 5/13 remedy of ZVI injection, land use controls, and monitored natural attenuation has been implemented and is functioning as intended by restricting exposure to contaminants by human and ecological receptors. However, the following item was identified based on the site inspection. This item concerns site access and is not critical to the performance of the remedy but is identified here because it involves access control not only to Site 5/13 but to the entire former NSWC-WO facility.

- There is a gap between the fence and gate in the vicinity of well 13GW202 that appears large enough for a person to enter the Site 5/13 area.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the issues identified in the previous sections, the following recommendations are provided:

- GSA should replace or modify the gate and or fence so that there is insufficient space for a person to pass through. Also, inspect the remainder of the fence line in the vicinity of Sites 5 and 13 for any gaps or damage.

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10.0 PROTECTIVENESS STATEMENT

The remedies for the Site 5 Open Burn Area and Site 13 Oil Sludge Disposal Area are protective of human health and ecological receptors based on achieving the RAOs specified in the RODs. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Monitored Natural Attenuation and five-year reviews help to ensure that the remedial actions are functioning as intended and that an overall reduction in groundwater contamination is being achieved.

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11.0 NEXT REVIEW

The next Five-Year Review for the Site 5 Open Burn Area and Site 13 Oil Sludge Disposal Area is required by 2011, five years from the date of this review.

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REFERENCES

- CH2M Hill, Basis of Design Report for Site 13, Zero-Valent Iron Injection, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, September 2004.

- Naval Facilities Engineering Command, Record of Decision for Sites 5 and 13 Soil and Groundwater. September 2004.

- Shaw Environmental and Infrastructure, Close-out Report for Site 13 Zero-Valent Iron Injection, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 2005.

- TtNUS, Site Screening Report for IRP Sites 1,5,6,12,13,28,29,31,32, and 33, EBS AOC 100, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, December 1998.

- TtNUS, Final RCRA Facility Investigation for Sites 5 and 13 Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, May 2003.

SITE 7

Final Five-Year Review

For

Site 7 (Ordnance Burn Area)

Former Naval Surface Warfare Center
White Oak, Maryland

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

Final Five-Year Review

For

Site 7 (Ordnance Burn Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
JM Waller Associates
9249 Old Keene Mill Road
Burke, VA 22015

CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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TABLES

FIGURES

LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
EBS	Environmental Baseline Survey
EISB	Enhanced In-situ Bioremediation
EOS	Emulsified Oil Substrate
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls – Remedial Design
MCL	Maximum Contaminant Level
MCS	Media Clean-up Standard
MDE	Maryland Department of the Environment
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
NSWC-WO	Naval Surface Warfare Center – White Oak
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachlorethene
PCOC	Potential Contaminant of Concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager

SI	Site Inspection
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedy at Sites 7 (Ordnance Burn Area) at the Former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland, is protective of human health and the environment. The methods, findings, and conclusions of the Site 7 Five-Year Review are documented in this report. In addition, issues found during the review and recommendations to address them are also included in this document.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of Site 7 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review is the initiation of remedial action at OU 2. The Five-Year Review is required for site 7 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. SITE 7 – ORDNANCE BURN AREA

Site 7, also known as the Ordnance Burn Area, consists of a large shallow ditch approximately 20 feet wide and 400 feet long which reportedly was used to dispose of waste ordnance materials between 1948 and 1968. Wastes disposed at this site included various types of explosives, primarily nitroaromatic and nitroaliphatic compounds, which were placed in the ditch and ignited. It has been reported that approximately 33,000 pounds of explosives were burned here over 20 years. The intent of the disposal operations was to burn all the waste residue, so that no solid wastes remained in the ditch. However, investigations indicate that surface soil and groundwater were affected by site operations, and that some wastes remain.

Site 7 was identified as a Navy Installation Restoration Program (IRP) site in an Initial Assessment Study (IAS) conducted by the Navy's Naval Energy and Environmental Support Activity (NEESA) in 1984. The purpose of the IAS was to identify sites at NSWC-WO that would undergo potential environmental investigation.

NSWC-WO operated under RCRA interim status for on-site storage of hazardous waste. The Navy first submitted an application for a final Part B permit to Maryland in 1985, and made subsequent resubmissions and modifications.

A RCRA Facility Assessment (RFA) was conducted by Kearney/Centaur Division, November 1990. The RFA identified 97 SWMUs and 19 areas of concern (AOCs) at NSWC-WO. Forty SWMUs were recommended for further investigation in an RFI to assess the presence and migration of potential contaminants of concern (PCOCs). SWMU 31 is associated with Site 7.

A Remedial Investigation (Malcolm Pirnie, October 1992) was performed, including among other things, soil and groundwater sampling at Site 7. This investigation suggested that soil contaminants at Site 7 might potentially affect groundwater quality.

In 1995, former NSWC-WO was selected for closure on the BRAC IV list. A Phase I Environmental Baseline Survey (EBS) was conducted by EA Engineering Science and Technology (EA) to assess the existing environmental information related to storage, release, treatment, or disposal of hazardous substances or petroleum products and to document the environmental condition of the property. The EBS was finalized and submitted in April 1996 (EA, April 1996).

An RFI (TtNUS, September 1999) was completed for six sites at White Oak, including Site 7; it included surface and subsurface soil sampling ad groundwater sampling at Site 7. The investigation concluded that elevated risks were present from exposure to soil contaminated with explosive compounds High Melting Explosive (HMX) and Royal Demolition Explosive (RDX). Additional groundwater data were obtained in 1999 during four rounds of sampling of numerous wells throughout White Oak, including the nine wells that existed at Site 7 at the time.

The groundwater affected by Site 7 was investigated further as part of the OU-1 RI (CH2M Hill, August 2002). OU-1 includes the groundwater beneath IR sites in the eastern portion of White Oak, including the Site 7. The OU-1 RI focused primarily on the downgradient edges of the various groundwater plumes within OU-1, as well as the surface water and sediment in the bounding streams. Initially, only one well in the Site 7 source area was sampled.

A soil removal action was conducted in November 2002, during which approximately 3,600 tons of soil contaminated with explosives residue. The soil was disposed offsite in a permitted non-hazardous waste landfill. Following the removal action, verification sampling was conducted to confirm the removal of the contaminated soil to levels protective of human health and the environment. A 2-foot layer of mulch and 2,000 gallons of vegetable oil were added to the site soil during the restoration activities to aid in the creation of subsurface conditions favorable to anaerobic degradation of contaminants in the groundwater and any residuals in the soil. Three new groundwater monitoring wells were installed at Site 7 after the completion of the removal action to address data gaps identified in the OU-1 RI and to allow more accurate cost estimates of remedial alternatives for the FS.

The Site 7 Record of Decision was finalized in September 2004.

3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 Site 7 Physical Characteristics

Site 7 consists of a slightly depressed swale. The rest of the area adjacent to the swale is relatively flat with a gentle eastward slope. Located just east of Site 7 is a dry swale leading south into Floral Drive stream, which runs along the eastern boundary of the former White Oak property and Floral Drive. The Floral Drive stream, which is southeast of Site 7, flows south into Paint Branch.

The subsurface geology of Site 7 consists primarily of Coastal Plain deposits, which are silty sand, sand, and gravel underlain by clayey sand with gravel or silt. The Coastal Plain deposits are approximately 50-75 feet thick through Site 7, and are underlain with saprolite of the Wissahickon Formation. The saprolite grades from a micaceous silt or silty sand with varying amounts of clay and schist fragments to a severely weathered schist with relict structure; it varies in thickness from 5 to 55 feet (and possibly greater). The competent bedrock is a gneiss and begins a approximately 80 to 130 feet below ground surface (bgs).

The depth to groundwater is about 40 feet, increasing from north to south across the site from about 36 to 55 feet. The aquifer is about 25 feet thick. The site geology is silty sand/sand and gravel underlain by clayey sand with gravel or silt. Coastal Plain sediments are underlain with saprolite. Data from well 07GW201, screened in the saprolite, indicates that contamination is present only in the groundwater in the Coastal Plain sediments. Groundwater flow is to the southeast and south with the hydraulic gradient estimated at 0.006 ft/ft (CH2M Hill, August 2002). The hydraulic conductivity in the Coastal Plain deposits was estimated at 6.6 ft/day from slug tests performed at the site wells. Using an effective porosity of 0.25, an average groundwater flow rate of 59 feet per year is assumed.

3.2. LAND AND RESOURCE USE

Site 7 consists of a slightly depressed 20 by 400 foot swale. The rest of the area adjacent to the swale is either cleared or covered by woodland or grass. Site 7 is located north of Dahlgren Road and the fenced area that contains Buildings 501, 506, and 508. The GSA, which owns the property, has no immediate plans to use Site 7. For the purposes of the risk assessment, the site was evaluated assuming the possibility of future residential use.

Groundwater at Site 7, and throughout the former NSWC-WO, is not used as a potable water source at this time and is unlikely to be used for such purposes in the future. Water for occupants of the former NSWC-WO and the surrounding properties is (and is expected to continue to be) supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable supply wells. Nonetheless, for the purposes of the site risk assessment, the groundwater was evaluated as a potential residential drinking water source.

3.3. NATURE AND EXTENT OF CONTAMINATION

3.3.1 Soil

Contaminants found in the soil prior to the removal action and their maximum detected concentrations were 2,4,6-TNT (2,000 mg/kg), RDX (2,700 mg/kg), HMX (900 mg/kg), 2-amino 4,6-DNT (4 mg/kg), 4-amino-2,6-DNT (6 mg/kg), PCBs (0.38 mg/kg), and polynuclear aromatic hydrocarbons (PAHs) (0.51 mg/kg in BAP equivalents).

In November 2002, approximately 2,000 tons of soil were excavated and disposed of at an appropriate offsite facility. The area of excavation measured 400 feet long by 20 feet wide on average. The depth of soil excavation ranged from 4 feet bgs at the east and west ends of the trench, to approximately 12 feet bgs in the center of the trench near wells 07GW08 and 07GW104. Verification samples were collected and analyzed by an off-site laboratory in order to confirm cleanup and assess any remaining risks.

The contaminants with maximum concentrations detected in the soil remaining after the removal action were: RDX (2.1 mg/kg), HMX (9.7 mg/kg), 2-amino 4,6-DNT (2.2 mg/kg), 4-amino-2,6-DNT (1.3 mg/kg).

3.3.2 Groundwater

The nature and extent of groundwater contamination at Site 7 is based on the data presented in the RFI (TtNUS, September 1999), Addendum Rounds 1, 2, 3 & 4 (TtNUS, April 2000), the OU-1 RI (CH2M Hill, August 2002), and the OU-1 FS, (CH2M, June 2003). Complete data for the Site 7 wells from 1999 to 2003 is provided in the referenced documents.

The contaminants in the groundwater at the Site 7 source area consist of 5 explosives, perchlorate, and TCE. While appearing in some wells, the TCE has been identified as coming from an upgradient source at Site 4. These compounds and their maximum concentrations between 1999 and 2003 are listed below.

- 2-amino-4,6-DNT: 140 ug/L
- 4-amino-2,6-DNT: 210 ug/L
- 2,4,6-TNT: 410 ug/L
- HMX: 500 ug/L
- RDX: 1300 ug/L
- Perchlorate: 29 ug/L
- TCE: 17 ug/L

The area of greatest contamination in the groundwater coincides with the historic area of explosive residue burning and documented soil contamination at Site 7. This area is approximately 240 feet long and 10-20 feet wide. The width of the head of the plume is estimated based on the presence of contaminated soil found during the 2002 removal action and the 2003 groundwater data from wells 07GW200 and 07GW202, both of which show no contamination.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

Site specific risks were estimated for the Site 7 groundwater using the results of the OU-1 wide risk assessment. Because Site 7 is a sub-area of OU-1 and many of the PCOCs identified for OU-1 are not found in the Site 7 groundwater, it is assumed the risks from Site 7 will be less than those from the entire OU-1 area. Also, it is assumed that the only exposure scenarios that might experience unacceptable risks from groundwater at Site 7 are those where unacceptable risks are present for a residential child, adult, and age-adjusted resident. The PCOCs for Site 7 were selected by identifying those OU-1 PCOCs that are present at concentrations corresponding to a cancer risk of 5.0 E-06 or above, or an HI of 0.1 or above, and were detected in monitoring wells within the Site 7 source area and plume. These levels were selected to ensure that the overall risk from COCs across OU-1 does not exceed a carcinogenic risk of 5 E10-5 or noncancer hazard index of 1.

Inorganic compounds found in the groundwater at Site 7 at concentrations that do not exceed base-wide background levels were excluded as PCOCs for Site 7 based on the background comparison evaluation conducted in the OU-1 RI. The maximum detected chemical concentrations in groundwater were compared to the 95 percent upper tolerance limits calculated for the background data. Based on the Mann-Whitney U test; cobalt, manganese, and nickel are also present in the site groundwater at similar concentrations to the background groundwater.

The following chemicals were retained as PCOCs in Site 7 groundwater:

- RDX
- 2,4,6-TNT
- 2-amino-4,6-DNT
- 4-amino-2,6-DNT
- TCE
- Perchlorate
- Cadmium
- Iron

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for Site 7 Groundwater

Hazard index for Site 7 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total HI - RME	12	28	NA
Total HI - CTE	2.2	7.4	NA
Incremental Lifetime Cancer Risk for Site 7 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total ILCR - RME	NA	NA	8.4 E-05
Total ILCR - CTE	NA	NA	1.3 E-05

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

3.4.2 Ecological Risk Assessment

The Navy conducted a Base-wide Ecological Risk Assessment (BERA) at former NSWC-WO. The procedures followed in conducting the BERA are outlined in the April 2001 final report. The BERA consisted of screening all soil, surface water, and sediment data collected at the facility against applicable ecological risk-based screening criteria. This data included soil data from Site 7 as well as sediment and surface water data from the Floral Drive stream. The BERA concluded that there was no risk from Site 7 soil prior to the 2002 removal action. The subsequent removal action, conducted to address potential risks to human receptors, has further mitigated the potential impact of the site contaminants on ecological receptors. The BERA also concluded that the sediment and surface water in the Floral Drive stream does not present unacceptable risks. As groundwater exposure is not associated with ecological receptors, Site 7 groundwater poses no unacceptable ecological risks.

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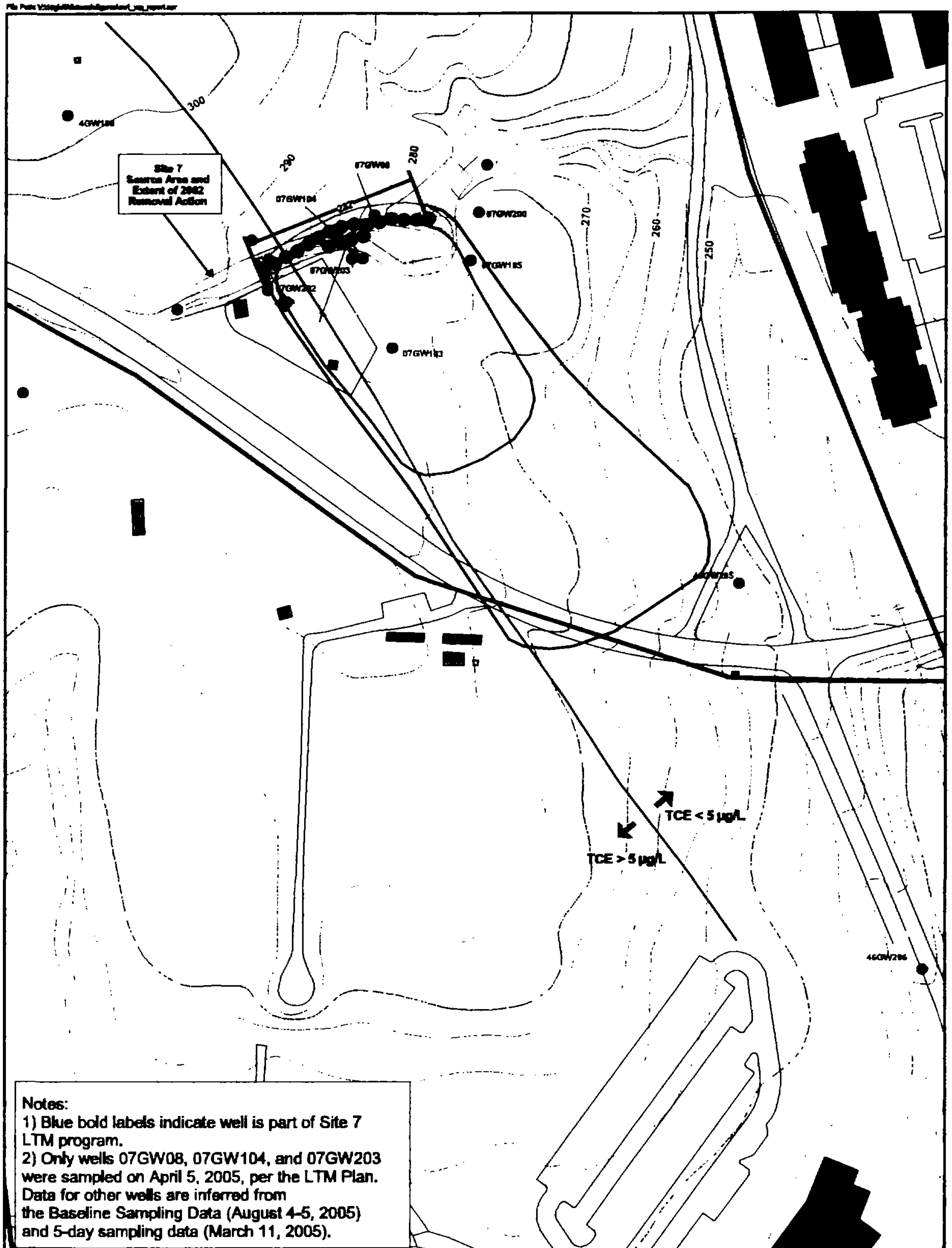

Notes:
1) Blue bold labels indicate well is part of Site 7 LTM program.
2) Only wells 07GW08, 07GW104, and 07GW203 were sampled on April 5, 2005, per the LTM Plan. Data for other wells are inferred from the Baseline Sampling Data (August 4-5, 2005) and 5-day sampling data (March 11, 2005).

LEGEND
- Monitoring Wells included in LTM Plan
- Other Monitoring Wells
- Injection Wells
- RDX Greater than PRG (30 µg/L)
- 2,4,5-TNT Greater than PRG (1.9 µg/L)
- Amino-DNT Greater than PRG (0.75 µg/L)
- TCE Concentration Greater than PRG (5 µg/L)
- Base Boundary
- Roads
- Intermittent Stream

N

0 60 120 180 Feet

Figure 3-1
Extent of Chemicals of Concern in Groundwater
Post-Injection Sampling- April 5, 2005
Site 7 Post-Remedial Action Long-Term Monitoring
Former NSWC White Oak, Silver Spring, MD

CH2MHILL

4.0 REMEDY IMPLEMENTATION

An interim removal action was performed for soil prior to the ROD and no further action is required for soil. Only the groundwater remedial action will be discussed here.

4.1. REMEDIAL ACTION OBJECTIVES

The Ordnance Burn Area Remedial Action Objectives (RAOs) for groundwater, as presented in the ROD (USEPA, September 2004), include the following:

- Prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.
- Where practicable, restore contaminated groundwater to a quality amenable to beneficial use (i.e., meet the Preliminary Remediation Goals (PRGs) identified).

Meeting these objectives for Site 7 is based primarily upon achieving the PRGs, which are shown in the following Table:

Table 4-1
PRGs for COCs in Site 7 Attainment Area

COC	PRG (ug/L)	Basis
2-amino-4,6-DNT	0.75	RBC
4-amino-2,6-DNT	0.75	RBC
2,4,6-TNT	1.9	RBC
RDX	30	RBC
TCE	5	MCL

RBC = Risk based concentration
Source: ROD, USEPA, September 2004.

4.2. SELECTED REMEDY

The primary components of the selected remedy are:

- Enhanced Anaerobic Bioremediation (sodium lactate injection)
- Groundwater Monitoring
- Implementation of institutional controls until PRGs are met.

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

The remedial action of enhanced bioremediation through injection of sodium lactate is complete. The only ongoing activity is groundwater monitoring; therefore O&M activities include inspection and maintenance of the injection and monitoring wells.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for the Site 7 Ordnance Burn Area at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document under contract N62477-03-D-0163, Delivery Order 011 to the Navy.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan for Site 7, and the RI and FS for OU-1 (including Site 7) became available to the public in June 2003 and are among the documents that comprise the Administrative Record file for NSWC-WO, which is maintained by NAVFAC at the Washington Navy Yard, Washington, DC and also in the information repository for the NSWC-WO, which is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of the availability of these documents, the public comment period, and a public meeting was published in the *Washington Post* on June 19, 2003, and in the *Silver Spring Gazette*, *College Park Gazette*, and *Burtonsville Gazette* on June 18, 2003. The public comment period was held from June 24, 2003 to July 24, 2003, and a public meeting was held on July 8, 2003.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the RAB members at their next meeting. The results of the five-year review and the report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation and decision documents including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

From January 10 through March 3, 2005, 19 injections wells ranging from a depth of 52 to 65 feet were installed. Batches of injection fluid consisting of potable water, sodium lactate and sodium hydroxide, were mixed in a designated area and added to a truck mounted mixing tank that dispensed the injection mixture to each individual well. Sodium lactate was diluted with water at a ratio of 17 gallons/83 gallons (to approximately 10%) per well and sodium hydroxide was added to adjust the pH to 10. After injection of the dilute lactate solution, the well was injected with a water slug of 2,400 gallons to flush the injectant into the formation. At an injection rate of approximately 4 gpm, each well injection (approximately 2,500 gallons) took approximately 10 hours to complete. The entire injection event used 323 gallons of 60% sodium lactate and 45,600 gallons of water.

An overview of the performance of the one-time injection event indicates that 2,4,6-TNT decreased from 13 ug/L in Feb 03 to 0.2 ug/L in March 06; 2-amino-4,6-DNT decreased from 15 in Feb 03 to 1.5 ug/L in March 06; 4-amino-2,6 decreased from 18 in Feb 03 to ND in Sep 05; and RDX decreased from 86 in Feb 03 to 9.7 ug/L in March 06.

The following observations are based on an analysis of Table 6-1, which includes results from a representative monitoring well (07GW103), from February 2003 through March 2006:

- There was an overall decrease in the concentrations of COCs as shown by the attainment of PRGs for 2,4,6 TNT, 4-amino-2,6-DNT, and RDX.
- There was a noticeable drop in many of the constituents after the lactate injection. The first monitoring event (May 2005) showed a drop in concentrations for 2-amino-4,6-DNT, 4-amino-2,6-DNT, HMX and RDX.
- TCE concentration was not detected throughout the monitoring period and was likely attributable to Site 4 instead of Site 7.
- The results for December 05 are suspect as it is unlikely that all constituents were not detected.

In summary, 4 of the 5 PRGs were met by March 2006, which indicates not only a decreasing trend but also success in meeting the Site 7 RAOs.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of Site 7 on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

All monitoring and injection wells appeared to be in good condition at the time of inspection.

The Land Use Controls (LUCs) for Site 7 appear to be functioning as intended. Although there is no fence around Site 7, the site is located within a secured area of the facility, which in effect controls access to the site. LUCs also include written restrictions, which control the conduct of activities which could disturb the ground surface activities on the site. In addition, there are restrictions on the use of groundwater for consumption. There was no physical evidence of any residential use or disturbance of the ground surface during the site inspection. At the time this Five-Year Review was prepared, the exact wording of the LUCs were still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

Recent monitoring in March 2006 indicated that RDX and 2,4,6 TNT concentrations were rebounding in some of the wells nearest the source area after an initial decrease. During the site visit it was mentioned by the RPM that based on the recent groundwater monitoring results, some of the explosives concentrations had rebounded in some of the wells. In fact, an additional injection to enhance bioremediation was ongoing as this document was being prepared.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August and September 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure no withdrawal of groundwater for any purposes from within the restricted area until the PRGs are met and risks from groundwater use are shown to be reduced to acceptable levels.

- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

- Ensure adequate protection to maintain the integrity of any current or future remedial equipment, such as monitoring wells, or remedial operations in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and future property owners.

These institutional controls will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure. Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated.

Table 6-1
Site 7
Monitoring Well 07GW103 Historical Results

	PRG (µg/L)	Monitoring Well 07GW103								
Sample ID		007GW1030009	007GW1030010	007GW1030011	007GW1030012	007GW1030013	007GW1030804	007GW1030905	007GW103-1205	07GW1030306
Sample Date		02/13/03	03/25/03	05/08/03	07/08/03	08/20/03	08/06/04	09/21/05	12/12/05	3/8/2006
Volatile Organic Compounds (µg/L)										
Acetone	no PRG	NA	NA	NA	NA	NA	NA	10 U	10 U	10 U
Chlorobenzene	no PRG	NA	NA	NA	NA	NA	NA	10 U	10 U	NA
Chloroform	no PRG	NA	NA	NA	NA	NA	NA	2 J	2 J	NA
Chloromethane	no PRG	NA	NA	NA	NA	NA	1 U	10 U	10 U	NA
Methyl acetate	no PRG	NA	NA	NA	NA	NA	NA	10 U	10 U	NA
Methyl tertiary-butyl ether (MTBE)	no PRG	NA	NA	NA	NA	NA	NA	10 U	10 U	NA
1,1,2,2-Tetrachloroethane (PCA)	no PRG	NA	NA	NA	NA	NA	1 U	2 U	2 U	2 U
Tetrachloroethene (PCE)	no PRG	NA	NA	NA	NA	NA	1 U	2 U	2 U	NA
Trichloroethene (TCE)	**5**	NA	NA	NA	NA	NA	1 U	2 U	2 U	2 U
cis-1,2-Dichloroethene	no PRG	NA	NA	NA	NA	NA	1 U	10 U	10 U	10 U
trans-1,2-Dichloroethene	no PRG	NA	NA	NA	NA	NA	1 U	10 U	10 U	NA
Vinyl chloride	no PRG	NA	NA	NA	NA	NA	1 U	2 U	2 U	NA
Energetics (µg/L)										
1,3,5-Trinitrobenzene	no PRG	4 U	4 U	1.2 U	1.2 J	1.4	0.6 U	0.2 U	0.15 U	NA
1,3-Dinitrobenzene	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.8 U	0.2 U	0.15 U	NA
2,4,6-Trinitrotoluene (TNT)	**1.9**	[redacted]							0.15 U	0.24
2,4-Dinitrotoluene	no PRG	4 U	4 U	1.2 U	2 U	0.28 J	0.6 U	0.2 U	0.15 U	0.2 U
2,6-Dinitrotoluene	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.8 U	0.2 U	0.15 U	NA
2-Amino-4,6-dinitrotoluene (2AmDNT)	**0.75**	[redacted]							0.15 U	[redacted]
4-Amino-2,6-dinitrotoluene (4AmDNT)	**0.75**	[redacted]						0.2 U	0.15 U	NA
2-Nitrotoluene	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.6 U	0.2 U	0.15 U	0.2 U
3-Nitrotoluene	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.6 U	0.2 U	0.15 U	NA
4-Nitrotoluene	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.6 U	0.2 U	0.15 U	NA
HMX	no PRG	130	120	40	19	9.4	17	13	0.15 U	24
Nitrobenzene	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.6 U	0.2 U	0.15 U	NA
RDX	**30**	[redacted]		25	[redacted]	28	11	11	0.15 U	9.7
Tetryl	no PRG	4 U	4 U	1.2 U	2 U	0.8 U	0.6 U	0.2 U	0.15 U	NA
Perchlorate (Method SW8321A)	no PRG	NA	NA	NA	NA	NA	0.24 U	NA	NA	NA
Perchlorate (Method EPA 314.1)	no PRG	NA	NA	NA	NA	NA	1 U	NA	NA	NA
Dissolved Metals (µg/L)										
Barium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	no PRG	42 U	42 U	42 U	42 U	120	NA	NA	NA	NA
Lead	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	no PRG	3 J	10 J	10 J	24	31	NA	NA	NA	NA
Nickel	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	no PRG	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not analyzed
B Blank contamination
J Estimated value
K Biased high
L Biased low
R Rejected Unusable
U Not detected
UJ [illegible]

7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents, monitoring results, and site inspection indicate that the final remedy which includes enhanced anaerobic bioremediation, land use controls, and groundwater monitoring is functioning as intended by the ROD. The site inspections did not identify any problems or disturbances at Site 7. The land use controls are responsible for controlling access to the source area and protecting human receptors from ingestion of groundwater. The groundwater bioremediation systems are responsible for limiting the off-site migration of contaminated groundwater. No evidence of any activities of an intrusive, residential, or disturbance nature were observed during the site inspection that would have violated any of the institutional controls.

Groundwater monitoring showed significant decreases for all the explosives and in four of five cases the PRGs have been attained. In addition, the LUCs prevent use of groundwater at Site 7. In summary, the enhanced bioremediation, land use controls, and groundwater monitoring are in place to successfully prevent human exposure to the site-related contaminants from the Ordnance Burn Area.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the ROD are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced to question the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The final remedy consisting of enhanced bioremediation, land use controls, and groundwater monitoring has been successful towards achieving the RAOs in the ROD. Analytical data from groundwater monitoring indicates that four of five COCs have met the PRGs and concentrations of the other COC, have decreased dramatically, as shown in Table 6-1. The LUCs are effective in controlling access to the source and plume areas and protecting human receptors from any direct contact with contaminated soil and from ingestion of groundwater.

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8.0 ISSUES

The Site 7 remedy of enhanced bioremediation, land use controls, and groundwater monitoring has been implemented and is functioning as intended by restricting exposure to contaminants by human and ecological receptors. However, the following item was identified based on a review of the recent groundwater monitoring results.

- Recent monitoring in March 2006 indicated that RDX and 2,4,6 TNT concentrations were rebounding in some of the wells near the source area after an initial decrease. This is normal based on the cyclic changes in groundwater levels and should not be construed as any type of failure of the remedial actions implemented.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the issues identified in the previous section, the following recommendation is provided:

- A follow-up injection to address the rebound in contaminant concentrations should be performed, and in fact has already been initiated by the Navy while this document was being prepared. Groundwater monitoring should be continued to ensure that the explosives and other COC concentrations remain below the PRGs.

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10.0 PROTECTIVENESS STATEMENT

The remedy for the Ordnance Burn Area is protective of the human health and ecological receptors based on achieving the RAOs specified in the RODs. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Groundwater monitoring and five-year reviews help to ensure that the remedial actions are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

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11.0 NEXT REVIEW

The next Five-Year Review for the Site 7 Ordnance Burn Area is required by 2011, five years from the date of this review.

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REFERENCES

- CH2M Hill, Basis of Design Report for Site 7 – Sodium Lactate Injection, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, January 2004.

- Malcolm Pirnie, Remedial Investigation Report for IRP Site 7, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 1992.

- Naval Facilities Engineering Command, Record of Decision for Site 7 Groundwater and Soil, September 2004.

- Shaw Environmental and Infrastructure, Close-out Report for Site 7 Sodium Lactate Injection, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 2005.

- TtNUS, Final RCRA Facility Investigation for Site 7, Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, September 1999.

SITE 9

Final Five-Year Review

For

Site 9 (Industrial Wastewater Disposal Area)

Former Naval Surface Warfare Center
White Oak, Maryland

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

Final Five-Year Review

For

Site 9 (Industrial Wastewater Disposal Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

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CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
EBS	Environmental Baseline Survey
EISB	Enhanced In-situ Bioremediation
EOS	Emulsified Oil Substrate
NSWC-WO	Naval Surface Warfare Center – White Oak
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls – Remedial Design
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MCS	Media Clean-up Standard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
MSL	mean sea level
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCOC	Potential contaminant of concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	Remedial Facility Assessment
RFI	Remedial Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision

RPM	Remedial Project Manager
SI	Site Inspection
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedy at Sites 9 (Industrial Wastewater Disposal Area) at the former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland, is protective of human health and the environment. The methods, findings, and conclusions of the Site 9 Five-Year Review are documented in this report. In addition, issues found during the review and recommendations to address them are also included in this document.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

Although this is not an NPL site, the Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore, the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of Site 9 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review is the initiation of remedial action at OU 2. The Five-Year Review is required for site 9 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. SITE 9 – INDUSTRIAL WASTEWATER DISPOSAL AREA

Site 9, also known as the Industrial Wastewater Disposal Area, consists of various wastewater collection and disposal features in the 300 Area, which is located in the southeast portion of NSWC-WO. The 300 Area is located between West Farm Branch (a small southward-flowing tributary of Paint Branch) and the small intermittent stream running along the east side of Isherwood Road (the Isherwood Road stream), and extends south from Dahlgren Road to the NSWC-WO boundary. The area occupied by Site 9 is located entirely within property currently owned by the GSA. However, the plume of contaminated groundwater originating on Site 9 extended onto property that has since been transferred to the Army and is now part of the Army's ALC.

Site 9 consists of 17 former leaching wells, two former leach fields, the former location of an underground wastewater storage tank at Building 327, and a former industrial wastewater collection sump at Building 318, all of which are located within the 300 Area. Liquid wastes containing explosive compounds, including RDX and HMX, as well as TCE and other chemicals, reportedly were disposed in the leaching wells, were stored in the Building 327 UST, and handled in the Building 318 sump.

Site 9 was identified as a Navy IRP site in an Initial Assessment Study (IAS) conducted by the Navy's Naval Energy and Environmental Support Activity (NEESA) in 1984. The purpose of the IAS was to identify sites at NSWC-WO that would undergo potential environmental investigation. The IAS included a records search, on-site survey, and site ranking and identified 14 sites as needing further investigation, including Site 9.

A Confirmation Study Verification Phase for NSWC-WO was conducted in 1985 (Malcolm-Pirnie, April 1987) to confirm the findings of the IAS and to obtain additional information to characterize site hazards. The study involved the installation of groundwater monitoring wells, the drilling of soil borings in areas of suspected soil contamination, and the collection of soil, surface water, groundwater, and sediment samples to characterize site contaminants. Site contamination was found in subsurface soil and groundwater. The study concluded that sufficient contamination existed in the groundwater at Site 9 to warrant additional study.

An RI was conducted at NSWC-WO in two phases between January 1989 and March 1992 (Malcolm Pirnie, October 1992). The RI was conducted to further characterize hazards associated with the identified sites and to aid in the development of remedial action plans for each. The RI involved the placement of additional groundwater monitoring wells at most sites; collection of surface and subsurface soil, sediment, surface water, and groundwater samples throughout the areas of investigation; and collection of ecological data at all sites, including Site 9.

In September 1992, Malcolm Pirnie completed an RFA review for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual

SWMU. Generally, for those SWMUs that were being investigated under the IRP, it was concluded that the planned level of effort was sufficient to address potential impacts from each SWMU. It was also concluded that some level of sampling would probably be required for the SWMUs and AOCs that were recommended for an RFI or verification sampling.

In 1995, NSWC-WO was selected for closure on the BRAC IV list. A Phase I Environmental Baseline Survey (EBS) was conducted by EA Engineering Science and Technology (EA) to assess the existing environmental information related to storage, release, treatment, or disposal of hazardous substances or actions required prior to property transfer to ensure compliance with requirements of CERCLA 120(h), applicable state and real estate laws, compliance programs, and DOD policy *Environmental Requirements for Federal Agency-to-Agency Property Transfer at BRAC Installations*. The EBS was finalized and submitted in April 1996.

Two leaching wells at Site 9 along with some surrounding soil that contained discolorations and elevated levels of PAHs, were excavated in a removal action conducted in October 1996. Post-excavation samples contained no unacceptable concentrations of constituents. The removal action is documented in a post-removal action report (TtNUS, November 2001). At approximately the same time in the mid-1990s, the UST used to store wastewater at Building 327 was excavated.

An RFI was conducted for the immediate area around Site 9 (and five other sites) that further characterized the nature and extent of contamination in soil and groundwater at Site 9 (TtNUS, October 2000). The RFI concluded that elevated risks were present from exposure to Site 9 groundwater contaminated with explosives compounds and chlorinated volatile organic compounds (VOCs), most notably TCE. Additional groundwater data were obtained in 1999 during four rounds of sampling and analysis of groundwater from numerous wells through NSWC-WO, including the wells that existed at and around Site 9 at the time (TtNUS, April 2000).

An FS was conducted for OU-1 in 2003 (CH2M Hill, June 2003). The FS included the evaluation of remedial alternatives for Site 9 groundwater.

A pilot test was conducted at the site beginning in July 2003 to evaluate the effectiveness of enhanced in-situ anaerobic bioremediation to degrade contaminants in groundwater at the site (CH2M HILL, October 2003). The pilot test used sodium lactate as an electron donor to promote biodegradation of the site contaminants. Groundwater data from these wells identified the source as the former wastewater collection sump in Building 318.

Four additional leaching wells were excavated as a housekeeping measure in 2003 or were confirmed as having been previously removed. No physical evidence of the other 13 leaching wells/fields were found during the IRP activities, and it was assumed that they had been previously removed.

The Site 9 Record of Decision was finalized in September 2004.

In January 2005, the sump area was excavated and 110 gallons of sodium lactate and approximately 500 gallons of water were placed into the excavation. The excavation was backfilled and a monitoring well was installed in the former location of the sump.

In November 2006, 55 gallons of emulsified oil substrate (EOS) and approximately 1,000 gallons of water were injected into the monitoring well at the sump.

In December 2006, an additional 110 gallons of EOS and water were injected into the same monitoring well.

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3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 Site 9 Physical Characteristics

The geology of the Site 9 area in the vicinity of Building 318 consists of silty sand and gravel (Coastal Plain sediments) to a depth of approximately 18 feet bgs. The Coastal Plain sediments are underlain by decayed rock (saprolite), which is significantly less conducive to groundwater flow than the Coastal Plain sand and gravel. The saprolite extends to a depth of about 30 to 40 feet where it grades to competent rock consisting of gneiss and schist. Groundwater flow in the rock occurs in fractures.

Groundwater flow near building 318 is to the south-southwest. The depth to groundwater is approximately 20 ft, so the upper portion of the aquifer is entirely in the saprolite. In the downgradient reaches of the contaminant plume, as it enters the West Farm Branch Valley, the Coastal Plain deposits thin and ultimately disappear.

The ground surface at Site 9 slopes generally to the south and southwest toward West Farm Branch, and the maximum difference in elevation is approximately 100 feet. Site 9 is bounded by two surface water bodies, the site is located between West Farm Branch, and the smaller intermittent stream running along the east side of Isherwood Road (the Isherwood Road stream) see figure 3-1. Both streams are southward-flowing tributaries of Paint Branch. During rain events, surface water infiltrates into the surface soil or drains towards West Farm Branch and the Isherwood Road stream.

3.2. LAND AND RESOURCE USE

The area of Site 9 consists of open field and woodlands in the southwest part of OU-1. The area surrounding the field to the north, east, and west is wooded property owned by the U.S. government. The GSA has no immediate plans to use this area. There are no water supply wells located on the property in the area within or downgradient of the plume. Groundwater at and downgradient of Site 9, and throughout the former NSWC-WO, is not used as a potable water source at this time and is unlikely to be used for such purposes in the future. Water for occupants of the former NSWC-WO and the surrounding properties is, and is expected to continue to be, supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable wells where a public supply is readily available. However, for the purposes of the site assessment, the site was evaluated assuming the possibility of residential use for the entire area including the use of the groundwater as a primary drinking water source.

3.3. NATURE AND EXTENT OF CONTAMINATION

3.3.1 Soil

No surface soil samples were collected at Site 9 because the potential sources of contamination were the leaching wells, an UST, and a building sump, none of which would impact surface soil. In addition, the RFI (TtNUS, October 2000), indicated that there was no evidence of surface soil contamination at the site.

Removal of two of the Site 9 leaching wells, LW-1 and LW-9, was completed in 1996 (TtNUS, November 2001). Elevated levels of PAHs were identified in the subsurface soil prior to the removal action, but post-excavation samples indicated no unacceptable levels of contamination.

The RFI, conducted in 1999, and the follow-up soil sampling in May 2003 did not identify any risks from exposure to Site 9 soil at any of the leaching wells (TtNUS, February 2004). The only constituent detected above Region III RBCs and site background concentrations in Site 9 soil is mercury, detected at a maximum concentration of 3.8 milligrams per kilogram in a soil sample collected in 2003 during the excavation of a drain pipe related to a former leaching well at Building 345. The sample was collected below the pipe at a depth of about four to five feet.

Low concentrations of explosives compounds (RDX at 1,200 ug/kg; HMX at 10,000 ug/kg; 2,4,6-trinitrotoluene at 1,500 ug/kg; 1,3,5-trinitrobenzene at 580 ug/kg; and 4 amino-2,6-dinitrotoluene at 150 ug/kg) and perchlorate at 1,400 ug/kg were detected in the soil beneath the former sump at Building 318 in a June 2003 sampling event. While these concentrations do not exceed EPA Region III RBCs, they may serve as a continuing source of groundwater contamination (CH2M Hill, October 2003).

3.3.2 Groundwater

The OU 1 RI identified the center of the Site 9 groundwater contamination at a hot spot near well 09GW01, located within the southwest portion of OU-1. Elevated levels of RDX and TCE were consistently detected above PRGs at this location. Perchlorate was also detected in the Site 9 groundwater at this location. PCE was detected in only two wells also located near this area. The maximum concentrations of these compounds detected at Site 9 between 1999 and just prior to the July 2003 groundwater pilot test in this area were:

TCE:	44 ug/L
RDX:	310 ug/L
PCE:	6.5 ug/L
Perchlorate:	880 ug/L

For the most part, the maximum concentrations were from samples collected from 1995 – 1998. Baseline sampling conducted in 2003 as part of the groundwater remediation pilot test at Site 9 showed that the source area of the explosives and perchlorate contamination was about 250 feet upgradient (north) of well 09GW01, the originally defined hot spot. Direct-push soil and groundwater samples, as well as three new monitoring wells, defined the source of contamination as the former wastewater collection sump in Building 318. At the start of the pilot test, the highest concentrations of the target contaminants RDX (190 ug/L) and perchlorate (250 ug/L) were found in well 09GW214, located 30 feet downgradient of the source sump. TCE was found at a maximum concentration of 11 ug/L in well 09GW205, approximately 225 feet downgradient of the sump.

The upgradient boundary of the target contamination zone is defined by well 09GW212, which is located upgradient of the source at Building 318 and serves as a background monitoring well. Low concentrations of TCE, RDX, and perchlorate extend to the south and southwest (downgradient) of the source area to the point at which the groundwater discharges to West Farm Branch. It should be noted that these target contaminants, particularly RDX and perchlorate, are found in the groundwater throughout this portion of OU-1 at low concentrations (below PRGs). TCE, RDX, and perchlorate have been detected at low concentrations in wells within 30 feet of West Farm Branch; however, none of these contaminants have been detected in the surface water in the stream and none have been detected in wells located across the stream.

It is not clear whether the Building 318 sump was also the source of the TCE found in the groundwater. Currently, the highest concentration of TCE at the site is located in the area between wells 09GW01 and 09GW57D, and the concentrations of TCE have decreased steadily and significantly since groundwater sampling was first conducted at Site 9 in 1986. For example the concentrations of TCE in well 09GW57D has decreased from 160 ug/L in 1991 to 11 ug/L in February 2004. Similarly, the concentration of TCE in well 09GW01 has decreased from 225 ug/L in 1986 to 6.2 ug/L in 2004.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

Site specific risks were estimated for the Site 9 groundwater using the results of the OU-1 wide risk assessment. Because Site 9 is a sub-area of OU-1 and many of the PCOCs identified for OU-1 are not found in the Site 9 groundwater, it is assumed the risks from Site 9 will be less than those from the entire OU-1 area. Also, it is assumed that the only exposure scenarios that might experience unacceptable risks from groundwater at Site 9 are those where unacceptable risks are present for a residential child, adult, and age-adjusted resident. The PCOCs for Site 9 were selected by identifying those OU-1 PCOCs that are present at concentrations corresponding to a cancer risk of 5.0 E-06 or above, or an HI of 0.1 or above, and were detected in monitoring wells within the Site 9 source area and plume. These levels were selected to ensure that the overall risk from COCs across OU-1 does not exceed a carcinogenic risk of 5.0 E-05 or noncancer hazard index of 1.

Inorganic compounds found in the groundwater at Site 9 at concentrations that do not exceed base-wide background levels were excluded as PCOCs for Site 9 based on the background comparison evaluation conducted in the OU-1 RI. The maximum detected chemical concentrations in groundwater were compared to the 95 percent upper tolerance limits calculated for the background data. Additionally a population to population comparison was conducted using the Mann-Whitney U test since the site data and background data are not normally distributed.

The following chemicals were retained as PCOCs in Site 9 groundwater:

- PCE
- TCE
- RDX
- Perchlorate
- Iron

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for Site 9 Groundwater

Hazard index for Site 9 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total HI - RME	8.8	20	NA
Total HI - CTE	0.6	1.9	NA
Incremental Lifetime Cancer Risk for Site 9 Groundwater in the Coastal Plain/Saprolite			
	Adult Resident	Child Resident	Age-adjusted Resident
Total ILCR - RME	1.3 E-04	NA	7.6 E-04
Total ILCR - CTE	3.9 E-06	NA	1.7 E-04

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

3.4.2 Ecological Risk Assessment

A Base-wide Ecological Risk Assessment (BERA) was developed for the former NSWC-WO to characterize the potential risks to ecological receptors from site-related chemicals found throughout the facility, including Site 9. The procedures followed in conducting the baseline ERA are outlined in the April 2001 final report.

There are no ecological risk exposure pathways related to soil at Site 9. No surface soil or shallow subsurface soil samples were collected at the site because the nature of any potential release from the Site 9 features would be several feet below the ground surface.

As groundwater exposure is not associated with ecological receptors, Site 9 groundwater poses no unacceptable ecological risks. No site-related chemicals were detected in the surface water or sediment in West Farm Branch and therefore, risks to ecological receptors were not evaluated for this media relative to Site 9.

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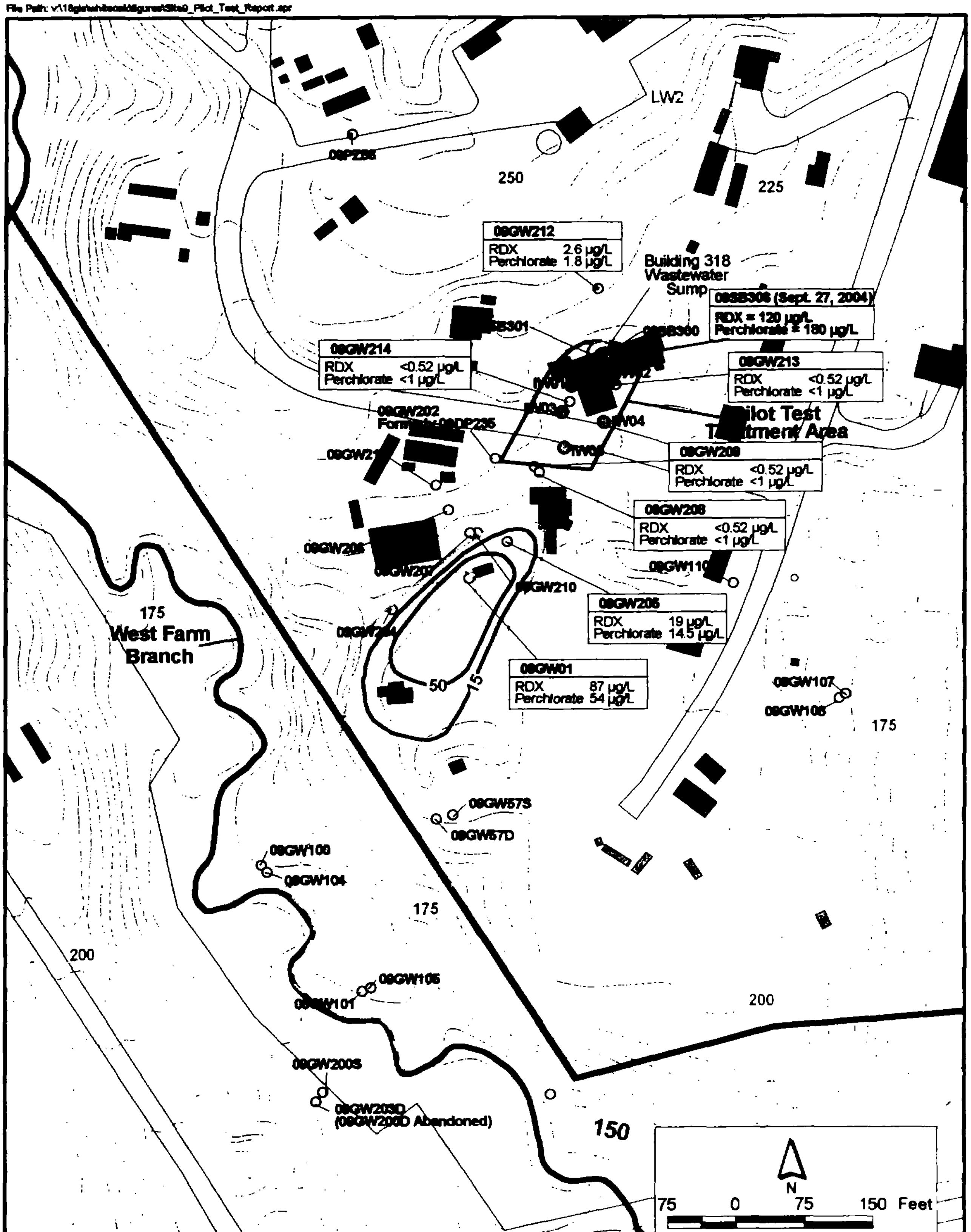

LEGEND
- Direct Push Location
- Monitoring Well Location
- Lactate Injection Boring
- Base Boundary
- Roads
- Topography (5 feet Intervals)
- Perennial Stream
- Intermittent Stream
- RDX Isoconcentrations (ug/L)
- Perchlorate Isoconcentrations (ug/L)
- Former Buildings

Figure 3-1
Approximate Extent of RDX and Perchlorate in Groundwater at 12 Months (August 3, 2004)
Site 9 Pilot Test Report
Former NSWC White Oak, Silver Spring, Maryland

CH2MHILL

4.0 REMEDY IMPLEMENTATION

A soil removal action was conducted in October 1996, which consisted of removing two leaching wells at Site 9 along with some surrounding soil that contained discolorations and elevated levels of PAHs. Post-excavation samples contained no unacceptable concentrations of constituents.

A pilot test to remediate groundwater was conducted at the site beginning in July 2003 to evaluate the effectiveness of enhanced in-situ anaerobic bioremediation to degrade contaminants (explosives compounds and perchlorate) in groundwater at the site. The pilot test was incorporated as part of the final remedy and additional EOS was injected in 2006.

4.1. REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for groundwater for Site 9, as presented in the ROD (USEPA, September 2004), include the following:

- Prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.
- Where practicable, restore contaminated groundwater to a quality amenable to beneficial use (meet the PRGs.

The RAO for the Site 9 soil beneath the Building 318 sump is:

- Prevent leaching of constituents from soil to groundwater at concentrations that would result in unacceptable risks to human receptors.

Meeting these objectives for Site 9 is based largely upon achieving the PRGs, which are shown in the following Table:

Table 4-1
PRGs for COCs in Site 9 Attainment Area

COC	PRG (ug/L)	Basis
PCE	5	MCL
TCE	5	MCL
RDX	15	RB

RB = Risk based criteria developed by EPA Region III.
Source: ROD, USEPA, September 2004.

4.2. SELECTED REMEDY

The primary components of the selected remedy are:

- Enhanced Anaerobic Bioremediation in the former Building 318 sump area (sodium lactate injection)
- Monitored Natural Attenuation
- Implementation of institutional controls until PRGs are met.

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

The remedial actions of lactate injection, groundwater monitoring, and institutional controls are currently underway. The need for additional injections will be based on the results of the current lactate injections. O&M activities include groundwater monitoring well inspection and maintenance.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for the Site 9 - Industrial Wastewater Disposal Area at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document under contract N62477-03-D-0163, Delivery Order 011 to the Navy.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan, the RI, and RFI for Site 9, and FS for OU-1 (including Site 9 groundwater), became available to the public on April 4, 2004 and are among the documents that comprise the Administrative Record file for former NSWC-WO, which is maintained by NAVFAC Washington at the Washington Navy Yard, Washington, DC. These documents are also located in the information repository for the NSWC-WO, which is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of the availability of these documents, the public comment period, and a public meeting was published in the *Washington Post* on April 1, 2004, and in the *Silver Spring Gazette*, *College Park Gazette*, and *Burtonsville Gazette* on March 31, 2004. The public comment period was held from April 4, 2004 to May 4, 2004, and a public meeting was held on April 13, 2004.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the Restoration Advisory Board (RAB) members at their next meeting. The results of the five-year review and the report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation, decision, and remediation documents, including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

A pilot test to evaluate whether groundwater remediation was feasible was conducted at the site beginning in July 2003 using enhanced in-situ anaerobic bioremediation to degrade contaminants (explosives compounds and perchlorate) in groundwater at the site. The pilot test used sodium lactate as an electron donor to promote biodegradation of the site contaminants. Ten new monitoring wells were installed in the pilot study target area at Site 9 to further define the source of contamination. Groundwater data from these wells identified the source as the former wastewater collection sump in Building 318.

The sodium lactate was delivered to the subsurface via pneumatic fracturing in five injection borings, installed on July 16, 2003 in a five-point configuration at approximately 45-foot spacing. Pneumatic fracturing focused on the interval between the top of the water table and the top of the bedrock. The fracturing was used to allow better mixing of the sodium lactate in the tight saprolite.

Well 09GW214, located immediately downgradient of the source, contained the highest concentrations of RDX (190 ug/L) and perchlorate (250 ug/L) during the baseline sampling in June and July 2003. Groundwater samples collected from the same well six months after the pilot test (Feb 2004) show these contaminant concentrations reduced to non-detect levels. RDX concentrations were reduced to non-detect in four of six downgradient wells sampled as part of the pilot test. Perchlorate concentrations were reduced to non-detect in three out of the six downgradient wells sampled.

09GW01 was chosen as the location most representative of the performance of the remedial action associated with Site 9 due to its location directly downgradient of the center of the source area and because it was sampled during the pilot test. An overview of the COCs indicates that PCE at 09GW01 was either not detected or not analyzed and therefore PCE is not included in this analysis; TCE decreased from 9 ug/L in Sept. 05 to 4 ug/L in June 06; perchlorate decreased from 95 ug/L in Feb 04 to 12 ug/L in June 06; and RDX decreased from 99 ug/L in Feb 04 to 38 ug/L in June 06.

The following observations were made based on an analysis of Table 6-1:

- There was an overall decrease in the concentrations in COCs as shown by the attainment of PRGs for TCE and Perchlorate. Even though RDX remains above its PRG, there was still a significant drop (99 ug/L to 38 ug/L).
- There was a noticeable drop in many of the constituents before and after the lactate injection. The RDX and perchlorate values were significantly lower in Feb 04.
- PCE and TCE concentrations were either not available or not detected throughout the monitoring period and was likely attributable to Site 4 instead of Site 9.

In summary, 2 of the 3 PRGs were met by June 2006 and each COC showed successive decreases from one monitoring event to the next one. These data indicate a relatively steady decreasing trend, particularly for the explosive compounds, and success in meeting the Site 9 RAOs.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of Site 9 on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

The pilot test using lactate injection is complete and there are currently no ongoing remedial activities except for occasional monitoring. The entire site area has been backfilled and regraded and there are no signs of any current or former site-related activities. All monitoring wells appeared to be in good condition at the time of inspection.

The Land Use Controls (LUCs) for Site 9 appear to be functioning as intended. Although there is no fence around Site 9, the site is located within a secured area of the facility, which in effect controls access to the site. LUCs also include written restrictions, which control the conduct of activities which could disturb the ground surface at the site. In addition, there are restrictions on the use of groundwater for potable use. There was no physical evidence of any residential use or disturbance of the ground surface during the site inspection. At the time this Five-Year Review was prepared, the exact wording of the LUCs were still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

Recent monitoring in June 2006 indicated that perchlorate and RDX concentrations have rebounded in 09GW215, one of the new wells near the source area. Additional lactate injections were performed in November and December of 2006. The need for additional lactate injections will be evaluated based on these results.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August and September 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure no withdrawal of groundwater for any purpose from within the restricted area until the PRGs are met and risks from groundwater use are shown to be reduced to acceptable levels.

- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and future property owners.

These institutional controls will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure. Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated.

Table 6-1
Site 9
Monitoring Well 09GW01 Historical Results

Sample Location / Sample Date		09GW01 6/03	09GW01 2/04	09GW01 8/3/04	09GW01 9/21/05	09GW01 6/7/06
Chemical Name	**PRG**					
Volatile Organic Compounds (µg/L)						
2- Butanone		NA	NA	NA	ND	ND
Acetone		NA	NA	NA	ND	ND
Chloroform	--	NA	NA	NA	ND	ND
cis-1,2-Dichloroethene	--	NA	NA	NA	ND	ND
Dichlorodifluoromethane	--	NA	NA	NA	ND	ND
Methane	--	NA	NA	NA	130	ND
Tetrachloroethene (PCE)	**5**	NA	NA	NA	ND	ND U
Trichloroethene (TCE)	**5**	NA	NA	NA	9	4
Trichlorofluoromethane	--	NA	NA	NA	7 J	3 J
Energetics (µg/L)						
1,3-DNB	--	NA	NA	NA	ND	ND
2,4,6-TNT	--	NA	NA	NA	ND	ND
2,4-DNT		NA	NA	NA	ND	ND
2,6-DNT	--	NA	NA	NA	ND	ND
2-AM-4,6-DNT	--	NA	NA	NA	ND	ND
HMX	--	NA	NA	NA	6.2	6.6 P
NB	--	NA	NA	NA	0.16 U	0.2 U
Perchlorate	**25.5**	250	95	54	29	12
RDX	**15**	190	99	87	58	38 E

E = Result exceeds instrument calibration range
J = Estimated value
ND = Not detected
NA = Not available
U = Not detected
Shading = Exceedance of PRG

7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents, monitoring results, and site inspection indicate that the portion of the final remedy which has been implemented, land use controls and groundwater monitoring, is functioning as intended by the ROD. The pilot scale test was effective in reducing the contaminant concentrations in the groundwater that could potentially migrate off-site; however, some explosives concentrations remain above PRGs in the source area. Additional lactate injections were recently performed in 2006 and the results were not available during the preparation of this document.

The land use controls are responsible for controlling access to the source area and protecting human receptors from any direct contact with contaminated soil or ingestion of groundwater. The site inspections did not identify any problems or disturbances at Site 9. No evidence of any activities of an intrusive or land disturbance nature and no signs of residential use were observed during the site inspection that would have violated any of the institutional controls.

Groundwater monitoring showed significant decreases for all the explosives and volatiles monitored for and in two of three cases, the PRGs have been attained. In addition, the LUCs prevent use of groundwater at Site 9. In summary, the enhanced bioremediation pilot test, land use controls, and groundwater monitoring are in place to successfully prevent human exposure to the site-related contaminants from Site 9.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the ROD are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced to question the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The final remedy consisting of lactose or EOS injections, land use controls, and groundwater monitoring has been successful towards achieving the RAOs in the ROD. Analytical data from groundwater monitoring indicates that two of three COCs have met the PRGs and concentrations of the other COC, have decreased significantly. The LUCs are effective in controlling access to the source and plume areas and protecting human receptors from any direct contact with contaminated soil from ingestion of groundwater.

8.0 ISSUES

The remedial actions of lactate injection, groundwater monitoring, and institutional controls are currently underway. The need for additional injections will be based on the results of the current lactate injections.

- Currently there are no issues identified at Site 9.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the Five-year review, the following recommendation is provided:

- Groundwater monitoring should be continued to identify whether all the RAOs have been met and to determine the need for additional injections.

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10.0 PROTECTIVENESS STATEMENT

The remedy for the Industrial Wastewater Disposal Area – Site 9 is protective of the human health and ecological receptors based on achieving most of the RAOs specified in the RODs. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Groundwater treatment through lactate and EOS injections have reduced VOC and explosives concentrations near the source area. Groundwater monitoring and five-year reviews help to ensure that the remedial actions are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

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11.0 NEXT REVIEW

The next Five-Year Review for Site 9 is required by 2011, five years from the date of this review.

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REFERENCES

- CH2M Hill, Site 9 Pilot Test Report, September 2004.
- CH2M Hill, Site 9 Monitoring Data Summary, September 2005.
- CH2M Hill, Site 9 Monitoring Data Summary, June 2006.
- Naval Facilities Engineering Command, Record of Decision for Site 9 Groundwater and Soil, September 2004.
- Malcolm Pirnie, Remedial Investigation Report for IRP Site 9, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 1992.
- TtNUS, Final RCRA Facility Investigation for Site 9, Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 2000.

SITE 11

Final Five-Year Review

For

Site 11 (Industrial Wastewater Disposal 100 Area)

Former Naval Surface Warfare Center White Oak, Maryland

Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

Final Five-Year Review

For

Site 11 (Industrial Wastewater Disposal 100 Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
JM Waller Associates
9249 Old Keene Mill Road
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CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
EOS	Emulsified Oil Substrate
NSWC-WO	Naval Surface Warfare Center – White Oak
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls – Remedial Design
MCL	Maximum Contaminant Level
MCS	Media Clean-up Standard
MDE	Maryland Department of the Environment
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCOC	Potential Contaminant of Concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SI	Site Inspection

SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedy at Site 11 (Industrial Wastewater Disposal 100 Area) at the former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland, is protective of human health and the environment. The methods, findings, and conclusions of the Site 11 Five-Year Review are documented in this report. In addition, issues found during the review and recommendations to address them are also included in this document.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore, the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of Site 11 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review is the initiation of remedial action at OU 2. A Five-Year Review is required for site 11 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

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2.0 SITE HISTORY

2.1. SITE 11 – INDUSTRIAL WASTEWATER DISPOSAL 100 AREA

Site 11, also known as the Industrial Wastewater Disposal Area 100, comprises approximately 16 acres. Reportedly, up to 14 leaching (or dry) wells were used to dispose of an estimated 20,000 gallons of liquid wastes generated by NSWC-WO laboratories between 1951 and 1976. The wastes of concern were reported to include acids, metals, photographic wastes, solvents (including TCE), and organic explosive compounds. The liquid wastes were conveyed from the laboratories to the wells by subsurface piping. Through their operation, subsurface soil and groundwater were potentially impacted and are the media of concern associated with Site 11. Two Records of Decision have been signed for this site, one for the soils and another for the groundwater.

Site 11 was identified as a Navy IRP site in an Initial Assessment Study (IAS) conducted by the Navy's Naval Energy and Environmental Support Activity (NEESA) in 1984. The purpose of the IAS was to identify sites at NSWC-WO that would undergo potential environmental investigation. The IAS included a records search, on-site survey, and site ranking and identified 14 sites as needing further investigation, including Site 11.

A Confirmation Study Verification Phase for NSWC-WO was conducted in 1985 (Malcolm-Pirnie, April 1987) to confirm the findings of the IAS and to obtain additional information to characterize site hazards. The study involved the installation of groundwater monitoring wells, the drilling of soil borings in areas of suspected soil contamination, and the collection of soil, surface water, groundwater, and sediment samples to characterize site contaminants. Site contamination was found in subsurface soil and groundwater. The study concluded that sufficient contamination existed in the groundwater at Site 11 to warrant additional study.

An RI was conducted at NSWC-WO in two phases between January 1989 and March 1992 (Malcolm Pirnie, October 1992). The RI was conducted to further characterize hazards associated with the identified sites and to aid in the development of remedial action plans for each. The RI involved the placement of additional groundwater monitoring wells at all sites; collection of surface and subsurface soil, sediment, surface water, and groundwater samples throughout the areas of investigation; completion of slug tests and aquifer pumping tests; and collection of ecological data at all sites, including Site 11.

In September 1992, Malcolm Pirnie completed an RFA review for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual SWMU. Generally, for those SWMUs that were being investigated under the IRP, it was concluded that the planned level of effort was sufficient to address potential impacts from each SWMU. It was also concluded that some level of sampling would probably be required for the SWMUs and AOCs that were recommended for an RFI or verification sampling.

In 1995, NSWC-WO was selected for closure on the BRAC IV list. A Phase I Environmental Baseline Survey (EBS) was conducted by EA Engineering Science and Technology (EA) to assess the existing environmental information related to storage, release, treatment, or disposal of hazardous substances or petroleum products and to document the environmental condition of the property. The EBS also addressed actions required prior to property transfer to ensure compliance with requirements of CERCLA 120(h), applicable state and real estate laws, compliance programs, and DOD policy *Environmental Requirements for Federal Agency-to-Agency Property Transfer at BRAC Installations.* The EBS was finalized and submitted in April 1996.

Source removal activities were completed at Sites 8, 9, and 11 during 1996 to address contaminant sources that may be impacting groundwater at NSWC-WO. The activities included the excavation and off-site disposal of waste and contaminated media from these sites in conjunction with the findings of the Design Verification Study (B&R Environmental, 1995). The activities included the removal of five leaching wells (LW-2, LW-4, LW-5, LW-12, and LW-13) and surrounding subsurface soil from Site 11. Subsurface soil sampling was performed following completion of waste and soil removal activities to verify the removal of contamination.

Based in part on the removal of these leaching wells and an evaluation of the potential soils contamination at the other leaching wells, a No Further Action Record of Decision was finalized in July 2002.

Additional groundwater data were obtained in 1999 during four rounds of sampling and analysis of groundwater from 32 wells. Data from this investigation are presented in the report titled Addendum Rounds 1, 2, 3 & 4 Groundwater Data, RCRA Facility Investigation for Site 11 (TtNUS, 2000b). Groundwater samples were analyzed for VOCs, SVOCs, pesticides and PCBs, explosives, and inorganic compounds. Results provided data for within-well comparisons over time.

To focus on the deeper bedrock groundwater contamination, an RFI Addendum was prepared (TtNUS, 2001a). The objectives of the RFI Addendum were to further delineate the lateral and vertical extent of contamination in the bedrock aquifer, better define groundwater flow directions in bedrock, evaluate natural attenuation mechanisms/potential, evaluate groundwater discharge impacts to local surface water bodies, and to gather data for a groundwater extraction and treatment system design, if needed.

Through the RFI-related site investigation work performed at Site 11, two VOC plumes, one perchlorate plume, and one chromium plume were identified in groundwater, as shown in figure 3-1. This report focuses on remedial actions for VOC Plume No. 2, as shown in figure 3-2, which is associated with former leaching well LW02. Contaminants of concern (COCs) at VOC Plume No. 2 include tetrachloroethene (PCE) (maximum detected concentration in 2001 – 61 ug/L) and TCE (maximum detected concentration in

2001 – 27 ug/L). The highest concentrations of contamination related to this plume were found in the overburden (saprolite) aquifer.

Within VOC Plume No. 2, the zone of contamination in the saprolite is centered around groundwater monitoring well 11TW-03. It had been estimated that approximately 70 years would be required for naturally occurring degradation processes to reduce the concentration of the main COC within this area (PCE) to its media clean-up standard (MCS = 5 ug/L) based on first-order rate trend projections. A remedial action was implemented to enhance natural biodegradation processes within VOC Plume No. 2 such that VOC concentrations in the saprolite zone are reduced to the contaminant-specific MCSs within a more reasonable timeframe.

The results of site investigations were used to prepare a corrective measures study (CMS) for the Site 11 groundwater (TtNUS, 2003). This CMS identified COCs and established media cleanup standards (MCSs). As part of the CMS, remedial technologies were screened; corrective measure alternatives were assembled, analyzed, and compared; and a preferred alternative was identified.

The Record of Decision for Site 11 Soils was finalized in July 2002.

The Record of Decision for Site 11 Groundwater was finalized in April 2004.

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3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 Site 11 Physical Characteristics

Two west-east flowing, intermittent streams, located east of Site 11, flow into Paint Branch. One northwest-southeast flowing stream located at the western end of Site 11 discharges offsite and eventually flows into Paint Branch.

The surficial geology of Site 11 consists of the Upland Sand and Gravel Formation, which exists in the central and southern regions of Site 11, and the saprolite of the Wissahickon Formation, which exists in the northern region. A thin layer of the Upland Sand and Gravel thickens to the south and southeast and varies in thickness from 2 to 30 feet. It consists of brown silt and red-brown, fine to medium sand with some gravel. Clayey silt seams less than 1 foot thick interbedded with fine gravel occur near the base of the unit. The saprolite of the Wissahickon Formation varies in thickness from 5 to 55 feet (and possibly greater). The saprolite grades from a micaceous silt or silty sand with varying amounts of clay and schist fragments to a severely weathered schist with relief texture. The competent bedrock is a wide gneiss and begins at approximately 23 to 47 feet below ground surface (bgs).

3.2. LAND AND RESOURCE USE

The majority of the property occupied by Site 11 is open space with a few buildings and paved roads and parking areas. The GSA, which owns the property, has plans to use Site 11 for nonresidential purposes. The buildings constructed as part of this development will be leased to the FDA. Nonetheless, for the purposes of the site assessment, the site was evaluated assuming the possibility of future residential use.

Groundwater at Site 11 is not used as a potable water supply at this time and there is no known plan to use the impacted groundwater. In addition, water for occupants of the former NSWC-WO and the surrounding properties is, and is expected to continue to be, supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable wells where a public supply is readily available.

3.3. NATURE AND EXTENT OF CONTAMINATION

This summary of the nature and extent of contamination for the Site 11 groundwater is based on the discussions and data presented in the RFI (TtNUS, 2000a), Addendum Rounds 1,2,3 & 4 (TtNUS, 2000b), Site 11 RFI Addendum (TtNUS, 2001a), Letter Report – March 2001 Groundwater Sampling Results – Site 11 (TtNUS, 2001b), and the Site 11 Groundwater Report (TtNUS, 2003). Chemicals detected in groundwater were screened against various criteria to identify potential chemicals of concern (PCOCs).

- Results of the subsurface soil sampling activities conducted during the RFI indicate that subsurface soil is not a source of groundwater contamination.

- Chlorinated VOCs are the primary concern in regard to groundwater contamination.

- Contamination occurs primarily in the surficial aquifer at Site 11. However, the highest COC concentrations were mostly detected in groundwater samples from two bedrock wells (11GW110 and 11GW118). Elevated VOCs concentrations were also detected in samples collected from two other bedrock monitoring wells (11GW112, 11GW119S/D).

- Of the 16 VOCs detected, 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), cis-1,2-DCE, tetrachloroethene (PCE), and trichloroethene (TCE) were detected at concentrations greater than drinking water standards (EPA, 1999a), indicating an unacceptable risk to potential groundwater users.

- Hexavalent chromium was detected above screening levels, but within background values, during the RFI (TtNUS, 2000a) and three additional sampling rounds (TtNUS, 2000b). Hexavalent chromium was detected at 410 micrograms per liger (ug/L) in one (11GW27) of two groundwater wells sampled during the Data Gap investigation (TtNUS, 2002). This concentration is above both the human health risk-based screening level of 110 ug/L and the EPA Maximum Contaminant Level (MCL) of 100 ug/L.

- Perchlorate was detected at concentrations (5 to 130 ug/L) in 11 saprolite wells and two shallow bedrock wells sampled during one or more of three rounds of the RFI Addendum investigation for which this chemical was analyzed (TtNUS, 2000b).

- Unfiltered arsenic was detected at concentrations exceeding the human health risk-based screening level (0.07 ug/L) in most of the saprolite and bedrock wells sampled during the four rounds of the RFI Addendum investigation for which this chemical was analyzed. However, no concentrations of filtered arsenic exceeded the analytical detection limit.

- Four separate groundwater contaminant plumes have been identified, including two chlorinated VOC plumes, a hexavalent chromium plume, and a perchlorate plume. These plumes are shown in figure 3-1.

- The chlorinated VOC plume with the highest COC concentrations and greatest areal extent is identified as VOC Plume No. 1 and is centered around saprolite well 11GW22. A much smaller plume with lower contaminant concentrations, identified as VOC Plume No. 2, is located in the vicinity of saprolite well 11GW28. This report focuses on remedial actions for VOC Plume No. 2, as shown in figure 3-2.

- The hexavalent chromium plume is centered around saprolite well 11GW27 and its depth is currently assumed to extend only to the saprolite zone but this will be verified through installation of an additional shallow bedrock monitoring well.

- The perchlorate plume overlaps almost all of VOC Plume No. 1 and approximately half of the hexavalent chromium plume.

- The contaminant plumes decrease in concentration rapidly with increasing distance from the sources. It is expected that contaminant concentrations are reduced through natural processes to trace/nondetectable levels prior to reaching the stream or any potential human receptors.

- The highest levels of groundwater contamination are in the portion of the bedrock aquifer less than 130 feet in depth. Packer sampling and subsequent deep well installations confirm that contaminant levels drop off with increasing depth below 130 feet.

- Based on the results of the Data Gap investigation, the vertical extent of Site 11 groundwater contaminated above MCLs is estimated to be approximately 200 feet, with the highest contaminant levels occurring at depths of less than 130 feet bgs.

- Based upon the screening, nine VOCs (1,1-DCE, 1,2-DCA, acetone, benzene, chloroform, PCE, TCE, and vinyl chloride) and four inorganic chemicals (arsenic, perchlorate, hexavalent chromium, and nitrate) were identified as groundwater PCOCs.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

The Risk assessment in the RI report contains an evaluation of all PCOC and exposure pathways, including those that do not pose unacceptable risks to human health. PCOCs are those chemicals that are identified as a potential threat to human health and are evaluated further in the baseline risk assessment. PCOCs for groundwater are identified using EPA Region III RBCs for tap water use. These criteria are based on the assumption that groundwater is used for domestic purposes. This is a conservative assumption since groundwater at Site 11 is not currently used or expected to be used in the future as a potable water supply. MCLs are also used in the PCOC screening process. Although these additional criteria are not used to select PCOCs, they are used for informative purposes and for comparison of site data to applicable standards.

The following chemicals were retained as PCOC in groundwater:

- Chlorinated VOCs: 1,1-DCE, 1,2-DCA, cic-1,2-DCE, chloroform, PCE, TCE, and vinyl chloride
- Other VOCs: acetone, benzene
- Inorganic chemicals: arsenic, hexavalent chromium, nitrate, and perchlorate

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for Site 11 Groundwater

Hazard index for Site 11 Groundwater in Coastal Plain/Saprolite						
	Full Time Worker	Maintenance Worker	Construction Worker	Day Care Child	Adult Resident	Child Resident
Total HI - RME	0.18	0.41	2.1	0.39	160	370
Total HI - CTE	0.04	0.21	2.1	0.17	73	240
Incremental Lifetime Cancer Risk for Site 9 Groundwater in the Coastal Plain/Saprolite						
	Full Time Worker	Maintenance Worker	Construction Worker	Day Care Child	Adult Resident	Child Resident
Total ILCR - RME	7.1 E-5	1.0 E-5	2.1 E-6	3.8 E-5	1.3 E-3	8.6 E-4
Total ILCR - CTE	5.8 E-6	1.8 E-6	2.1 E-6	8.4 E-6	1.8 E-4	1.7 E-4

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Under current conditions, there is no unacceptable human health risk associated with contaminants in groundwater because groundwater at Site 11 is not being used as a potable source. Non-carcinogenic HIs associated with exposure to Site 11 groundwater under a construction or hypothetical future residential scenario exceeded the EPA's acceptable target of unity. In addition, the ILCRs associated with exposure to groundwater under a hypothetical future residential scenario were above the 1.0 E-4 upper limit of EPA's acceptable range.

3.4.2 Ecological Risk Assessment

Since the surface soil, surface water, and sediment are unaffected (essentially uncontaminated) by the Site 11 activities, an ecological risk assessment was not necessary.

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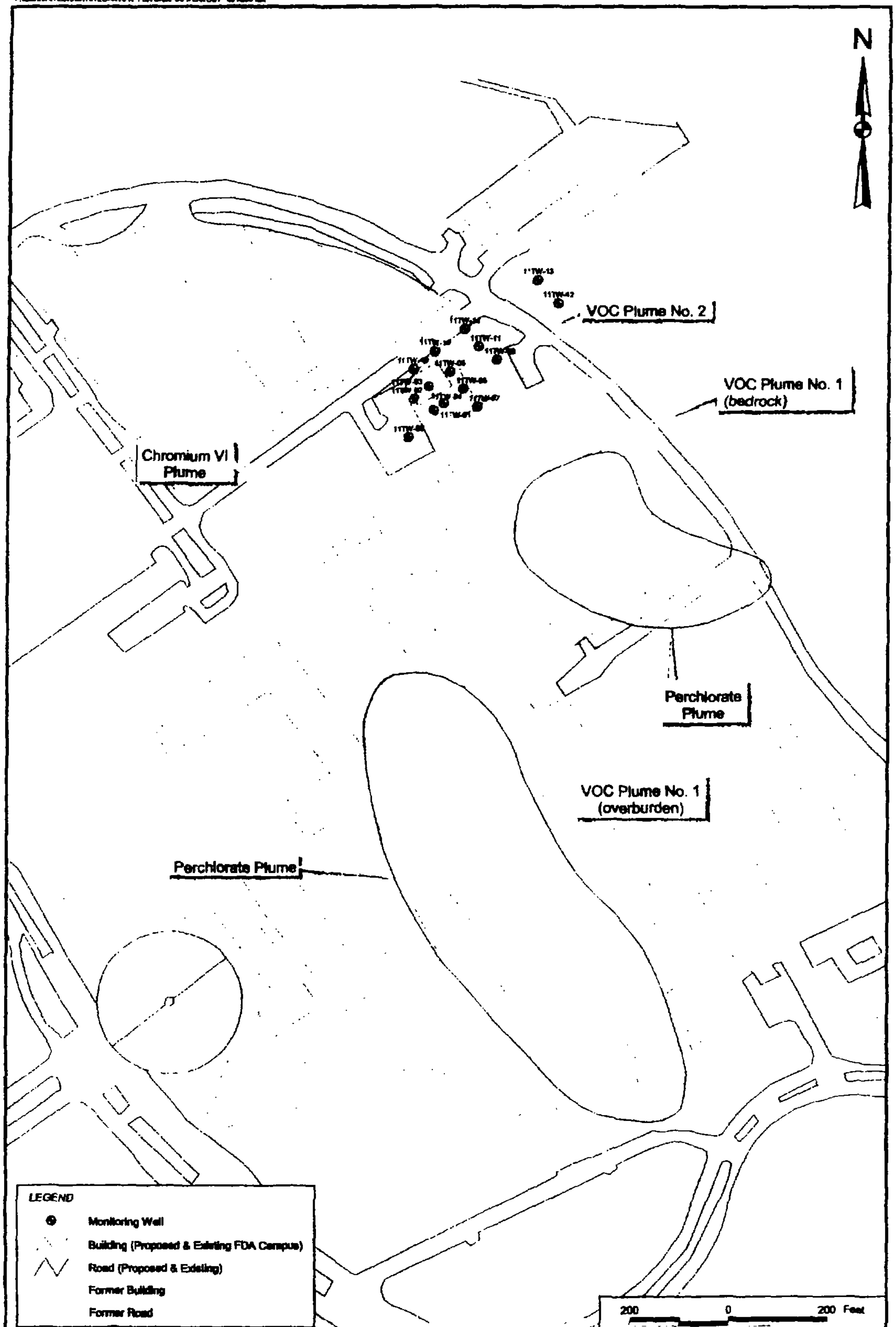
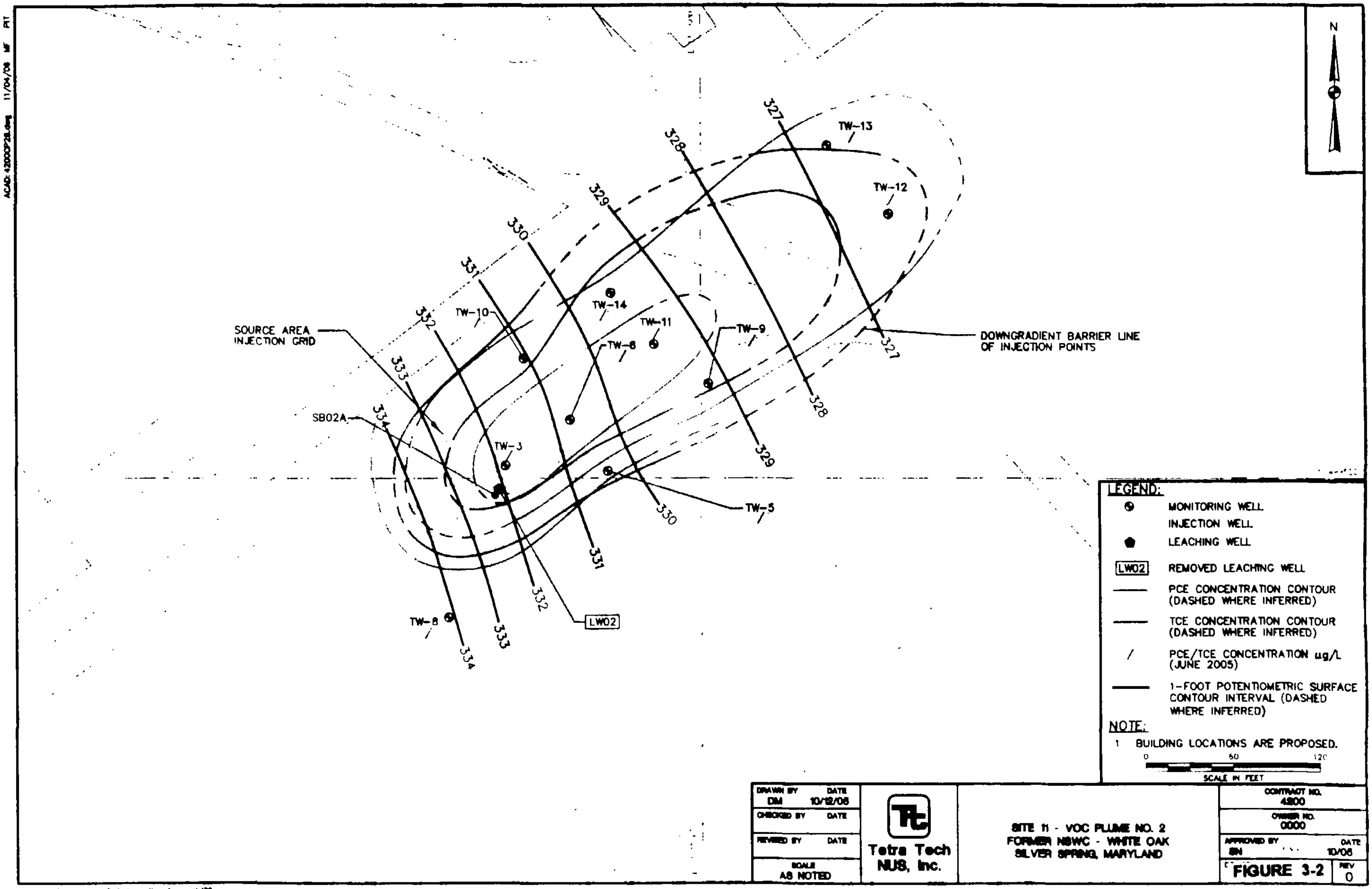


Tetra Tech NUS, Inc.

SITE 11 GROUNDWATER PLUMES
FORMER NSWC - WHITE OAK
SILVER SPRING, MARYLAND

SCALE AS NOTED

FIGURE 3-1 REV 0



N
TW-13
TW-12
TW-14
TW-11
TW-10
TW-9
TW-6
TW-3
TW-5
TW-8
SB02A
LW02
SOURCE AREA INJECTION GRID
DOWNGRADIENT BARRIER LINE OF INJECTION POINTS
327
328
329
330
331
332
333
334
LEGEND:
MONITORING WELL
INJECTION WELL
LEACHING WELL
LW02 REMOVED LEACHING WELL
PCE CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
TCE CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
PCE/TCE CONCENTRATION ug/L (JUNE 2005)
1-FOOT POTENTIOMETRIC SURFACE CONTOUR INTERVAL (DASHED WHERE INFERRED)
NOTE:
1 BUILDING LOCATIONS ARE PROPOSED.
0 60 120
SCALE IN FEET
DRAWN BY DM DATE 10/12/06
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
Tetra Tech NUS, Inc.
SITE 11 - VOC PLUME NO. 2
FORMER NSWC - WHITE OAK
SILVER SPRING, MARYLAND
CONTRACT NO. 4200
OWNER NO. 0000
APPROVED BY SN DATE 10/06
FIGURE 3-2
REV 0

4.0 REMEDY IMPLEMENTATION

Source removal activities were completed at Sites 8, 9, and 11 during 1996 to address contaminant sources that may be impacting groundwater at NSWC-WO. The activities included the excavation and off-site disposal of waste and contaminated media from these sites in conjunction with the findings of the Design Verification Study (B&R Environmental, 1995). The activities included the removal of five leaching wells (LW-2, LW-4, LW-5, LW-12, and LW-13) and surrounding subsurface soil from Site 11.

Although four groundwater plumes (VOC Plume 1, VOC Plume 2, the Hexavalent-Chromium Plume, and the Perchlorate Plume) were identified at Site 11, groundwater sampling results combined with numerical modeling suggested that only VOC Plume 2 required a remedy that included an active-phase.

The active-phase remedial action for VOC Plume 2 involved Enhanced In-situ Bioremediation (EISB) using Emulsified Oil Substrate (EOS®) delivered via high-pressure nitrogen gas. Injection occurred in 34 injection wells installed in November 2004. Pneumatic fracturing was performed to enhance the distribution of EOS within the subsurface. After fracturing, EOS was mixed with water into a solution (1 part EOS mixed with 10 parts water) and injected into the subsurface.

4.1. REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for groundwater at Site 11, as presented in the ROD (USEPA, September 2004), include the following:

- Prevent human exposure (through ingestion, inhalation, and dermal contact) to groundwater having contaminants at concentrations in excess of media cleanup standards (MCSs).

- Restore contaminated groundwater quality to MCSs taking the known future reuse of the Site 11 area into consideration.

- Comply with contaminant-, location-, and action-specific ARARs, and TBCs, as appropriate.

Meeting these objectives for Site 11 is based largely upon achieving the MCSs, which are shown in the following Table:

Table 4-1
MCSs for COCs in Site 11 Attainment Area

COC	MCS (ug/L)	Basis
1,1-DCE	7	MCL
1,2-DCA	5	MCL
Cis-1,2-DCE	70	MCL
PCE	5	MCL
TCE	5	MCL
Vinyl chloride	2	MCL
Chloroform	80	MCL
Hexavalent chromium	100	MCL

Source: ROD, USEPA, April 2004.

4.2. SELECTED REMEDY

The selected remedy consists of five major components:

- Source removal – this has already been completed through removal of the leaching wells.
- For VOC Plume No. 2 - In-situ bioremediation through use of a soybean oil emulsion (EOS).
- For the hexavalent chromium, perchlorate and VOC No. 1 plumes – monitored natural attenuation (MNA).
- Institutional controls – involves the implementation of LUCs for surface soil and deed restrictions for groundwater use
- Groundwater monitoring

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

The remedial action of source removal and EOS injection for VOC Plume No. 2 has been completed. Monitoring data will be evaluated to determine if additional treatment is necessary. MNA is ongoing for the remaining three plumes. Currently, the only ongoing activity is groundwater monitoring; therefore O&M activities include inspection and maintenance of the monitoring wells.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for the Site 11 - Industrial Wastewater Disposal Area 100 at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document under contract N62477-03-D-0163, Delivery Order 011 to the Navy.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan for the Site 11 soils was released for public comment on January 25, 2002. The proposed plan identified no further action as the preferred alternative for soils. The Navy reviewed all comments received during the public comment period, January 25 to February 25, 2002, and the public meeting, held on February 6, 2002. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

The Proposed Plan for the Site 11 groundwater was released for public comment on May 9, 2003. The proposed plan identified EISB, source removal, institutional controls, and monitoring for groundwater as the preferred alternative. The Navy reviewed all comments received during the public comment period, May 9 to June 8, 2003, and the public meeting, held on May 22, 2003. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the Restoration Advisory Board (RAB) members at their next meeting. The results of the five-year review and the report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation, decision, and remediation documents, including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

During November 2004, a total of 34 substrate injection wells were installed. Five-inch diameter steel casings were installed to a depth of 25 feet bgs. Boreholes were then advanced through saprolite to a depth of 34 to 48 feet. Boreholes were left open and undeveloped for the injection process. Finally, a 3-inch diameter, Schedule 40 PVC casing was set in each well to keep the hole open until the injection event occurred.

After removing the temporary casing, saprolitic bedrock was pneumatically fractured in 3.5 foot intervals by applying high-pressure nitrogen gas for about 10 seconds. After fracturing each interval, food-grade emulsified oil substrate (EOS) was mixed with water into a solution and injected into the newly fractured bedrock using a pressurized nitrogen pumping system. A total of 20,570 gallons of EOS solution and 22,132 gallons of flush water were successfully injected into the subsurface at Site 11.

Table 6-1 shows groundwater data collected from ten monitoring wells between April 2004 and December 2005. Limited groundwater data has been collected since December 2005 due to the location of Site 11 within an active construction area. An overview of the COCs indicates that for 1,1-DCE, 1,2-DCA, vinyl chloride and chloroform: concentrations have been close to or slightly above detection limits for the entire monitoring period, including the beginning of the monitoring period. For cis-1,2-DCE: concentrations remained steady for eight of the wells, decreasing in one well and increasing in one well. For PCE: concentrations remained steady in seven wells with one well decreasing and two wells increasing. Nine of the wells had PCE concentrations, which still exceeded the MCS of 5 ug/L, the highest PCE concentration was 64 ug/L at 11TW-03. For TCE: concentrations remained steady in eight wells with two wells decreasing and no wells increasing. Seven of the wells had TCE concentrations, which still exceeded the MCS of 5 ug/L, the highest TCE concentration was 17 ug/L at 11TW-03 and 11TW-11. It should be noted that these results represent the concentrations present for VOC Plume No. 2 in the bedrock wells only.

The following observations were made based on an analysis of Table 6-1:

- PCE and TCE were the only COCs that had concentrations at or above the MCSs throughout the monitoring period. All other contaminants were near or below their detection limits, which the occasional exception of cis-1,2-DCE.

- The concentrations of PCE and TCE remained relatively steady during the monitoring period.

The strongest and most unambiguous indicator that biodegradation is occurring is contaminant concentration data that show the sequential breakdown of parent compound(s) into daughter products. Through anaerobic biodegradation processes, PCE is sequentially degraded to TCE, 1,2-DCE (primarily cis-1,2-DCE), vinyl chloride, and ultimately ethene. Site 11 performance monitoring data show mixed and inconclusive results for PCE and TCE trends; some concentrations appear to be decreasing while concentrations in other wells appear to be increasing or remaining stable, and the overall changes appear to be minimal to date. Concentrations of cis-1,2-DCE and vinyl chloride also do not appear to be changing significantly, particularly in comparison to the concentrations of other chlorinated ethenes in each well. Based on this contaminant concentration data, it does not appear that biodegradation activities have been accelerated to any significant degree to date following EOS injection.

In addition to the contaminant concentrations discussed above, various geochemical indicators (MNA indicators) also show that the conditions for favorable anaerobic degradation do not exist. This was true for total organic carbon (TOC) concentrations, ferrous iron, alkalinity, oxidation reduction potential (ORP), and pH.

There are several possible explanations for the lack of success of the EOS injections. Two of them are (1) the EOS injections did not reach the monitoring wells; this could be do to complex flow patterns present in the subsurface geology, which is not uncommon in bedrock or the pneumatic fracturing was insufficient in strength to produce the flow paths necessary for the distribution of the injected materials and (2) the contaminant concentrations (PCE and TCE) may be insufficient to support the growth of the microbial community (there may be insufficient substrate).

In summary, the PCE and TCE MCSs were not attained through EOS injection as of December 2005. The fact that 5 of the 7 COCs are below the MCSs is misleading because all five of the COCs were below the MCSs when the monitoring period began. These data indicate that the bioremediation using EOS has not had a decreasing effect on the concentration of PCE and TEC.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of Site 11 on June 21, 2006. The EOS injection for VOC Plume 2 has been completed, and currently ongoing remedial activities include groundwater monitoring and MNA. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

The EOS injection has been completed and there are currently no ongoing remedial activities except groundwater monitoring and MNA. Several of the existing monitoring wells have been damaged and are in need of repair and some of them are open to the atmosphere. The fact that the wells are open to the atmosphere is more of a problem at this site because there is no access control at this site. The injection wells and most of the earlier monitoring wells have been removed since the site inspection.

LUCs include written restrictions, which control the use of groundwater for potable use. There was no evidence that groundwater is being used for any purpose, nor is it likely that it ever will be. At the time this Five-Year Review was prepared, the exact wording of the LUCs was still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August and September 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure that a deed notification is put into place that prohibits withdrawal of groundwater from within the restricted area for any purpose until the MCSs are met and risks from groundwater use are shown to be reduced to acceptable levels.

- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as groundwater treatment systems and monitoring wells in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and future property owners.

These institutional controls will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure. Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated.

TABLE 6-1

SUMMARY OF POSITIVE DETECTIONS
SITE 11 REMEDIAL ACTION - VOC PLUME NO. 2
FORMER NSWC WHITE OAK
SILVER SPRING, MARYLAND
PAGE 1 of 6

Well	11TW-03							
nsample	11TW03-01	11GW03-2004Q4	11TW03	11TW03-200503	11TW03-200506			
Sample ID	11TW03-01	11GW03	11TW03	11TW03	11TW03	FD091205	11TW03	11TW03
Sample Date	4/1/2004	10/19/2004	1/19/2005	3/22/2005	6/15/2005	9/12/2005	9/12/2005	12/7/2005
Volatile Organics (ug/L)								
1,1,1-TRICHLOROETHANE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
1,1-DICHLOROETHENE	0.5 U	0.5 J	1 U	1 U	1 U	1 U	1 U	
1,2,4-TRICHLOROBENZENE	0.5 U	5 U	1 U	0.31 J	1 U	1 U	1 U	
1,2,4-TRIMETHYLBENZENE		5 U						
1,2-DICHLOROETHANE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
1,2-DICHLOROPROPANE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-TRIMETHYLBENZENE		5 U						
1,4-DICHLOROBENZENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
ACETONE	5 U	50 U	10 UR	10 U	10 U	10 U	10 U	
BENZENE	0.6	1 J	0.89 J	0.4 J	1 U	1 U	1 U	1 U
CARBON DISULFIDE	0.9 K	5 U	1 U	1 U	0.21 J	1 U	0.33 J	
CHLOROBENZENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
CHLOROFORM	0.7	0.4 J	0.64 J	0.75 J	0.73 J	0.67 J	0.71 J	0.61 J
CHLOROMETHANE	0.3 U	5 U	2 U	2 U	2 U	2 U	2 U	
CIS-1,2-DICHLOROETHENE	15	28	25	14	7.2	5.2	5.3	4.3
DICHLORODIFLUOROMETHANE	0.5 U	5 U	2 U	0.44 J	2 U	2 U	2 U	0.44 J
ETHYLBENZENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
ISOPROPYLBENZENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
M+P-XYLENES		10 U						
METHYL CYCLOHEXANE	0.5 U		1 U	1 U	1 U	1 U	1 U	1 U
METHYL TERT-BUTYL ETHER	1	10 U	2 U	2 U	2 U			2 U
N-PROPYLBENZENE		5 U						
NAPHTHALENE		5 U						
O-XYLENE		5 U						
SEC-BUTYLBENZENE		5 U						
STYRENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	
TETRACHLOROETHENE	46	45	63	63 J	61	68	70	64
TOLUENE	0.2 J	5 U	1 U	1 U	1 U	1 U	1 U	
TOTAL XYLENES	0.5 U		3 U	3 U	3 U	3 U	3 U	
TRANS-1,2-DICHLOROETHENE	0.5 U	0.4 J	1 U	1 U	1 U	1 U	1 U	
TRICHLOROETHENE	16	15	19	17	15	18	18	17
TRICHLOROFLUOROMETHANE	3	5	5.9	3.6	2.7	3.5	3.8	5.9
VINYL CHLORIDE	0.5 U	5 U	0.25 J	2 U	2 U	2 U	2 U	2 U
Dissolved Gases (ug/L)								
METHANE					4.5			
ETHANE					2 U			
ETHENE					2 U			
Miscellaneous Parameters (mg/L)								
ACETIC ACID					0.509			
BUTANOIC ACID					0.5 U			
CHLORIDE					52.4 J			
LACTIC ACID					0.5 U			
NITRATE-N					3.38			
NITRITE-N					0.1 UL			
ORTHOPHOSPHATE-P					0.5 U			
PROPIONIC ACID					0.5 U			
PYRUVIC ACID					0.5 U			
SULFATE					0.862			
SULFIDE					1 U			
TOTAL ORGANIC CARBON	1.5	1 U	0.547 J	0.862 J	0.53 J	1.26	1.38	0.739 J

U - Indicates that the chemical was not detected at the limit shown
J - Indicates that the chemical was detected but the concentration is estimated.
UL - Indicates that the chemical was not detected at the limit shown but the limit is biased low

TABLE 6-1

SUMMARY OF POSITIVE DETECTIONS
SITE 11 REMEDIAL ACTION - VOC PLUME NO. 2
FORMER NSWC WHITE OAK
SILVER SPRING, MARYLAND
PAGE 2 of 6

Well	11TW-05					11TW-06				
nsample	11TW05-01	11GW05-2004Q4	11TW05	11TW05-200506		11TW06-01	11GW06-2004Q4	11TW06	11TW06-200506	
Sample ID	11TW05-01	11GW05	11TW05	11TW05	11TW05	11TW06-01	11GW06	11TW06	11TW06	11TW06
Sample Date	4/6/2004	10/19/2004	1/18/2005	6/15/2005	12/7/2005	4/5/2004	10/19/2004	1/18/2005	6/14/2005	12/7/2005
Volatile Organics (ug/L)										
1,1,1-TRICHLOROETHANE	0.5 U	2 J	1 U	1 U		0.5 U	5 U	1 U	1 U	
1,1-DICHLOROETHENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
1,2,4-TRICHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
1,2,4-TRIMETHYLBENZENE		5 U					5 U			
1,2-DICHLOROETHANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
1,2-DICHLOROPROPANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
1,3,5-TRIMETHYLBENZENE		5 U					5 U			
1,4-DICHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	0.26 J	1 U	
ACETONE	5 U	50 U	10 UR	10 U		5 U	50 U	10 UR	10 U	
BENZENE	0.5 U	5 U	1 U	1 U	1 U	0.3 J	5 U	0.28 J	0.3 J	0.51 J
CARBON DISULFIDE	0.5 U	5 U	1 U	0.28 J		0.3 J	5 U	1 U	1 U	
CHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
CHLOROFORM	0.3 J	5 U	0.34 J	0.35 J	0.46 J	0.7	0.8 J	0.86 J	0.69 J	0.78 J
CHLOROMETHANE	0.4 U	5 U	2 U	2 U		0.5 U	5 U	2 U	2 U	
CIS-1,2-DICHLOROETHENE	1	1 J	0.7 J	1 U	0.32 J	14	13	11	11	18
DICHLORODIFLUOROMETHANE	1 K	0.8 J	2 U	2 U	1.6 J	0.2 J	5 U	2 U	2 U	2 U
ETHYLBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
ISOPROPYLBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
M+P-XYLENES		10 U					10 U			
METHYL CYCLOHEXANE	0.5 U		1 U	1 U	1 U	0.5 U		1 U	1 U	1 U
METHYL TERT-BUTYL ETHER	0.5 U	10 U	2 U	2 U	0.27 J	0.5 U	10 U	2 U	2 U	2 U
N-PROPYLBENZENE		5 U					5 U			
NAPHTHALENE		5 U					5 U			
O-XYLENE		5 U					5 U			
SEC-BUTYLBENZENE		5 U					5 U			
STYRENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
TETRACHLOROETHENE	14	12	9	5.9	6.2	65	60	71	50	57
TOLUENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
TOTAL XYLENES	0.5 U		3 U	3 U		0.5 U		3 U	3 U	
TRANS-1,2-DICHLOROETHENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	
TRICHLOROETHENE	13	10	8	5.7	6.6	14	14	12	12	14
TRICHLOROFLUOROMETHANE	7	11	14	12	18	2 J	4 J	2.3	1.8 J	3
VINYL CHLORIDE	0.5 U	5 U	2 U	2 U	2 U	0.5 U	5 U	2 U	2 U	2 U
Dissolved Gases (ug/L)										
METHANE										
ETHANE										
ETHENE										
Miscellaneous Parameters (mg/L)										
ACETIC ACID										
BUTANOIC ACID										
CHLORIDE										
LACTIC ACID										
NITRATE-N										
NITRITE-N										
ORTHOPHOSPHATE-P										
PROPIONIC ACID										
PYRUVIC ACID										
SULFATE										
SULFIDE										
TOTAL ORGANIC CARBON	0.48 J	0.48 U	1.0 U	0.782 J	0.753 J	0.61 J	1 U	0.623 J	1.48	0.862 J

U - Indicates that the chemical was not detected at the limit shown
J - Indicates that the chemical was detected but the concentration is estimated.
UL - Indicates that the chemical was not detected at the limit shown but the limit is biased low.

TABLE 6-1

SUMMARY OF POSITIVE DETECTIONS
SITE 11 REMEDIAL ACTION - VOC PLUME NO. 2
FORMER NSWC WHITE OAK
SILVER SPRING, MARYLAND
PAGE 3 of 6

Well	11TW-08					11TW-09					
nsample	11TW08-01	11GW08-2004Q4	11TW08	11TW08-200506		11TW09-01	11GW09-2004Q4	11TW09	11TW09-D	11TW09-200506	
Sample ID	11TW08-01	11GW08	11TW08	11TW08	11TW08	11TW09-01	11GW09	11TW09	FD011705-01	11TW09	11TW09
Sample Date	4/7/2004	10/18/2004	1/19/2005	6/15/2005	12/7/2005	4/8/2004	10/19/2004	1/17/2005	1/17/2005	6/15/2005	12/7/2005
Volatile Organics (ug/L)											
1,1,1-TRICHLOROETHANE	0.5 U	5 U	1 U	1 U		0.5 U	2 J	1 U	1 U	1 U	
1,1-DICHLOROETHENE	0.5 U	0.4 J	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
1,2,4-TRICHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
1,2,4-TRIMETHYLBENZENE		5 U					5 U				
1,2-DICHLOROETHANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
1,2-DICHLOROPROPANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
1,3,5-TRIMETHYLBENZENE		5 U					5 U				
1,4-DICHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
ACETONE	5 UJ	50 U	10 UR	10 U		5 UJ	50 U	10 UR	10 UR	10 U	
BENZENE	0.5 U	5 U	1 U	1 U	1 U	0.5 U	5 U	1 U	1 U	1 U	1 U
CARBON DISULFIDE	0.6 K	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
CHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
CHLOROFORM	0.2 J	5 U	0.39 J	0.38 J	0.43 J	0.3 J	0.3 J	0.5 J	0.5 J	0.46 J	0.51 J
CHLOROMETHANE	0.5 U	5 U	2 U	2 U		0.3 U	5 U	2 U	2 U	2 U	
CIS-1,2-DICHLOROETHENE	0.5 U	5 U	0.2 J	1 U	1 U	2	2 J	2	1.8	0.83 J	1.1
DICHLORODIFLUOROMETHANE	0.9 K	0.9 J	2 U	2 U	2 J	0.6 K	0.5 J	2 U	2 U	2 U	1.3 J
ETHYLBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
ISOPROPYLBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
M+P-XYLENES		10 U					10 U				
METHYL CYCLOHEXANE	0.5 U		1 U	1 U	1 U	0.5 U		1 U	1 U	1 U	1 U
METHYL TERT-BUTYL ETHER	0.5 U	10 U	2 U	2 U	0.39 J	0.5 U	10 U	2 U	2 U	2 U	2 U
N-PROPYLBENZENE		5 U					5 U				
NAPHTHALENE		5 U					5 U				
O-XYLENE		5 U					5 U				
SEC-BUTYLBENZENE		5 U					5 U				
STYRENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
TETRACHLOROETHENE	0.4 J	5 U	0.38 J	0.25 J	1 U	24	27	31	31	21	18
TOLUENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
TOTAL XYLENES	0.5 U		3 U	3 U		0.5 U		3 U	3 U	3 U	
TRANS-1,2-DICHLOROETHENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	
TRICHLOROETHENE	6	4 J	4.3	2.8	1.9	16	15	16	16	11	9.2
TRICHLOROFLUOROMETHANE	9 J	17	22	16	26	4 J	9	9.9	9.6	9.7	14
VINYL CHLORIDE	0.5 U	5 U	2 U	2 U	2 U	0.5 U	5 U	2 U	2 U	2 U	2 U
Dissolved Gases (ug/L)											
METHANE				0.82 J							
ETHANE				2 U							
ETHENE				2 U							
Miscellaneous Parameters (mg/L)											
ACETIC ACID				0.5							
BUTANOIC ACID				0.5 U							
CHLORIDE				55.4 J							
LACTIC ACID				0.5 U							
NITRATE-N				7.04							
NITRITE-N				0.1 UL							
ORTHOPHOSPHATE-P				0.5 U							
PROPIONIC ACID				0.5 U							
PYRUVIC ACID				0.5 U							
SULFATE				0.768							
SULFIDE				1 U							
TOTAL ORGANIC CARBON	1.0	1.4 U	0.543 J	0.717 J	0.873 J	0.49 J	0.95 U	1.0 U	0.543 J	0.634 J	0.67 J

U - Indicates that the chemical was not detected at the limit shown.
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UL - Indicates that the chemical was not detected at the limit shown but the limit is biased low.

TABLE 6-1

SUMMARY OF POSITIVE DETECTIONS
SITE 11 REMEDIAL ACTION - VOC PLUME NO. 2
FORMER NSWC WHITE OAK
SILVER SPRING, MARYLAND

Well	11TW-10						11TW-11								
nsample	11TW10-01	11GW10-2004Q4	11GW10-2004Q4-D	11TW10	11TW10-200506		11TW11-01	11GW11-2004Q4	11TW11	11TW11-200503	11TW11-200506				
Sample ID	11TW10-01	11GW10	FD101904	11TW10	11TW10	11TW10	11TW11-01	11GW11	11TW11	11TW11	11TW11	11TW11	11TW11D	11TW11
Sample Date	4/8/2004	10/19/2004	10/19/2004	1/18/2005	6/15/2005	12/7/2005	4/8/2004	10/19/2004	1/17/2005	3/22/2005	6/14/2005	9/12/2005	12/7/2005	12/7/2005
Volatile Organics (ug/L)														
1,1,1-TRICHLOROETHANE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
1,1-DICHLOROETHENE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
1,2,4-TRICHLOROBENZENE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
1,2,4-TRIMETHYLBENZENE		5 U	5 U					88						
1,2-DICHLOROETHANE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	0.23 J	1 U	1 U		
1,2-DICHLOROPROPANE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
1,3,5-TRIMETHYLBENZENE		5 U	5 U					29						
1,4-DICHLOROBENZENE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
ACETONE	5 UJ	50 U	50 U	10 UR	10 U		9 J	50 U	10 UR	10 U	10 U	10 U		
BENZENE	0.2 J	5 U	5 U	1 U	1 U	1 U	0.8	5 U	1 U	1 U	1 U	0.22 J	0.21 J	0.2 J
CARBON DISULFIDE	0.5 K	0.4 J	0.3 J	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
CHLOROBENZENE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
CHLOROFORM	0.2 J	5 U	5 U	0.23 J	0.28 J	0.21 J	0.4 J	0.3 J	0.82 J	0.68 J	0.62 J	0.73 J	0.63 J	0.65 J
CHLOROMETHANE	0.6 U	5 U	5 U	2 U	2 U		0.3 U	5 U	2 U	2 U	0.42 J	2 U		
CIS-1,2-DICHLOROETHENE	2	3 J	3 J	2.9	1.7	3.5	15	13	12	9.8	9.4	13	12	12
DICHLORODIFLUOROMETHANE	0.2 J	5 U	5 U	2 U	2 U	2 U	0.5 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U
ETHYLBENZENE	0.5 U	5 U	5 U	1 U	1 U		98	2 J	1 U	1 U	1 U	1 U		
ISOPROPYLBENZENE	0.5 U	5 U	5 U	1 U	1 U		10	1 J	0.4 J	1 U	1 U	0.29 J		
M+P-XYLENES		10 U	10 U					12						
METHYL CYCLOHEXANE	0.5 U			1 U	1 U	1 U	0.9		0.78 J	0.57 J	0.69 J	0.45 J	0.43 J	0.44 J
METHYL TERT-BUTYL ETHER	0.5 U	10 U	10 U	2 U	2 U	2 U	2	10 U	2 U	2 U	2 U		2 U	2 U
N-PROPYLBENZENE		5 U	5 U					4 J						
NAPHTHALENE		5 U	5 U					18						
O-XYLENE		5 U	5 U					12						
SEC-BUTYLBENZENE		5 U	5 U					5 U						
STYRENE	0.5 U	5 U	5 U	1 U	1 U		8	5 U	1 U	1 U	1 U	1 U		
TETRACHLOROETHENE	20	21	22	24	28	24	38	52	82	66 J	57	67	61	63
TOLUENE	0.5 U	5 U	5 U	1 U	1 U		120	5 U	1 U	1 U	1 U	1 U		
TOTAL XYLENES	0.5 U			3 U	3 U		810		5.9	2 J	0.47 J	3 U		
TRANS-1,2-DICHLOROETHENE	0.5 U	5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U	1 U	1 U		
TRICHLOROETHENE	5	9	9	10	9.1	8.5	12	14	16	16	16	18	17	17
TRICHLOROFLUOROMETHANE	2 J	3 J	3 J	3	3.7	2.7	0.4 J	0.3 J	0.34 J	0.3 J	0.27 J	0.47 J	0.66 J	0.64 J
VINYL CHLORIDE	0.5 U	5 U	5 U	2 U	2 U	2 U	0.5 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U
Dissolved Gases (ug/L)														
METHANE											140			
ETHANE											2 U			
ETHENE											2 U			
Miscellaneous Parameters (mg/L)														
ACETIC ACID											0.47 J			
BUTANOIC ACID											0.5 U			
CHLORIDE											13.1 J			
LACTIC ACID											0.5 U			
NITRATE-N											1.44			
NITRITE-N											0.1 UL			
ORTHOPHOSPHATE-P											0.5 U			
PROPIONIC ACID											0.5 U			
PYRUVIC ACID											0.5 U			
SULFATE											4.19			
SULFIDE											1 U			
TOTAL ORGANIC CARBON	1.6	2.6	2.8	2 0	1 33	1.27	1.3	1.9 U	0.905 J	0.958 J	1.16	1.52	0 787 J	0.785 J

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UL Indicates that the chemical was not detected at the limit shown but the limit is biased low.

TABLE 6-1

SUMMARY OF POSITIVE DETECTIONS
SITE 11 REMEDIAL ACTION - VOC PLUME NO. 2
FORMER NSWC WHITE OAK
SILVER SPRING, MARYLAND
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Well	11TW-12								
nsample	11TW12-01	11GW12-2004Q4	11TW12	11TW12-200503	11TW12-200503-D	11TW12-200506	11TW12-200506-D		
Sample ID	11TW12-01	11GW12	11TW12	11TW12	FD032105-1	11TW12	FD061405-01	11TW12	11TW12
Sample Date	4/21/2004	10/19/2004	1/18/2005	3/21/2005	3/21/2005	6/14/2005	6/14/2005	9/12/2005	12/6/2004
Volatile Organics (ug/L)									
1,1,1-TRICHLOROETHANE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,1-DICHLOROETHENE	0.5 U	5 U	0.32 J	0.24 J	0.21 J	1 U	1 U	1 U	
1,2,4-TRICHLOROBENZENE	0.4 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2,4-TRIMETHYLBENZENE		5 U							
1,2-DICHLOROETHANE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,2-DICHLOROPROPANE	0.6	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
1,3,5-TRIMETHYLBENZENE		5 U							
1,4-DICHLOROBENZENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
ACETONE	5 U	50 U	10 UR	10 U	10 U	10 U	10 U	10 U	
BENZENE	0.2 J	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CARBON DISULFIDE	0.5 U	0.5 J	1 U	1 U	1 U	0.2 J	0.25 J	1 U	
CHLOROBENZENE	0.3 J	0.3 J	1 U	1 U	1 U	1 U	1 U	1 U	
CHLOROFORM	0.5 U	0.5 J	1.5	0.84 J	0.9 J	0.57 J	0.57 J	0.52 J	0.4 J
CHLOROMETHANE	0.5 U	5 U	2 U	2 U	2 U	0.8 J	2 U	2 U	
CIS-1,2-DICHLOROETHENE	0.9 K	0.6 J	1.7	1.6	1.8	2.2	2.2	4.9	5.5
DICHLORODIFLUOROMETHANE	4 K	3 J	1.8 J	1.5 J	1.6 J	2 U	2 U	2 U	0.33 J
ETHYLBENZENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
ISOPROPYLBENZENE	0.3 J	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
M+P-XYLENES		10 U							
METHYL CYCLOHEXANE	0.5 U		1 U	1 U	1 U	1 U	1 U	1 U	1 U
METHYL TERT-BUTYL ETHER	1	0.4 J	0.76 J	0.4 J	0.44 J	2 U	2 U	0.26 J	0.28 J
N-PROPYLBENZENE		5 U							
NAPHTHALENE		2 J							
O-XYLENE		5 U							
SEC-BUTYLBENZENE		0.4 J							
STYRENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
TETRACHLOROETHENE	8	11	22	21	22	23	22	24	22
TOLUENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
TOTAL XYLENES	0.7		3 U	3 U	3 U	3 U	3 U	3 U	
TRANS-1,2-DICHLOROETHENE	0.5 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	
TRICHLOROETHENE	6	5	9.7	8.8	9.2	8.7	8.7	10	8.8
TRICHLOROFLUOROMETHANE	0.5 U	1 J	1.7 J	1 J	1 J	0.87 J	0.91 J	1.1 J	1.4 J
VINYL CHLORIDE	0.5 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	0.33 J
Dissolved Gases (ug/L)									
METHANE						490	600		
ETHANE						2 U	2 U		
ETHENE						2 U	2 U		
Miscellaneous Parameters (mg/L)									
ACETIC ACID						0.417 J			
BUTANOIC ACID						0.5 U			
CHLORIDE						75.5 J	43.5 J		
LACTIC ACID						0.5 U			
NITRATE-N						1.33	1.34		
NITRITE-N						0.1 UL	0.1 UL		
ORTHOPHOSPHATE-P						0.5 U	0.5 U		
PROPIONIC ACID						0.5 U			
PYRUVIC ACID						0.5 U			
SULFATE						9.44	9.4		
SULFIDE						1 U	1 U		
TOTAL ORGANIC CARBON	5 4	5.1	2 57	2.33	2.11	2.02	1.76	2.84	1.55

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TABLE 6-1

SUMMARY OF POSITIVE DETECTIONS
SITE 11 REMEDIAL ACTION - VOC PLUME NO. 2
FORMER NSWC WHITE OAK
SILVER SPRING, MARYLAND
PAGE 6 of 6

Well	11TW-13					11TW-14					INJMP01
nsample	11TW13-01	11GW13-2004Q4	11TW13	11TW13-200506		11TW14-01	11GW14-2004Q4	11TW14	11TW14-200506		
Sample ID	11TW13-01	11GW13	11TW13	11TW13	11TW13	11TW14-01	11GW14	11TW14	11TW14	11TW14	1NJMP01
Sample Date	4/21/2004	10/18/2004	1/18/2005	6/15/2005	12/7/2005	4/22/2004	10/19/2004	1/17/2005	6/15/2005	12/6/2004	6/14/2005
Volatile Organics (ug/L)											
1,1,1-TRICHLOROETHANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
1,1-DICHLOROETHENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
1,2,4-TRICHLOROBENZENE	0.5 UJ	5 U	1 U	1 U		0.5 UJ	5 U	1 U	1 U		1 U
1,2,4-TRIMETHYLBENZENE		5 U					5 U				
1,2-DICHLOROETHANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
1,2-DICHLOROPROPANE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
1,3,5-TRIMETHYLBENZENE		5 U					5 U				
1,4-DICHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
ACETONE	28	50 U	10 UR	10 U		5 U	50 U	10 UR	10 U		1300
BENZENE	0.3 J	5 U	0.49 J	1 U	0.37 J	0.2 J	5 U	1 U	1 U	1 U	0.82 J
CARBON DISULFIDE	0.2 J	5 U	1 U	0.38 J		0.5 U	5 U	1 U	1 U		1.5
CHLOROBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
CHLOROFORM	4	5	1.9	2.6	0.72 J	0.5 U	5 U	1 U	1 U	1 U	0.49 J
CHLOROMETHANE	0.3 U	5 U	2 U	2 U		1 U	5 U	2 U	2 U		2 U
CIS-1,2-DICHLOROETHENE	2	3 J	6.5	3.8	5.9	18	16	17	12	9.2	1 U
DICHLORODIFLUOROMETHANE	0.5 U	5 U	2 U	2 U	2 U	0.5 U	5 U	2 U	2 U	2 U	2 U
ETHYLBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		0.34 J
ISOPROPYLBENZENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
M+P-XYLENES		10 U					10 U				
METHYL CYCLOHEXANE	0.5 U		1 U	1 U	1 U	0.5 U		1 U	1 U	1 U	1 U
METHYL TERT-BUTYL ETHER	5	1 J	5.4	0.86 J	4.1	0.5 U	10 U	2 U	2 U	2 U	2 U
N-PROPYLBENZENE		5 U					5 U				
NAPHTHALENE		0.3 J					5 U				
O-XYLENE		5 U					5 U				
SEC-BUTYLBENZENE		5 U					5 U				
STYRENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
TETRACHLOROETHENE	6	12	19	15	14	4	4 J	6.9	12	12	0.4 J
TOLUENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	1 U	1 U		1 U
TOTAL XYLENES	0.5 U		3 U	3 U		0.5 U		3 U	3 U		3 U
TRANS-1,2-DICHLOROETHENE	0.5 U	5 U	1 U	1 U		0.5 U	5 U	0.2 J	1 U		1 U
TRICHLOROETHENE	2	3 J	5.9	4.8	4.8	3	2 J	2.6	5.6	4.9	1 U
TRICHLOROFLUOROMETHANE	0.6	0.9 J	0.74 J	0.79 J	0.58 J	0.5 U	5 U	2 U	0.46 J	0.34 J	2 U
VINYL CHLORIDE	0.5 U	5 U	2 U	2 U	0.62 J	0.5 U	5 U	0.23 J	2 U	2 U	2 U
Dissolved Gases (ug/L)											
METHANE											
ETHANE											
ETHENE											
Miscellaneous Parameters (mg/L)											
ACETIC ACID											
BUTANOIC ACID											
CHLORIDE											
LACTIC ACID											
NITRATE-N											
NITRITE-N											
ORTHOPHOSPHATE-P											
PROPIONIC ACID											
PYRUVIC ACID											
SULFATE											
SULFIDE											
TOTAL ORGANIC CARBON	0.86 J	1.2 U	0.866 J	0.805 J	1.21	4.1	3.2	2.22	2.49	1.93	736

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7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents and site inspection indicate that the source removal, institutional controls, and groundwater monitoring are functioning as intended by the ROD. The institutional controls in the form of groundwater use restrictions are responsible for protecting human receptors from any direct contact with or ingestion of groundwater. Groundwater monitoring has been utilized to document the effectiveness of the remedial actions and whether MCSs have been achieved.

The review of monitoring results has indicated that in situ groundwater treatment through EOS injection did not reduce VOC Plume 2 contaminant concentrations as intended by the ROD. In particular, the monitoring results for VOC Plume 2 have shown that bioremediation using EOS has not had a decreasing effect on the concentration of PCE and TCE. Considering that the treatment time was initially estimated to be 70 years, the ultimate achievement of the MCSs may eventually occur. Nevertheless, the data collected so far does not support achievement of the treatment goals. Considering the low initial concentrations, the presence of natural attenuation processes, and the lack of exposure routes, the overall remedy is considered to be functioning adequately from a human health and ecological risk standpoint.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the ROD are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced to question the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The institutional controls and groundwater monitoring are effective in protecting human receptors from any direct contact with or ingestion of groundwater. However, the groundwater monitoring results for VOC Plume 2 have shown that bioremediation using EOS did not reduce PCE and TCE concentrations as expected.

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8.0 ISSUES

The institutional controls and groundwater monitoring portions of the Site 11 remedy are functioning as intended by restricting exposure to groundwater contaminants by human and ecological receptors. However, the following items were identified based on a review of the monitoring results:

- Enhanced bioremediation using EOS has not had a decreasing effect on the concentration of PCE and TCE.
- Groundwater monitoring has not been consistent due to ongoing construction activities.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the issues identified in the previous section, the following recommendations are provided:

- As noted in section 7.1, natural attenuation will continue to reduce concentrations in VOC Plume No. 2; therefore, monitored natural attenuation should continue.

- Groundwater monitoring should be continued to measure the progress in meeting the MCSs.

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10.0 PROTECTIVEMENT STATEMENT

The remedy for the Industrial Wastewater Disposal 100 Area – Site 11 is protective of the human health and ecological receptors. Monitored natural attenuation is reducing contaminant concentrations in VOC Plume No. 2. Once the long-term monitoring well network is put in-place, monitoring of the other plumes should indicate decreasing contaminant concentrations. The institutional controls which prevent usage of groundwater as a potable water supply are protecting human receptors from exposure to groundwater contamination. Groundwater monitoring and five-year reviews help to ensure that the remedial actions are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

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11.0 NEXT REVIEW

The next Five-Year Review for Site 11 is required by 2011, five years from the date of this review.

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REFERENCES

- Malcolm Pirnie, Remedial Investigation Report for IRP Site 9, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 1992.
- Malcolm Pirnie RCRA Facility Assessment for Site 11 - Industrial Wastewater Disposal Area 100, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, September 1992.
- Naval Facilities Engineering Command, Washington Navy Yard, Record of Decision for Site 11 Soils, July 2002.
- Naval Facilities Engineering Command, Washington Navy Yard, Record of Decision for Site 11 Groundwater, April 2004.
- Shaw Environmental and Infrastructure, Close-Out Report for In-Situ Bioremediation of Groundwater at Site 11 – Industrial Wastewater Disposal Area 100, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, October 2005.
- Tetra Tech NUS, Inc., RCRA Facility Investigation for Site 11 - Industrial Wastewater Disposal Area 100, former Naval Surface Warfare Center, White Oak, Silver Spring, 2000.
- Tetra Tech NUS, Inc., Interim Remedial Action Completion Report for Site 11 - Industrial Wastewater Disposal Area 100, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, June 2006.

SITE 49

Final Five-Year Review

For

Site 49 (TCE Groundwater Plume in 400 Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

Final Five-Year Review

For

Site 49 (TCE Groundwater Plume in the 400 Area)

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
JM Waller Associates
9249 Old Keene Mill Road
Burke, VA 22015

CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

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TABLES

FIGURES

LIST OF ACRONYMS

AEDC	Arnold Engineering Development Center
BERA	Base-wide Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRs	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Contaminant of Concern
COMARs	Code of Maryland Regulations
DCE	Dichloroethene
EBS	Environmental Baseline Survey
EISB	Enhanced In-situ Bioremediation
EOS	Emulsified Oil Substrate
NSWC-WO	Naval Surface Warfare Center – White Oak
FS	Feasibility Study
GIS	Geographical Information System
GSA	General Services Administration
IAS	Initial Assessment Study
ICs	Institutional Controls
IRP	Installation Restoration Program
JMWA	J.M. Waller Associates, Inc.
LUCs	Land Use Controls
LUC-RD	Land Use Controls – Remedial Design
MCL	Maximum Contaminant Level
MCS	Media Clean-up Standard
MDE	Maryland Department of the Environment
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCOC	Potential Contaminant of Concern
RA	Remedial Action
RAB	Restoration Advisory Board
RAOs	Remedial Action Objectives
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager

SI	Site Inspection
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

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1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedy at Site 49 (TCE Groundwater Plume in the 400 Area) at the former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland, is protective of human health and the environment. The methods, findings, and conclusions of the Site 49 Five-Year Review are documented in this report. In addition, issues found during the review and recommendations to address them are also included in this document.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore, the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of Site 49 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review was the initiation of the remedial action for OU 2. The Five-Year Review is required for Site 49 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. SITE 49 – TRICHLOROETHENE GROUNDWATER PLUME IN THE 400 AREA

Site 49 is located at the eastern edge of the 400 Area of the former NSWC-WO facility in the north-central portion of the facility. The topography in this portion of the former Navy property contains considerable relief. The western portion of Site 49, including building 427, is relatively flat. The central and eastern portions of Site 49 include a steep-sided ravine formed by Paint Branch. The total elevation drop from west to east across Site 49 is approximately 49 feet.

Contamination at Site 49 was initially identified during the Washington Suburban Sanitation Commission (WSSC) and White Oak sanitary sewer lines investigation. Trichloroethene (TCE) was detected in groundwater samples collected using direct-push technology on two occasions from one location (near WSSC Manhole 32142) along the bedding of a WSSC sewer that runs along Paint Branch hydraulically downgradient of the Building 427 area. Groundwater samples collected from sewer bedding up- and down-pipe of Building 427 did not contain TCE. A subsequent screening investigation indicated that TCE was present in groundwater near Building 427 at concentrations as high as 4,000 ug/L.

A "limestone pit" or leaching well was present on the west side of the building and, according to construction drawings, was to be used for disposing of acidic wastewater from the water treatment system used to pretreat water before filling the testing tank. Former building personnel stated that the leaching well was never used for its designed purpose and that the wastewater lines leading to the leaching well were reportedly connected to sinks in rooms that were initially designed to be laboratories but were in actuality used as offices. The leaching well was excavated in 2002 as part of the Site 49 remedial investigation.

It was noted by former building personnel that inert torpedoes used for testing in the tank were sometimes cleaned on the loading dock area on the north side of Building 427. It was also noted that a small area outside the east gate along Perimeter Road was used for debris disposal and may have conceivably been used for unauthorized dumping of wastes because it is relatively remote and hidden from view. Construction drawings also indicate that a subsurface foundation drain runs along the perimeter of the building about 17 to 27 feet below grade. The drain consists of 6-inch perforated clay pipe draining to two manholes, one at the northwest corner of the building and one near the southeast corner of the building. The northwest manhole is a sump that collects and pumps water to the southeast manhole. The southeast manhole also receives water from two interior basement sumps. Water was discharged from the southeast manhole to Paint Branch by a pipe and open channel.

Site 49 was identified as a Navy IRP site during an investigation that the Navy conducted in 1999 through 2002 at the request of WSSC to identify impacts from the NSWC-WO property to the WSSC sanitary sewer line that traverses the property through Paint Branch Valley (CH2M HILL, January 2004).

The area was designated as Site 49 and the origin of the TCE and the nature and extent of the contamination in groundwater, surface water and soil was then fully characterized in the Site 49 RI (CH2M HILL, May 2004). The removal of the leaching well and a visual inspection of Building 427 was conducted as part of the RI. In addition, the Building 427 perimeter drain and basement sumps were sampled for VOCs. Soil, surface water and groundwater grab samples were collected and twelve permanent monitoring wells were installed and sampled.

An FS was subsequently performed to identify and evaluate remedial alternatives (CH2M HILL, June 2004).

The former leaching well mentioned above, also referred to on architectural drawings as a limestone pit, and was excavated on June 17, 2002 by Shaw E&I, Inc. (Shaw) as a housekeeping measure and a presumptive remedy. Two soil samples were collected for laboratory analyses during excavation. The first sample was collected from the bottom of the excavation and analyzed for VOCs.

Following removal of the leaching well, the excavation was backfilled and the area was seeded and covered with hay. The leaching well, which appeared to be constructed with an up-ended concrete sewer pipe with a diameter of 4 feet and a height of 5 feet, was disposed of as construction debris.

The Site 49 Record of Decision was finalized in November 2004.

3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 Site 49 Physical Characteristics

The terrain in the vicinity of Site 49 consists of locally steep hills, particularly in areas dissected by stream channels. The drainage pattern at Site 49 is dominated by Paint Branch. Land cover varies between woodland, grassland, paved areas and buildings. Elevations at Site 49 range from approximately 275 feet above msl around Building 427 to approximately 180 feet above msl, at Paint Branch, see figure 3-1.

The subsurface geology of Site 49 is primarily underlain by Piedmont bedrock and derived saprolite. Potomac group deposits and recent sediments are not present at Site 49. The saprolite is composed of the same materials as the underlying schist bedrock. The saprolite is strongly foliated, preserving the structures of the parent schist. Its thickness ranges from about 5 feet in the north and west to about 25 feet in the south and east. Underlying the saprolite is Precambrian to Cambrian, meta-sedimentary crystalline bedrock of the Wissahickon Formation.

3.2. LAND AND RESOURCE USE

Site 49 is located at the eastern edge of the Arnold Engineering Development Center (AEDC). The topography in this portion of the former NSWC-WO contains considerable relief. The western portions of Site 49, associated with AEDC including Building 427, are relatively flat. The central and eastern portions of Site 49 include a steep-sided ravine formed by Paint Branch. The total elevation drop from west to east across Site 49 is approximately 100 feet.

Groundwater at Site 49 and throughout the former NSWC-WO is not used as a potable water source at this time and is unlikely to be used for such purposes in the future. Water for occupants of the former NSWC-WO and the surrounding properties is (and is expected to continue to be) supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable supply wells without a permit. Additionally, the rock aquifer matrix within the site is incapable of providing a supply in excess of 1 gpm. Nonetheless, for the purposes of the site risk assessment, the groundwater was evaluated as a potential residential drinking water source.

3.3. NATURE AND EXTENT OF CONTAMINATION

Soil was investigated in order to determine if a source of the TCE in groundwater could be identified. Investigation of soil conditions and potential source areas found no continuing sources for the TCE remaining in the soil. Analytical data for the Site 49 soil samples is presented in the Site 49 RI (CH2M HILL, May 2004).

Tetrachloroethene (PCE) was detected at very low concentrations in seven samples from three boring locations (maximum concentration 3.0 ug/kg). Chloromethane (2.7 ug/kg), bromomethane (1.4 ug/kg) and carbon disulfide (1.7 ug/kg) were also detected in one area of the site at very low concentrations.

Semi-volatile compounds (SVOCs) were detected in one area at low concentrations. Only one SVOC, benzo(a)pyrene, was detected in a subsurface soil sample at a concentration exceeding the EPA Region III RBC for residential soil. The maximum concentration of benzo(a)pyrene was 590 ug/kg.

Maximum detections of arsenic, iron, and manganese at 2.7 mg/kg, 37,400 mg/kg and 2,090 mg/kg, respectively, exceeded EPA Region III RBCs for residential soil. However, the maximum detected concentration of arsenic was below the 95% UCLs for background at White Oak. Although the maximum detected concentration of iron and manganese exceeded the calculated 95% UCLs for background, it is unlikely that the results indicate anthropogenic soil contamination. Rather, the variability in concentrations detected in Site 49 samples appears to be consistent with variability expected in natural soils, based on the background data set and regional-scale reference data sets.

The nature and extent of groundwater contamination for Site 49 is based on the discussions and the analytical data for groundwater presented in the Site 49 RI report (CH2M HILL, May 2004). The primary contaminants detected in groundwater are TCE and its breakdown products (cis-DCE and vinyl chloride). The maximum concentrations of these contaminants are listed below.

- TCE – 4,400 ug/L
- cis-DCE – 1,100 ug/L
- Vinyl chloride – 5.7 ug/l

The contaminant plume extends approximately 450 feet from Building 427 on the west and is bounded by Paint Branch on the east. The northern side of the TCE plume extends

100 to 200 feet onto property owned by the Maryland National Capital Park and Planning Commission and remains undefined due to lack of offsite access rights.

The vertical delineation program indicates TCE concentrations increase with depth near the source area and decrease with depth away from the source. It is postulated that this may be due to the complex vertical gradients and groundwater flow patterns near Paint Branch.

Five metals were detected in the groundwater at concentrations above applicable screening levels. The metals and their maximum concentrations in filtered groundwater are: aluminum (6,800 ug/L), chromium (75.5 ug/L), iron (14,100 ug/L), manganese (2,290 ug/L), and nickel (81 ug/L).

Surface water samples were collected along Paint Branch. Results indicate that surface water quality in Paint Branch, adjacent to Site 49, is consistent with background data and shows no anthropogenic influences from Site 49. The absence of detectable concentrations of VOCs indicates that any groundwater discharged to Paint Branch from Site 49 has no adverse affect on surface water quality.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

PCOCs were defined as those chemicals with maximum concentrations greater than the EPA Region III risk-based concentration for tap water in a residential setting. Constituents with maximum detected concentrations below the RBC were not retained as PCOCs. Lead concentrations in groundwater were compared with the Safe Drinking Water Act action level. Comparison with background concentrations were not used in the screening process.

Thirteen PCOCs were identified for the groundwater, consisting of seven VOCs and five inorganics which are as follows:

- 1,2-dibromomethane
- Chloroform
- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- Vinyl chloride
- Cis-1,2-DCE
- Trans-1,2-DCE
- Aluminum
- Chromium
- Iron

- Manganese
- Nickel

For the purposes of the risk assessment, it was assumed that groundwater from beneath the site would be used as a future residential potable water supply. Therefore, the future child and adult resident were evaluated for potential exposure to groundwater for potable use. Carcinogenic risks were calculated for a lifetime resident instead of for the individual child and adult resident, as directed by EPA Region III risk assessment guidance. The risk assessment also assumed that a future construction worker could be exposed to groundwater in an open excavation during any construction or excavation activities at the site.

HIs from an assumed exposure to groundwater under RME and CTE conditions are summarized below. The cumulative HIs for the construction worker or adult resident under CTE conditions does not exceed the EPA target of unity (one), however the cumulative HIs under RME conditions does exceed unity. The cumulative HIs for a child resident exceeds unity for both RME and CTE conditions.

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for Site 49 Groundwater

Hazard index for Site 49 Groundwater				
	Adult Construction Worker	Adult Resident	Child Resident	Life Time Resident
Total HI - RME	3.7	34	79	NA
Total HI - CTE	0.11	0.79	2.5	NA
Incremental Lifetime Cancer Risk for Site 49 Groundwater				
	Adult Construction Worker	Adult Resident	Child Resident	Life Time Resident
Total ILCR - RME	9.7 E-05	NA	NA	1.3 E-01
Total ILCR - CTE	2.7 E-06	NA	NA	1.3 E-03

HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

ILCRs from exposure to groundwater under RME and CTE conditions are summarized below. The cumulative ILCRs for the construction worker under CTE and RME conditions are within the EPA acceptable target range of 1.0 E-6 to 1.0 E-4. The cumulative ILCRs for the life time resident under both the RME and CTE conditions are greater than the upper bound of the EPA acceptable target range.

3.4.2 Ecological Risk Assessment

The Navy has completed a Base-wide Ecological Risk Assessment (BERA) for NSWC-WO (TtNUS, October 1999 – 2001) that included an evaluation of surface water and sediment in Paint Branch, including the area of Paint Branch near Site 49. The BERA concluded that the surface water and sediment in Paint Branch did not pose an unacceptable risk to ecological receptors. The chemical concentrations in the surface water samples that were subsequently collected as part of the Site 49 RI were all less than the screening levels established as par of the BERA process.

Groundwater exposure is not associated with any ecological receptors, therefore no ecological risks are posed by Site 49 groundwater. Soil data collected at Site 49 was limited to subsurface soil because of the anticipated nature of any releases. Similarly, no ecological risks are posed by subsurface soil because there are no exposure routes for ecological receptors.

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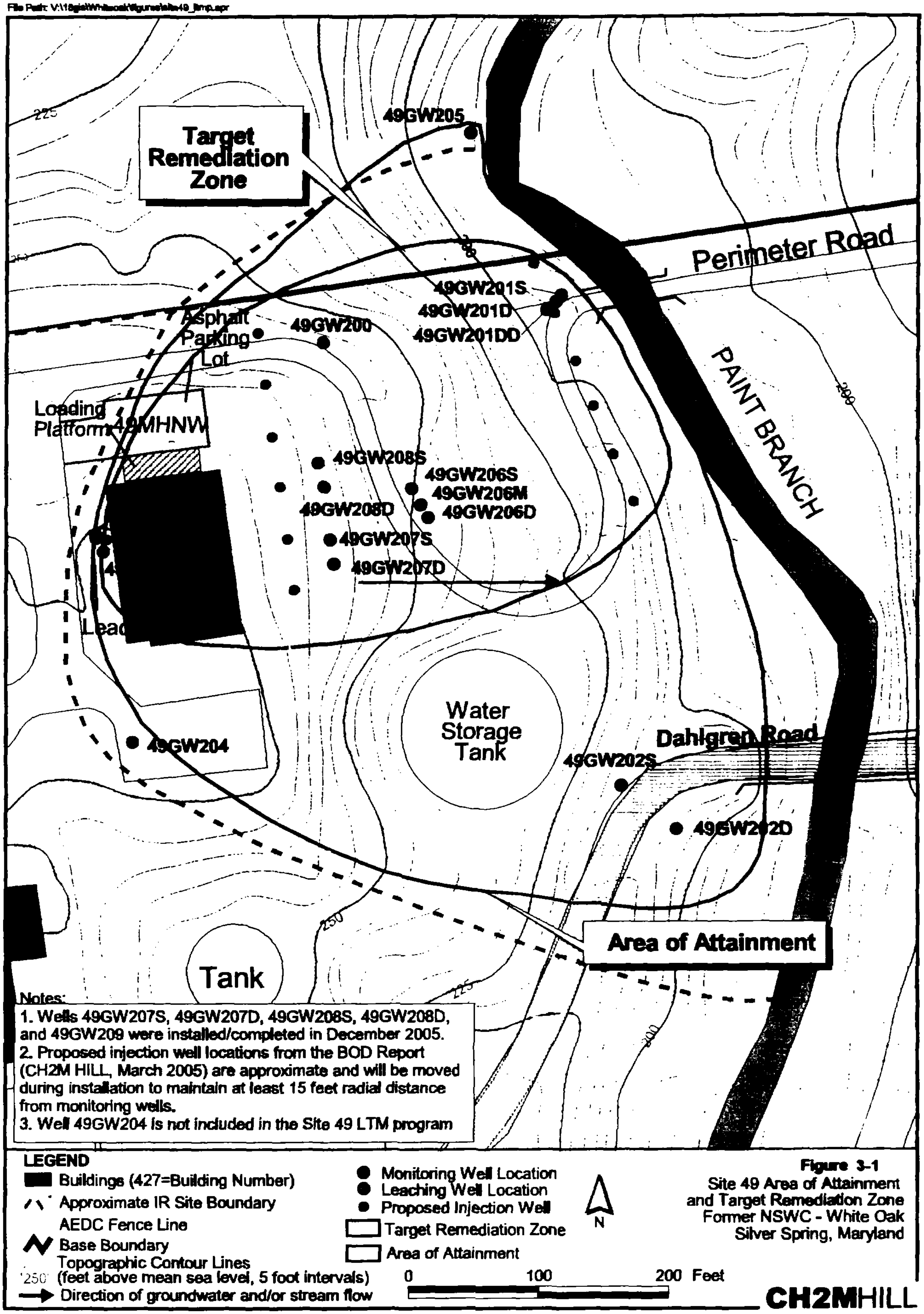

Figure 3-1
Site 49 Area of Attainment and Target Remediation Zone
Former NSWC - White Oak
Silver Spring, Maryland

4.0 REMEDY IMPLEMENTATION

Interim source removal activities were completed at Site 49 during 2002 to address contaminant sources that may be impacting groundwater at NSWC-WO. The activities included the excavation and off-site disposal of the leaching well and surrounding soil. The remedial action of in-situ chemical oxidation is in the process of being implemented and the injection wells have just recently been constructed.

4.1. REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for groundwater for Site 49, as presented in the ROD (USEPA, November 2004), include the following:

- Prevent unacceptable risk to human receptors from exposure to contaminants in the groundwater.
- Restore contaminated groundwater to a quality amenable to beneficial use (meet the PRGs identified).
- Prevent further migration of contaminants.

Meeting these objectives for Site 49 is based largely upon achieving the PRGs, which are shown in the following Table:

Table 4-1
PRGs for COCs at Site 49

COC	PRG (ug/L)	Basis
cis-1,2-DCE	70	MCL
TCE	5	MCL
Vinyl chloride	2	MCL
Iron	4,700	RBC

Source: ROD, USEPA, November 2004.

4.2. SELECTED REMEDY

The selected remedy consists of:

- In-situ chemical oxidation through injection of sodium permanganate into wells and pneumatic fracturing
- Long-term monitoring of the plume until PRGs are met.
- Implementation of institutional controls until PRGs are met.

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

Currently, the only ongoing activity is groundwater monitoring; therefore the only O&M activity is the inspection and maintenance of monitoring wells. Since chemical injection occurs in periodic treatment episodes, limited O&M activities are anticipated over the duration of the remedial action process.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for Site 49 – TCE Groundwater Plume in the 400 Area at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document under contract N62477-03-D-0163, Delivery Order 011 to the Navy.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan, RI, CMS, and FS for Site 49 became available to the public on July 1, 2004 and are among the documents that comprise the Administrative Record file for former NSWC-WO, which is maintained by NAVFAC Washington at the Washington Navy Yard, Washington, DC. These documents are also located in the information repository for the NSWC-WO, which is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of availability of these documents, the public comment period, and a public meeting were published in the *Washington Post, Silver Spring Gazette, College Park Gazette,* and *Burtonsville Gazette* in June 2004. The public comment period was held from July 1, 2004 to July 30, 2004, and a public meeting was held on July 13, 2004.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the Restoration Advisory Board (RAB) members at their next meeting. The results of the five-year review and the report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation, decision, and remediation documents, including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

At the time this document was prepared, implementation of the remedial action was still in progress and the results of the remedial action are not yet available. A brief description of the remedial actions is presented followed by the most recent (pre-remedial action) groundwater results currently available.

The remedial action consists of in-situ chemical oxidation through the injection of sodium permanganate into the saprolite and bedrock wells. A total of fifteen injection wells will be installed. Fourteen deep injection well boreholes will be advanced by air-rotary drilling methods, using nominal 8-inch outside diameter bit. The bit will be advanced slightly into bedrock. The expected depth to the upper bedrock layer is approximately 30 feet but will vary with location. An additional injection well will be installed into the saprolite layer in the location of the leaching well.

Sodium permanganate will be delivered in dosages to provide a 5 to 10% permanganate strength. The goal will be to displace the permanganate 25 feet radially from each borehole. The anticipated volume to accomplish this is expected to be 1,200 gallons of water for each inch of fracture treated in each borehole. Shaw E&I currently estimates that approximately 7,200 gallons of chase water will be required per borehole. Groundwater samples will be evaluated from eight existing designated monitoring wells and each of the fifteen injection wells prior to initiation of permanganate additions.

Since the results of the remedial action injections are not yet available, only the most recent results from December 2005 (pre-treatment phase) are presented in Table 6-1. The actual review of the remedial action will either be provided in the final version of this report or in the next Five-Year Review document for the former NSWC-WO facility. Therefore the data presented in Table 6-1 serves only as a baseline for comparison for future remedial action results.

The following observations for COCs for which PRGs have been developed are made based on the data in Table 6-1 for the baseline (pre-treatment) conditions. The cis-1,2-DCE concentration ranged from 2 ug/L to 550 ug/L with the maximum concentration occurring in well 49GW200. The TCE concentration ranged from 4 ug/L to 3,100 ug/L with the maximum concentration occurring in well 49GW208D. The vinyl chloride concentrations ranged from non-dectection to 81 ug/L with the maximum concentration occurring in well 49GW206M. The total iron concentration ranged from 651 ug/L to 63,100 ug/L with the maximum concentration occurring in well 49GW202S. The dissolved iron concentration ranged from 427 ug/L to 27,500 ug/L with the maximum concentration occurring in well 49GW207S.

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of Site 49 on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

At the time of the site inspection, construction of the remedial action had not yet begun but was imminent. A cursory inspection of the monitoring wells indicated that all the wells were in good physical condition and were secured with locks.

There is a potential access point just north of the GW201 monitoring well cluster where Paint Branch crosses the facility boundary. Due to the topography of the stream banks, there is a gap between the stream and the bottom of the facility fence. Potential trespassers could easily enter the site through this gap. The fence should not be lowered or altered at this point as this could cause additional damage from swiftly moving debris during a flood.

LUCs include written restrictions, which control the use of groundwater for potable use. There was no evidence that groundwater is being used for any purpose, nor is it likely that it ever will be. At the time this Five-Year Review was prepared, the exact wording of the LUCs were still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August and September 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure no withdrawal of groundwater for any purpose (including drinking water) from within the restricted area until the PRGs are met and risks from groundwater use are reduced to acceptable levels.

- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and future property owners.

These institutional controls will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure. Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated.

Table 6-1
Site 49
December 2005 Groundwater Results

Sample Date		49GW200 12/15/05	49GW201D 12/14/05	49GW201DD 12/15/05	49GW201S 12/13/05	49GW202D 12/13/05	49GW202S 12/15/05	49GW203 12/13/05	49GW205 12/14/05	49GW206D 12/15/05	49GW206M 12/15/05	49GW206S 12/16/05
Chemical Name	**PRGs**											
Volatile Organic Compounds (UG/L)												
1,1-Dichloroethane		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene		6 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	11	10 U	4 J
cis-1,2-Dichloroethene	**70**	**550**	**310**	10 U	38	2 J	10	19	10 U	**85**	**210**	87
Tetrachloroethene		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Toluene		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,2-Dichloroethene		41	12	10 U	10 U	10 U	10 U	10 U	10 U	2 J	2 J	10 U
Trichloroethene	**5**	**1,700**	**550**	4	**150**	**17**	**29**	**120**	**7**	**46**	**210**	180
Vinyl Chloride	**2**	**4**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	**81**	2 U
Total Metals (UG/L)												
Chromium		28.8 J	4.5 B	6.1 B	3 B	3.2 B	17 B	0.37 B	21.3 B	11.5 B	7.8 B	4.3 B
Iron	**4,700**	**7,130 J**	**9,050 J**	153 B	**16,800 J**	422 B	**63,100 J**	**11,900 J**	**9,770 J**	439 B	**18,700 J**	2,740 J
Manganese		407	967	13.9	125	151	344	3,230	1,160	35	1,310	275 .
Potassium		7,230	5,100	12,300	3,300 B	5,930	5,590	8,980	32,500	9,020	7,470	3,040 B
Dissolved Metals (UG/L)												
Chromium		2.2 B	0.77 B	3 B	0.43 B	0.65 B	0.81 B	0.2 U	0.87 B	6.4 B	3 B	0.84 B
Iron	**4,700**	427 J	2,640 J	60.2 B	188 B	39.4 B	2,680 J	**11,600 J**	**5,220 J**	260 J	**16,100 J**	2,000 J
Manganese		216 J	452 J	9.8 B	46.6 J	75.3 J	303 J	3,290 J	1,050 J	33.3 J	1,470 J	254 J
Potassium		6,150	5,100	12,400	3,110	6,360	4,850	8,550	33,000	8,970	6,930	2,970

Shaded cells represent exceedances of the PRGs
B = *Contamination found in associated blank sample*
J = Estimated value
U = Non-detected

NA - Not analyzed

Table 6-1
Site 49
December 2005 Groundwater Results

Sample Date	49GW207D 12/16/05	49GW207S 12/16/05	49GW208D 12/14/05	49GW208S 12/14/05	49GW208SP 12/14/05	49GW209 12/13/05
Chemical Name						
Volatile Organic Compounds (UG/L)						
1,1-Dichloroethane	10 U	10 U	2 J	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	9 J	10 U	10 U	10 U
Chloroform	1 J	1 J	10 UJ	8 J	7 J	10 U
cis-1,2-Dichloroethene	130	140	450	120	120	180
Tetrachloroethene	2 U	2 U	2 UJ	2 U	2 U	2
Toluene	10 U	10 U	10 UJ	10 U	10 U	2 J
trans-1,2-Dichloroethene	10 U	10 U	30 J	10 U	10 U	10 U
Trichloroethene	520	650	3,100	270	290	1,400
Vinyl Chloride	2 U	2 U	6 J	2 U	2 U	2 U
Total Metals (UG/L)						
Chromium	4.7 B	15.3 B	10.1 B	55.1 J	37.6 J	9.4 B
Iron	651 J	51,100 J	2,810 J	10,300 J	8,780 J	32,400 J
Manganese	171	821	681	1,080	1,040	4,890
Potassium	3,900	8,390	4,350	10,700	10,600	8,950
Dissolved Metals (UG/L)						
Chromium	1 B	0.54 B	1.2 B	2.4 B	2.4 B	6.6
Iron	53.9 B	27,500 J	999 J	67 B	68.8 B	14,000 J
Manganese	187 J	500 J	584 J	949 J	925 J	3,120 J
Potassium	3,670	5,590	4,010	8,740	8,620	7,360

Shaded cells represent exceedances of the
B = Contamination found in associated bla
J = Estimated value
U = Non-detected

NA - Not analyzed

7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents and site inspection indicate that the portions of the selected remedy that have been implemented to date, institutional controls and groundwater monitoring, are functioning as intended by the ROD. No assessment can be made regarding the in-situ chemical treatment as it has not been implemented yet. Institutional controls in the form of groundwater use restrictions are responsible for protecting human receptors from any direct contact with or ingestion of groundwater. Groundwater monitoring has and will continue to be utilized to document the effectiveness of the remedial actions in achieving the PRGs.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the ROD are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced that questions the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The institutional controls and groundwater monitoring are effective in protecting human receptors from any direct contact with or ingestion of groundwater. In particular, the institutional controls are responsible for preventing use of and therefore exposure to groundwater. A complete assessment of the selected remedy cannot be made until results following the chemical oxidation treatment become available.

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8.0 ISSUES

The institutional controls and groundwater monitoring portions of the Site 49 remedy are functioning as intended by restricting exposure to groundwater contaminants by human and ecological receptors. The remedial action of in-situ chemical oxidation is in the process of being implemented and results are not yet available to evaluate the performance of the remedial action. To date, no issues have been identified for these activities.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the review of documents and the site visit, there are no recommendations at this time. Recommendations may be identified when results from in-situ chemical oxidation become available.

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10.0 PROTECTIVEMENT STATEMENT

Based on the two activities that have been implemented to date (institutional controls and groundwater monitoring) the selected remedy is protective of human health and the environment in the short-term. In particular, institutional controls which prevent usage of groundwater as a potable water supply are functioning as intended and are protecting human receptors from exposure to groundwater contamination. However, in order for the remedy to be protective in the long-term, the injection of sodium permanganate needs to be implemented. Groundwater monitoring and five-year reviews will help ensure that the remedial actions are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

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11.0 NEXT REVIEW

The next Five-Year Review for Site 49 is required by 2011, five years from the date of this review. Since the in-situ chemical treatment results are not yet available, a complete remedy review will be performed during the next Five-Year Review.

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REFERENCES

- CH2M HILL, Site 49 Remedial Investigation at former Naval Surface Warfare Center, White Oak, MD, May 2004.
- CH2M HILL, Feasibility Study for Site 49 at former Naval Surface Warfare Center, White Oak, MD, June 2004.
- Naval Facilities Engineering Command Washington, Record of Decision for Site 49 at former Naval Surface Warfare Center, White Oak, MD, November 2004.
- Shaw Environmental and Infrastructure, Draft Work Plan for In-Situ Chemical Oxidation at Site 49, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland, June 2006.

SWMU 87

Final Five-Year Review

For

SWMU 87

Former Naval Surface Warfare Center
White Oak, Maryland

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

NAVFAC Washington
Contract Number N62477-03-D-0163
Contract Task Order 0011

April 2007

Final Five-Year Review

For

SWMU 87

Former Naval Surface Warfare Center
White Oak, Maryland

Submitted to:
Naval Facilities Engineering Command
1314 Harwood St., S.E.
Washington Navy Yard, D.C. 20374-5018

Submitted by:
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CONTRACT NUMBER N62477-03-D-0163
DELIVERY ORDER 0011

April 2007

TABLES

FIGURES

RPM	Remedial Project Manager
SI	Site Inspection
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
VC	Vinyl chloride
µg/L	microgram per liter

1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine whether the selected remedy at SWMU 87 at the former Naval Surface Warfare Center – WO (NSWC-WO) in Silver Spring, Maryland, is protective of human health and the environment. The methods, findings, and conclusions of the SWMU 87 Five-Year Review are documented in this report. In addition, issues found during the review and recommendations to address them are also included in this document.

The Department of the Navy (Navy) is the lead agency for site activities at former NSWC-WO. The US Environmental Protection Agency (USEPA) Region 3 and the Maryland Department of Environment (MDE) are the support agencies. Cleanup monies are provided by the Department of Defense.

The Navy is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

Furthermore, the NCP; 40 Code of Federal Regulations (CFR) §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.*

JM Waller Associates, Inc. (JMWA) conducted an analysis of the available information from June through October 2006 in support of the Five-Year Review in response to Delivery Order 011 under Contract Number N62477-03-D-0163. Representatives of JMWA conducted an inspection of SWMU 87 on June 21, 2006.

This is the first Five-Year Review for the former NSWC-WO sites. The triggering action for this statutory review was the initiation of the remedial action for OU 2. A Five-Year Review is required for SWMU 87 because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE HISTORY

2.1. SWMU 87

SWMU 87 is located west and north of former Building 611 in the south-central portion of the facility. The unit is located within 50 feet of Paint Branch and was reportedly used to store wood, metal waste, and other debris. The site itself is level but slopes quickly to the west due to erosion from the stream. To the northeast and southeast, moderately steep slopes rise above the site.

Under the provisions of the Hazardous and Solid Waste Amendments (HSWA) to RCRA, treatment, storage, or disposal facilities seeking final permits are required to initiate corrective actions for releases of hazardous wastes or constituents from Solid Waste Management Units (SWMUs). Former NSWC-WO operated under an interim status for on-site storage of hazardous waste. The Navy first submitted an application for a final (Part B) permit to Maryland in 1985, and made subsequent resubmissions and modifications. The last permit application was submitted in 1992.

In September 1992, Malcolm-Pirnie completed an RFA review for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual SWMU. Generally, for those SWMUs that were being investigated under the IRP, it was concluded that the planned level of effort was sufficient to address potential impacts from each SWMU. It was also concluded that some level of sampling would probably be required for the SWMUs and AOCs that were recommended for an RFI or verification sampling.

In 1995, former NSWC-WO was selected for closure on the BRAC IV list. A Phase I Environmental Baseline Survey (EBS) was conducted by EA Engineering Science and Technology (EA) to assess the existing environmental information related to storage, release, treatment, or disposal of hazardous substances or petroleum products and to document the environmental condition of the property. The EBS also addressed actions required prior to property transfer to ensure compliance with requirements of CERCLA 120(h), applicable state and real estate laws, compliance programs, and the DoD policy for Agency to agency property transfer at BRAC installations.

An investigation to characterize background soil, sediment, groundwater, and surface water quality was performed in the fall of 1997. A final background report was published in 1998 (TtNUS, December 1998).

The RFI for SWMU 87 (TtNUS 2005a) characterizes the nature and extent of contamination and associated environmental conditions that may impact human health and the environment. As described earlier, SWMU 87 is located within 50 feet of Paint Branch. AOC M was a storm drain in front of Building 611 that discharged to Paint Branch through an outfall. Any potential impacts to the surface water and sediment of Paint Branch were evaluated in the investigation for AOC M (TtNUS, 2004).

Surface and subsurface soil samples were analyzed for TCL VOCs, SVOCs, Pesticides/PCBS, and TAL metals. Three temporary monitoring wells were installed within and downgradient of SWMU 87 during an investigation conducted in 1999, and three additional temporary monitoring wells were installed during a supplemental investigation conducted in 2002. Based on the results of surface soil, subsurface soil, and groundwater samples collected during the 1999 and 2002 investigations, an additional field investigation was conducted at SWMU 87 in June 2003. The purpose of this investigation was to identify the source of VOCs in groundwater by the collection of surface and subsurface soil samples. Two potential source areas have been identified, the catch basin at the northern end of the building and the area near the former compressed air tanks slab on the eastern side of the building.

A Corrective Measures Study (CMS) was conducted for SWMU 87 in 2005 (TtNUS, April 2005). The CMS included the evaluation of remedial alternatives for SWMU 87 groundwater.

The SWMU 87 Record of Decision was finalized in October 2005.

3.0 BACKGROUND

3.1. FACILITY PHYSICAL CHARACTERISTICS

The former NSWC-WO facility is located approximately 5 miles northeast of Washington, DC, near the boundary between the Piedmont and Coastal Plain physiographic provinces. The facility lies in gently rolling terrain. The topographic expression of the area is typical of a deeply incised, dendritic stream channel pattern. Paint Branch and its tributaries dominate local drainage patterns.

The highest elevation of former NSWC-WO is approximately 398 feet above mean sea level (MSL). The lowest elevation is roughly 145 feet above msl. The terrain of the western portion of the facility slopes generally eastward toward Paint Branch with about 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes are more generally southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground surface slopes increase to as much as 65 percent.

3.1.1 SWMU 87 Physical Characteristics

The subsurface materials encountered beneath SWMU 87 consist of fill, natural unconsolidated materials, saprolite, and bedrock. The fill consists of reworked natural materials and fill that was placed to support grading activities during original building construction at SWMU 87. The fill exists in these isolated areas of prior construction, and extends to depths of approximately 5 feet; but thickens in the vicinity of Paint Branch. The natural unconsolidated material underlies the fill in disturbed areas, and exists at the ground surface in undisturbed areas. The natural unconsolidated materials consist of silty sand and range from approximately 5 feet along the hillsides to greater than 10 feet in the valley along Paint Branch and along the plateau on the top materials, and ranges from 5 feet thick in the highlands and thickens in the valleys along Paint Branch. The bedrock consists of schist with isolated fracturing, and is found at shallower depths (less than 15 feet below ground surface) to greater than 25 feet along Paint Branch.

Groundwater exists in the fill, unconsolidated natural materials, saprolite, and bedrock. The depth to groundwater is less than 15 feet bgs in the lowlands along Paint Branch, and greater than 25 feet bgs in the higher elevations. Groundwater exists generally under unconfined conditions at shallow depths, although confined groundwater was encountered in well borings drilled in higher elevations in the bedrock. Groundwater, once encountered in the bedrock, was observed to rise in the borings until reaching equilibrium.

Shallow groundwater follows topography and flows from higher elevations to lower elevations, discharging into Paint Branch. Shallow groundwater in the highlands exists in the bedrock, and flows generally south, passing through the saprolite and unconsolidated materials in the lowlands, and ultimately discharges into Paint Branch. Groundwater flow in the bedrock is believed to be influenced by fracturing as evidenced by the varying groundwater yield in the bedrock wells. Drilling logs also indicated soft zones during drilling of some of the bedrock borings, which may be the result of fracturing.

Seepage velocity calculations were developed for the saprolite and bedrock using measured slug test data and the pneumatic surface map for the site An average seepage velocity in the saprolite was calculated to be 5.4 feet/day and an average seepage velocity in the bedrock was calculated to be 0.48 feet per day.

3.2. LAND AND RESOURCE USE

The area of SWMU 87 consists of open field adjacent to Paint Branch in south central portion of the property owned by the US government. The GSA has no immediate plans to use this area. There are no water supply wells located on the property in the area within or downgradient of the plume. Groundwater at and downgradient of SWMU 87, and throughout the former NSWC-WO, is not used as a potable water source at this time and is unlikely to be used for such purposes in the future. Water for occupants of the former NSWC-WO and the surrounding properties is, and is expected to continue to be) supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable supply wells where a public supply is readily available.

However, for the purposes of the site risk assessment, the site was evaluated assuming the possibility of residential use for the entire area including the use of the groundwater as a primary drinking water source.

3.3. NATURE AND EXTENT OF CONTAMINATION

Seven surface soil samples were collected and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals. Based on the laboratory results, six metals (aluminum, arsenic, chromium, iron, manganese and nickel) exceeded screening levels for residential soil in surface soil. The six metals that exceeded the benchmarks were detected in all surface soil samples. Arsenic was detected within background concentrations. None of the VOCs, SVOCs, or pesticides/PCBs detected in the surface soil at SWMU 87 exceeded any benchmarks.

The maximum concentrations of arsenic, chromium, and nickel exceed the USEPA Region 3 Soil to Groundwater protection criteria. However, only the average arsenic concentration in surface soil exceeded the groundwater protection criterion. Because arsenic concentrations are within background levels, there would not be any significant, site-related impact to groundwater.

Twenty subsurface soil samples were collected from depths of 2 to 10 feet bgs and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and/or TAL metals. Based on the laboratory results, three metals (iron, manganese, and nickel) were retained as chemicals of potential concern (PCOC) in subsurface soil. The remaining metals that exceeded screening levels for soil were not detected at levels significantly greater than background. In addition, several VOCs were detected in the subsurface soil at SWMU 87 in excess of groundwater protection criteria; however, the detections were limited in number and were estimated values.

The maximum and average concentrations of arsenic exceed the EPA Region 3 leaching-to-groundwater soil screening levels (SSLs) used to evaluate potential impacts to groundwater. However, arsenic concentrations are within background levels and would not pose a significant, site-related impact to groundwater.

Based on the results of the site investigations performed at and around SWMU 87, groundwater contamination (chlorinated ethenes, with PCE the primary contaminant) is present in both the overburden and fractured bedrock groundwater flow systems. Concentrations are generally low, with maximum detected PCE concentrations of 120 ug/L (overburden) and 34 ug/L (bedrock) in the most recent round (October 2004) of groundwater monitoring.

The overburden groundwater plume is located in the general vicinity of Building 611 (SWMU 87) near Paint Branch, and is somewhat limited in extent. Several monitoring wells associated with this plume had PCE concentrations of 100 ug/L or more in the most recent round of sampling. The bedrock plume appears to originate from the vicinity of Building 613, approximately 600 feet north-northeast of Building 611. This plume has much lower contaminant concentrations associated with it, with only one well having a PCE concentration (36 ug/L) above the maximum contaminant level (MCL) of 5 ug/L in the most recent sampling round. The contaminant sources for the two plumes have not been identified, however, given the long time period since the area has been active and generally low concentrations, it is considered unlikely that there are any active, continuing sources.

For the bedrock plume, current data indicates that the area containing groundwater contamination above MCLs is extremely localized (one well) and is well away from any sensitive receptors (i.e. Paint Branch). The estimated mass of contamination present in the bedrock flow system based on the groundwater calculations is miniscule, approximately 0.003 lbs. of VOCs total. In addition, the bedrock wells closest to the stream have trace to no contamination, indicating that the plume is naturally attenuating through physical and to a lesser degree, biological processes as it migrates from the Building 613 area. The presence of trace levels of the PCE biodegradation daughter products TCE and cis 1,2-DCE at the site indicates that there is some level of biodegradation occurring in the bedrock flow system.. Due to the trace amounts and concentrations of contamination present, the lack of an identified source, and the lack of a completed risk pathway to a potential receptor, the bedrock plume will be allowed to continue to naturally attenuate.

3.4. RISK ASSESSMENT SUMMARY

The following risk summaries were developed from the information in the Record of Decision, before the remedy was implemented.

3.4.1 Human Health Risk Summary

Site specific risks were estimated for SWMU 87 groundwater. The maximum detected chemical concentrations in groundwater were compared to the 95 percent UCLs calculated for the background data. Additionally, a population-to-population comparison was conducted using the Wilcox Rank-Sum test since both the site data and background data are not statistically "normally" distributed. Inorganic compounds found in the groundwater at SWMU 87 at concentrations that do not exceed basewide background levels were excluded as PCOCs for SWMU 87.

The following chemicals were retained as PCOCs in SWMU 87 groundwater:

- Chlorinated VOCs: cis-1,2-DCE, TCE, and PCE

Estimated HIs from exposure to SWMU 87 groundwater in the Coastal Plain/saprolite under the RME and CTE conditions are summarized in Table 3-1. The cumulative HIs for possible future child residents exceed 1 for the RME and CTE conditions and exceed 1 for future adult residents under the RME condition.

As stated above, iron, manganese, and thallium were eliminated as PCOCs in groundwater on the basis of background levels. If these metals had been selected as PCOCs and evaluated in the risk assessment, the groundwater HI for the child resident would increase from 2 to 12, and the adult resident groundwater HI would increase from 1 to 5. These increases would be due to the ingestion of manganese and thallium. The overall site HI (soil + groundwater) for the child resident would still exceed unity and the total HI for the adult resident would now exceed unity.

Estimated ILCRs from exposure to SWMU 87 groundwater in the Coastal Plain/saprolite under the RME and CTE conditions are summarized below. The cumulative ILCRs for possible future adult, child, and lifelong residents exceed 1.0 E-4 for the RME condition and exceed 1.0 E-4 for the lifelong resident under the CTE condition.

Table 3-1 summarizes the groundwater risk results for various exposure populations.

Table 3-1
Summary of Health Risk for SWMU 87 Groundwater

Hazard index for Site 87 Groundwater						
	Full Time Worker	Maintenance Worker	Construction Worker	Day Care Child	Adult Resident	Child Resident
Total HI - RME	0.01	0.02	0.09	0.02	1	2
Total HI - CTE	0.002	0.009	0.09	0.02	0.5	1
Incremental Lifetime Cancer Risk for SWMU 87 Groundwater						
	Full Time Worker	Maintenance Worker	Construction Worker	Day Care Child	Adult Resident	Child Resident
Total ILCR - RME	8 E-6	5 E-5	5 E-6	5 E-6	9 E-4	5 E-4
Total ILCR - CTE	7 E-7	5 E-6	5 E-6	5 E-6	1 E-4	1 E-4

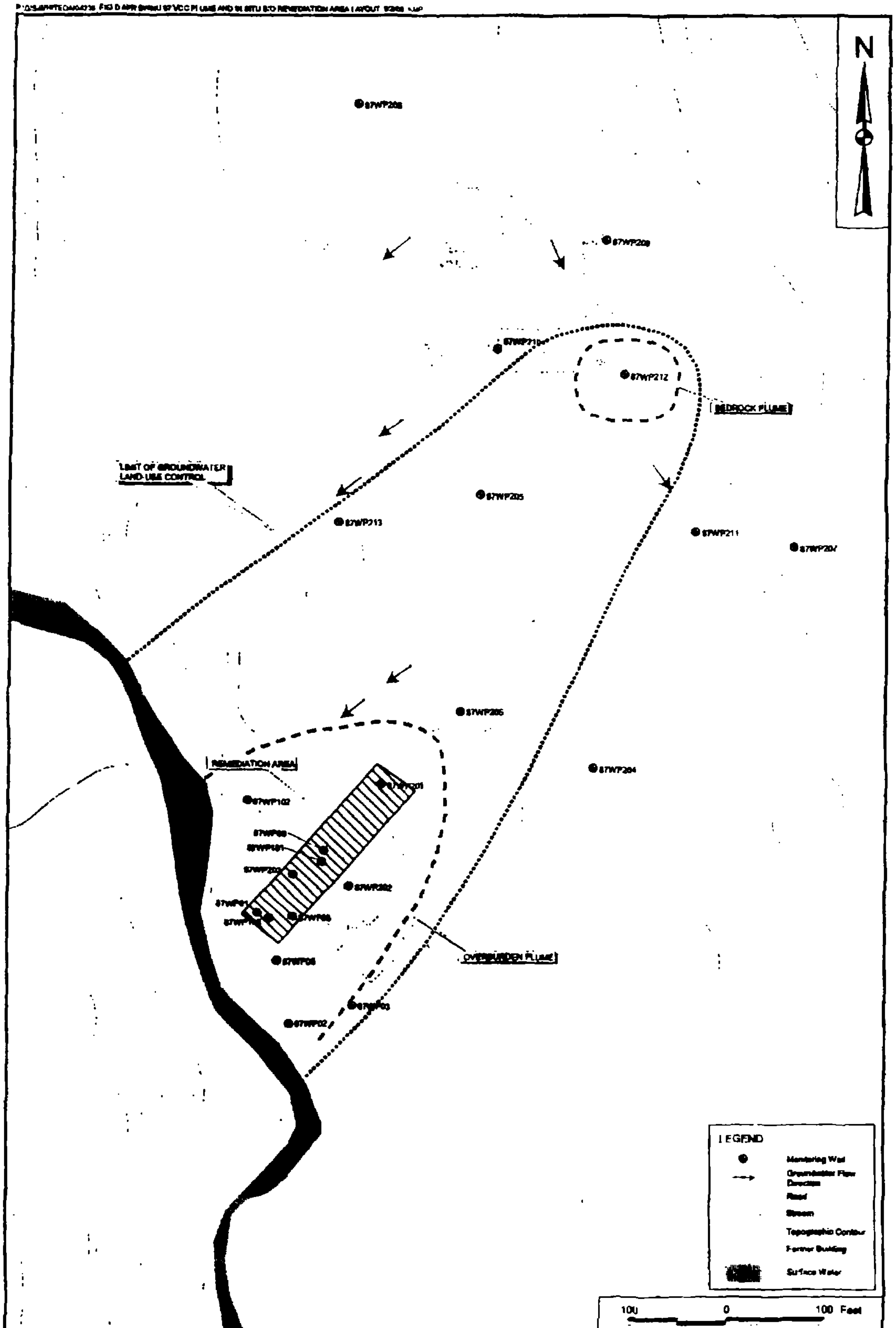
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

3.4.2 Ecological Risk Assessment

The Navy has completed a phased Base-wide Ecological Risk Assessment (BERA) for NSWC-WO to characterize the potential risks to ecological receptors from site-related chemicals found throughout the facility, including at SWMU 87. The procedures followed in conducting the baseline ecological risk assessment (BERA) are outlined in the April 2001 final report. Soil, surface water, and sediment data collected as part of the investigation of SWMU 87, AOC M, and Paint Branch were evaluated as part of the BERA. No chemicals, detected in these media at or near the site, were retained after the preliminary screening against ecological risk assessment values. Therefore, the BERA did not identify any potential unacceptable risks to ecological receptors.

Since the development of the BERA, additional surface soil samples were collected in 2002 and 2003 and analyzed for VOCs. The results were compared to screening levels developed by the USEPA Biological Technical Assistance Group (BTAG). In the additional surface soil samples, only low levels of dichlorodifluoromethane (30 to 38 ug/kg) and toluene (2 ug/kg) were detected. The toluene detection is less than the BTAG screening level of 100 ug/kg. There is no BTAG screening level for dichlorodifluoromethane, but the maximum detection is well below the BTAG screening level for most VOCs (100 to 300 ug/kg). Therefore, significant impacts to ecological receptors from these VOCs would be unlikely.

As groundwater exposure is not associated with any ecological receptors, SWMU 87 groundwater poses no ecological risks. No site-related chemicals were detected in the surface water or sediment in Paint Branch and therefore, risks to ecological receptors were not evaluated for these media relative to SWMU 87.



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COST/SCHEDULE-AREA	VOC PLUMES AND IN-SITU BIO REMEDIATION AREA SWMU 87 - BUILDING 611 SOLID WASTE STORAGE UNIT FORMER NSWC WHITE OAK SILVER SPRING, MARYLAND	APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 3-1	REV 1

4.0 REMEDY IMPLEMENTATION

To date, no remedial activities (including source removal or interim actions) have been conducted at SWMU 87.

4.1. REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for groundwater for SWMU 87, as presented in the ROD (USEPA, October 2005), include the following:

- Prevent human exposure (through ingestion, inhalation, and dermal contact) to groundwater having contaminants in excess of media cleanup standards (MCSs).
- Restore groundwater quality to MCSs.
- Comply with contaminant-, location-, and action-specific applicable or relevant and appropriate requirements (ARARs), and to-be-considered (TBCs) criteria to the extent appropriate.

Meeting these objectives for SWMU 87 is based largely upon achieving the MCSs, which are shown in the following Table:

Table 4-1
MCSs for COCs at SWMU 87

COC	MCS (ug/L)	Basis
cis-1,2-DCE	70	MCL
TCE	5	MCL
PCE	5	MCL

Source: ROD, USEPA, October 2005.

4.2. SELECTED REMEDY

The selected remedy consists of:

- In-situ bioremediation through injection of sodium lactate
- Long-term monitoring of groundwater
- Implementation of institutional controls until MCSs are met

4.3. REMEDIAL SYSTEM OPERATION AND MAINTENANCE

Currently, no O&M activities are ongoing at SWMU 87. Following implementation of sodium lactate injection and groundwater monitoring, O&M activities will consist of inspection and maintenance of monitoring wells.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first Five-year Review for SWMU 87 at the former NSWC-WO facility.

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6.0 FIVE-YEAR REVIEW PROCESS

6.1. ADMINISTRATIVE COMPONENTS

JMWA has prepared this Five-Year Review document under contract N62477-03-D-0163, Delivery Order 011 to the Navy.

The components of the Five-Year Review process include the following:

- Community involvement
- Document review
- Site inspection
- Data and Performance Evaluation
- Five-Year Review report development and review

6.2. COMMUNITY INVOLVEMENT

The Proposed Plan, CMS, and the RFI for SWMU 87 became available to the public on May 1, 2005 and are among the documents that comprise the Administrative Record file for former NSWC-WO, which is maintained by NAVFAC Washington at the Washington Navy Yard, Washington, DC. These documents are also located in the information repository for the NSWC-WO, which is maintained at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland. The notice of availability of these documents, the public comment period, and a public meeting was published in the *Washington Post, Silver Spring Gazette*, *College Park Gazette,* and *Burtonsville Gazette* on April 27, 2005. The public comment period was held from May 1, 2005 to May 30, 2005, and a public meeting was held on May 10, 2005.

A questionnaire was emailed to various entities that are involved or affected by the selected remedial action. The responses to these questionnaires are included in Appendix C.

Upon completion of this Five-Year Review, the results will be made available to the Restoration Advisory Board (RAB) members at their next meeting. The Five-year Review Report will be made available to the public at the local Information Repository located at the Montgomery County Public Library, White Oak Branch in Silver Spring, Maryland.

6.3. DOCUMENT REVIEW

The Five-Year Review consisted of a review of relevant investigation, decision, and remediation documents, including monitoring results. A list of the documents reviewed is provided in the Reference section of this report.

6.4. DATA REVIEW

At the time this document was prepared the remedial action of in-situ bioremediation was still in the process of being implemented; therefore there is no post remedial action data to review. The most recent groundwater sampling event was conducted in September 2004

6.5. SITE INSPECTIONS

Representatives of the Navy and JMWA conducted a site inspection of SWMU 87 on June 21, 2006. The purpose of the inspection was to assess the protectiveness of the implemented remedial action, including the presence of access restrictions and other land use controls (LUCs). Appendix A contains the site inspection checklists. Photographs taken during the site inspection are included in Appendix B.

At the time of the site inspection, the source area had been cleared and regraded and no evidence of site-related activities remained. A cursory inspection of the monitoring wells indicated that all the wells were in good physical condition and were secured with locks. Access to the site is well controlled because the site is located within a secured portion of the facility.

LUCs include written restrictions, which control the use of groundwater for potable use. There was no evidence that groundwater is being used for any purpose, nor is it likely that it ever will be. At the time this Five-Year Review was prepared, the exact wording of the LUCs was still in the developmental stage. The LUCs will remain in effect until contamination levels drop to a level that allow for unrestricted use of the site.

6.6. INTERVIEWS

Interviews were conducted by JMWA in August and September 2006 by sending out electronic questionnaires to the following groups: EPA, MDE, CH2M Hill, TtNUS, and the Army. To date, responses have been received by MDE, the Army, CH2M Hill, and TtNUS. Their input regarding the protectiveness of the implemented remedial actions has been incorporated into Appendix C of this Five-Year Review report.

6.7. INSTITUTIONAL CONTROLS

The Navy is responsible for implementing, inspecting, reporting, and enforcing the LUC objectives in accordance with a LUC Remedial Design. The LUC Remedial Design was developed during the Design Phase, has been reviewed by EPA and MDE and the proposed language is currently being reviewed by the Navy. The following institutional controls have been or are in the process of being implemented:

- Ensure no withdrawal of groundwater for any purpose (including drinking water) from within the restricted area until the MCSs are met and risks from groundwater use are reduced to acceptable levels.

- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and future property owners.

These institutional controls will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure. Based on the site inspection on June 21, 2006, there is no evidence that any of these LUCs have been violated.

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7.0 TECHNICAL ASSESSMENT

7.1. QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents and site inspection indicate that the portions of the selected remedy that have been implemented to date, institutional controls and groundwater monitoring, are functioning as intended by the ROD. No assessment can be made regarding the in-situ bioremediation as it has not been implemented yet. The institutional controls in the form of groundwater use restrictions are responsible for protecting human receptors from any direct contact with or ingestion of groundwater. Groundwater monitoring has and will continue to be utilized to document the effectiveness of the remedial actions in achieving the MCSs.

7.2. QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICTY DATA, CLEAN-UP LEVELS, AND RAOS USED AT THE TIME OF REMEDY SELECTION STILL VALID?

The exposure assumptions, toxicity data, clean-up levels, and RAOs identified in the ROD are still valid.

7.3. QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT CALLS INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional information has surfaced that questions the protectiveness of the selected remedy.

7.4. TECHNICAL ASSESSMENT SUMMARY

The institutional controls and groundwater monitoring are effective in protecting human receptors from any direct contact with or ingestion of groundwater. In particular, the institutional controls are responsible for preventing use of and exposure to groundwater. A complete assessment of the selected remedy cannot be made until results from in-situ bioremediation become available.

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8.0 ISSUES

The institutional controls and groundwater monitoring portions of the SWMU 87 remedy are functioning as intended by restricting exposure to groundwater contaminants by human and ecological receptors. No issues have been identified for either of these two activities.

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9.0 RECOMMENDATIONS AND FOLLOW UP ACTIONS

Based on the review of documents and the site visit, there are no recommendations for SWMU 87 at this time. Recommendations may be identified when results from in-situ bioremediation become available.

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10.0 PROTECTIVENESS STATEMENT

Based on the two activities that have been implemented to date, institutional controls and groundwater monitoring, the selected remedy is protective of human health and the environment in the short-term. In particular institutional controls, which prevent usage of groundwater as a potable water supply, are functioning as intended and are protecting human receptors from exposure to groundwater contamination. However, in order for the remedy to be protective in the long-term, the injection of sodium lactate or EOS needs to be implemented.

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11.0 NEXT REVIEW

The next Five-Year Review for SWMU 87 is required by 2011, five years from the date of this review. Since the in-situ bioremediation treatment results are not yet available, a complete remedy review will be performed during the next Five-Year Review.

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REFERENCES

- Tetra Tech NUS Inc., SWMU 87 Remedial Facility Investigation at former Naval Surface Warfare Center, White Oak, Silver Spring, MD, May 2005.

- Tetra Tech NUS Inc., SWMU 87 Corrective Measures Study at former Naval Surface Warfare Center, White Oak, Silver Spring, MD, April 2005.

- Naval Facilities Engineering Command Washington, Record of Decision for SWMU 87 at former Naval Surface Warfare Center, White Oak, MD, October 2005.

- Basis of Design Report for In-situ Bioremediation of Groundwater for SWMU 87, former Naval Surface Warfare Center, White Oak, MD, March 2006.

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APPENDICES

OU2 & OU3

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: Operable Unit 2	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD; Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90 °F, light to no wind

Remedy Includes: (Check all that apply)

- ✓ Landfill cover/containment
- ✓ Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other Long term monitoring
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA - BRAC site ______ ______
Name Title Date
Interviewed at site at office by phone Phone no. ______
Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
Name Title Date
Interviewed at site at office by phone Phone no. ______
Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________________
Contact ______________________________ ____________________ __________ ____________
Name Title Date Phone no.
Problems; suggestions; Report attached ____
____

Agency ______________________________
Contact ______________________________ ____________________ __________ ____________
Name Title Date Phone no.
Problems; suggestions; Report attached ____
____

Agency ______________________________
Contact ______________________________ ____________________ __________ ____________
Name Title Date Phone no.
Problems; suggestions; Report attached ____
____

Agency ______________________________
Contact ______________________________ ____________________ __________ ____________
Name Title Date Phone no.
Problems; suggestions; Report attached ____
____

4. **Other interviews** (optional) Report attached.

East side rip-rap draining ditch -

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks Methane monitoring ongoing			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks [illegible] Quarterly 1st year, 15 months after			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks			

IV. O&M COSTS N/A

1. **O&M Organization**
   State in-house | Contractor for State
   PRP in-house | Contractor for PRP
   Federal Facility in-house | Contractor for Federal Facility
   Other____

2. **O&M Cost Records**
   Readily available Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate____________________ Breakdown attached

   Total annual cost by year for review period if available

From__________ Date	To__________ Date	__________ Total cost	Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: ____

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map Gates secured N/A
   Remarks All around except stream side, accessed by [illegible]

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
   Remarks____

C. Institutional Controls (ICs)				
1.	**Implementation and enforcement** Site conditions imply ICs not properly implemented Site conditions imply ICs not being fully enforced Type of monitoring (*e.g.*, self-reporting, drive by) ______ Frequency ______ Responsible party/agency ______ Contact ______ (Name) ______ (Title) ______ (Date) ______ (Phone no.) Reporting is up-to-date Reports are verified by the lead agency Specific requirements in deed or decision documents have been met Violations have been reported Other problems or suggestions: Report attached	Yes Yes Yes Yes Yes Yes	No No No No No No	N/A N/A N/A N/A N/A N/A
2.	**Adequacy** ICs are adequate ICs are inadequate Remarks______			N/A
D. General				
1.	**Vandalism/trespassing** Location shown on site map No vandalism evident Remarks______			
2.	**Land use changes on site** N/A Remarks______			
3.	**Land use changes off site** N/A Remarks______			
VI. GENERAL SITE CONDITIONS				
A. Roads	Applicable N/A			
1.	**Roads damaged** Location shown on site map Roads adequate Remarks______			N/A

B. Other Site Conditions
Remarks

NA	VII. LANDFILL COVERS	Applicable	N/A

A. Landfill Surface

1.	**Settlement** (Low spots) Areal extent ______ Depth ______ Remarks	Location shown on site map	Settlement not evident
2.	**Cracks** Lengths ______ Widths ______ Depths ______ Remarks	Location shown on site map	Cracking not evident
3.	**Erosion** Areal extent ______ Depth ______ Remarks	Location shown on site map	Erosion not evident
4.	**Holes** Areal extent ______ Depth ______ Remarks	Location shown on site map	Holes not evident
5.	**Vegetative Cover** Grass Trees/Shrubs (indicate size and locations on a diagram) Remarks Mowing is overdue. Mowing is not critical but would allow for easier inspection of cover surface.	Cover properly established	No signs of stress
6	**Alternative Cover (armored rock, concrete, etc.)** Remarks	N/A	
7.	**Bulges** Areal extent ______ Height ______ Remarks	Location shown on site map	Bulges not evident

See LUC - Soil + GW - Lawyers

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
Wet areas No Location shown on site map Areal extent______
Ponding No Location shown on site map Areal extent______
Seeps No Location shown on site map Areal extent______
Soft subgrade Location shown on site map Areal extent______
Remarks Dry conditions prevailed over last month.

9. **Slope Instability** Slides Location shown on site map No evidence of slope instability
Areal extent______
Remarks______

B. Benches Applicable N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
Remarks______

2. **Bench Breached** Location shown on site map N/A or okay
Remarks______

3. **Bench Overtopped** Location shown on site map N/A or okay
Remarks______

C. Letdown Channels Applicable N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
Areal extent______ Depth______
Remarks______

2. **Material Degradation** Location shown on site map No evidence of degradation
Material type______ Areal extent______
Remarks______

3. **Erosion** Location shown on site map No evidence of erosion
Areal extent______ Depth______
Remarks______

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______ Depth______
Remarks______

5. **Obstructions** Type______ No obstructions
Location shown on site map Areal extent______
Size______
Remarks______

6. **Excessive Vegetative Growth** Type______
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______
Remarks Vegetation but does not impede flow

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks______

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks______

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration ~~Needs Maintenance~~ N/A
Remarks______

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks______

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks______

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring / Thermal destruction / Collection for reuse Good condition / Needs Maintenance Remarks		
2. **Gas Collection Wells, Manifolds and Piping** Good condition / Needs Maintenance Remarks		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition / Needs Maintenance / N/A Remarks		

F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks	Functioning	N/A
2. **Outlet Rock Inspected** Remarks Drainage channel on west side of LF has excessive vegetative growth but flow should not be impeded. North & east channels ok.	Functioning	N/A

G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent___ Depth___ N/A Siltation not evident Remarks		
2. **Erosion** Areal extent___ Depth___ Erosion not evident Remarks		
3. **Outlet Works** Remarks	Functioning	N/A
4. **Dam** Remarks	Functioning	N/A

H. Retaining Walls	Applicable	N/A	
1.	**Deformations**	Location shown on site map	Deformation not evident
	Horizontal displacement________ Vertical displacement________		
	Rotational displacement________		
	Remarks________		
2.	**Degradation**	Location shown on site map	Degradation not evident
	Remarks________		
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation**	Location shown on site map	Siltation not evident
	Areal extent________ Depth________		
	Remarks________		
2.	**Vegetative Growth**	Location shown on site map	N/A
	Vegetation does not impede flow		
	Areal extent________ Type________		
	Remarks Present, not impede flow		
3.	**Erosion**	Location shown on site map	Erosion not evident
	Areal extent________ Depth________		
	Remarks________		
4.	**Discharge Structure**	Functioning	N/A
	Remarks________		
NA	**VIII. VERTICAL BARRIER WALLS**	Applicable	N/A
1.	**Settlement**	Location shown on site map	Settlement not evident
	Areal extent________ Depth________		
	Remarks________		
2.	**Performance Monitoring** Type of monitoring________		
	Performance not monitored		
	Frequency________	Evidence of breaching	
	Head differential________		
	Remarks________		

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A
1. **Pumps, Wellhead Plumbing, and Electrical** Good condition All required wells properly operating Needs Maintenance N/A Remarks__________
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks__________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks__________
B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A
1. **Collection Structures, Pumps, and Electrical** Good condition Needs Maintenance Remarks__________
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** Good condition Needs Maintenance Remarks__________
3. **Spare Parts and Equipment** Readily available Good condition Requires upgrade Needs to be provided Remarks__________

C. Treatment System   Applicable   N/A

1. **Treatment Train** (Check components that apply)
   Metals removal   Oil/water separation   Bioremediation
   Air stripping   Carbon adsorbers
   Filters________________________________
   Additive (*e.g.*, chelation agent, flocculent)________________________________
   Others________________________________
   Good condition   Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually________________
   Quantity of surface water treated annually________________
   Remarks________________________________
   ____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A   Good condition   Needs Maintenance
   Remarks________________________________
   ____

3. **Tanks, Vaults, Storage Vessels**
   N/A   Good condition   Proper secondary containment   Needs Maintenance
   Remarks________________________________
   ____

4. **Discharge Structure and Appurtenances**
   N/A   Good condition   Needs Maintenance
   Remarks________________________________
   ____

5. **Treatment Building(s)**
   N/A   Good condition (esp. roof and doorways)   Needs repair
   Chemicals and equipment properly stored
   Remarks________________________________
   ____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked   Functioning   Routinely sampled   Good condition
   All required wells located   Needs Maintenance   N/A
   Remarks________________________________
   ____

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time   Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained   Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

Properly secured/locked | Functioning | Routinely sampled | Good condition

All required wells located | Needs Maintenance | N/A

Remarks MW-32 on south side was uncovered and in poor condition. Several other wells were covered but not locked.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B

OU2 PHOTOGRAPHS

OU2 Landfill, Photo 3 – Land use controls (sign and fence) on west side of landfill.

OU2 Landfill, Photo 4 – Sedimentation basin and drainage channel on southwest corner of landfill.

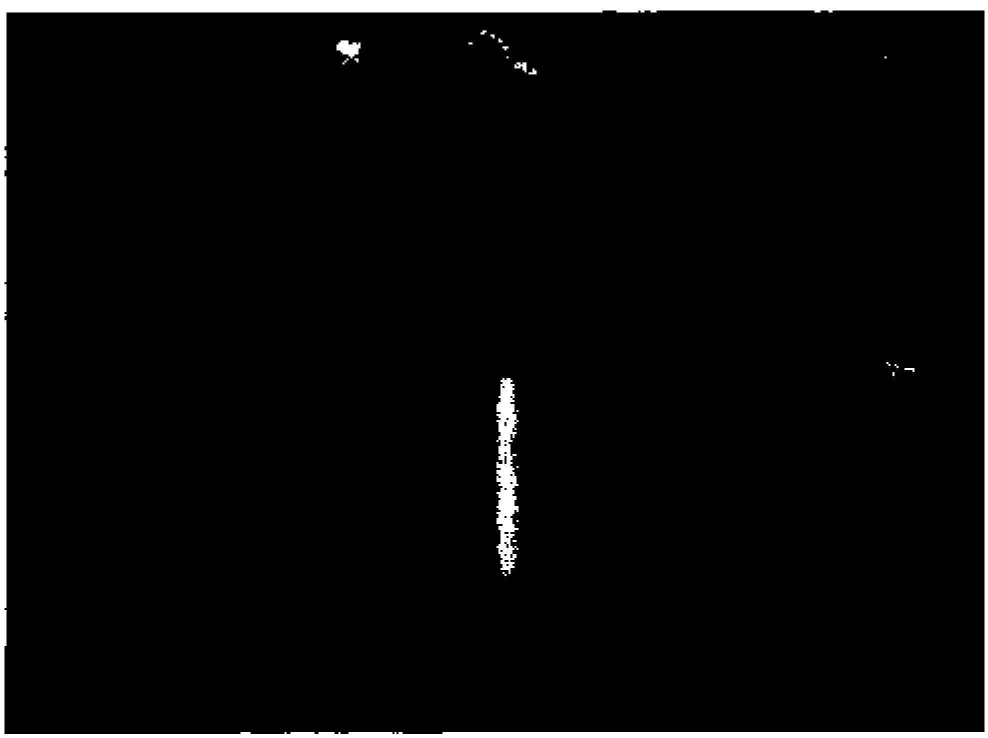
OU2 Landfill, Photo 1 – Overview of landfill, looking east.

OU2 Landfill, Photo 2 – Drainage channels and erosion control on south side of landfill.

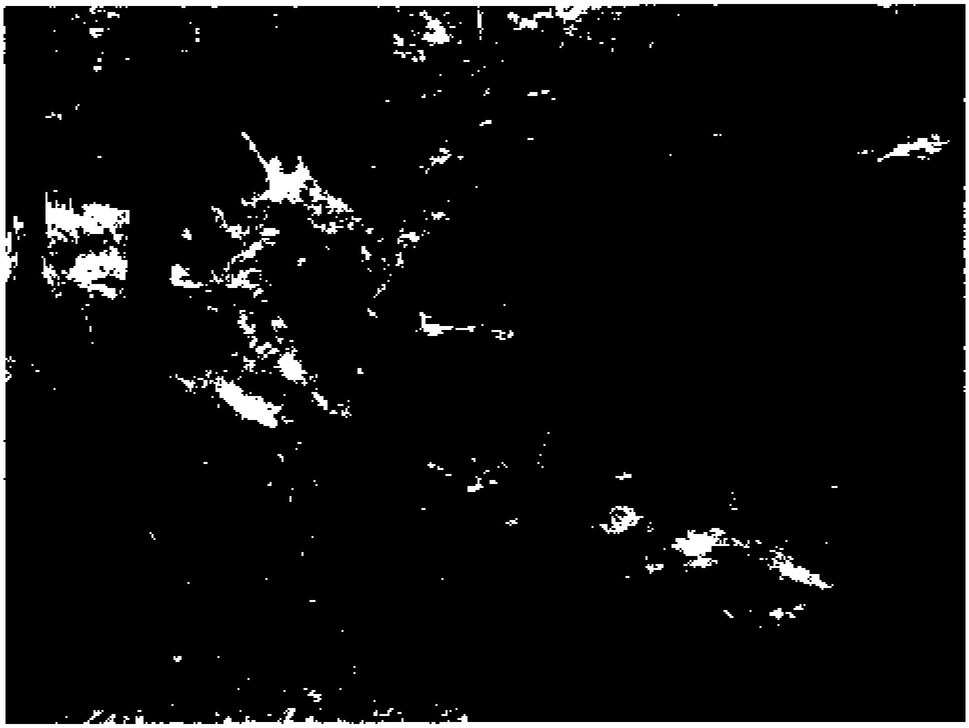
OU2 Landfill, Photo 5 – Storm drain discharge to rip-rap lined channel, note vegetative growth.

OU2 Landfill, Photo 6 – West side of landfill (looking north) and end of rip-rap area.

OU2 Landfill, Photo 7 – Rip-rap for stabilization along toe of landfill, looking east.



OU2 Landfill, Photo 8 – Riser pipe sealed with duct tape, unidentifiable well location next to unnamed tributary.



OU2 Landfill, Photo 9 – Unnamed tributary south of landfill.

OU2 Landfill, Photo 10 – Monitoring wells and rip-rap along landfill toe, looking east.

OU2 Landfill, Photo 11 – Monitoring well next to unnamed tributary, missing cover.

OU2 Landfill, Photo 12 – Drainage channel along east side of landfill, looking north.

OU2 Landfill, Photo 13 – Bench or access road across south landfill slope, looking west.

OU2 Landfill, Photo 14 – Drainage ditch and access road along north slope of landfill, looking west.

OU2 Landfill, Photo 15 – Passive gas vent, looking northwest.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: **Andy Zarins**
Agency/Title/etc: **MDE/Remedial Project Manager**
Date: **8/15/06**

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

   Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction; and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **OU2 – Apple Orchard Landfill**
Interviewee: **Scott Nesbit**
Agency/Title/etc: **Tetra Tech NUS, Project Manager**
Date: **22-August-2006**

Background

1. What effects have site operations had on the surrounding community or area?

No effects have been noted on the surrounding community.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

The tenants (FDA) at the Federal Research Center have shown an interest in the progress of the remedial activities and monitoring efforts. The National Treasury Employees Union (NTEU) representatives are members of the White Oak Restoration Advisory Board (NTEU represents the FDA employees) and have reviewed reports, work plans, and monitoring data to ensure that FDA employees are not exposed to elevated contaminant levels.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

No.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

I'm aware of none.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

TtNUS has conducted the post-RA monitoring at the site since 2001. The next monitoring event is scheduled for December 2006.

Mowing of landfill cover is conducted by GSA.

TtNUS has participated in the White Oak BRAC Clean-up Team and Restoration Advisory Board since their inception. The BCT meets quarterly to semi-annually, the RAB now meets semi-annually. The progress of work at OU2 is discussed frequently at BCT and RAB meetings.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

None.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

None.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Yes. Contaminant concentrations within the adjacent stream have been reduced to levels that do not pose a significant risk to human health and the environment. Contaminant concentrations in groundwater have also been reduced and contaminants are not migrating from the site.

The cap system is stable.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Groundwater monitoring and surface water sampling is now conducted every 15 months. When conducted 2 field staff complete the sampling event across 2 to 3 days. Monitoring activities also include an inspection of the cap and stormwater management features.

Additional inspections have been conducted by the TtNUS Project Manager following major storm events.

Inspection activities will transfer to GSA in the upcoming year.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

No significant changes have been made to the monitoring program.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

It is believed that the monitoring program is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SITE 4

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: Site 4 - Chemical Burial Area	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90 °F, little to no wind

Remedy includes: (Check all that apply)

- Landfill cover/containment
- ✓ Access controls
- ✓ Institutional controls
- ✓ Groundwater pump and treatment
- Surface water collection and treatment
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls
- Other: In situ bioremediation for GW, SVE for soil

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA, BRAC Site ______ ______
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency USEPA Region 3
Contact Bruce Beach — Remedial PM — ______ — ______
Name — Title — Date — Phone no.
Problems; suggestions; Report attached ______

Agency MD Dept. of Environment
Contact Andy Zarins — Remedial PM — ______ — ______
Name — Title — Date — Phone no.
Problems; suggestions; Report attached ______

Agency ______
Contact ______ — ______ — ______ — ______
Name — Title — Date — Phone no.
Problems; suggestions; Report attached ______

Agency ______
Contact ______ — ______ — ______ — ______
Name — Title — Date — Phone no.
Problems; suggestions; Report attached ______

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	~~Readily available~~	Up to date	N/A
Remarks Interim Remedy at Site 46 is monitored monthly. Bldg 500 Underdrain may be shut down after next O&M			
2. **Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
Contingency plan/emergency response plan	Readily available	Up to date	N/A
Remarks			
3. **O&M and OSHA Training Records**	Readily available	Up to date	N/A
Remarks			
4. **Permits and Service Agreements**			
Air discharge permit	Readily available	Up to date	N/A
Effluent discharge	Readily available	Up to date	N/A
Waste disposal, POTW	Readily available	Up to date	N/A
Other permits	Readily available	Up to date	N/A
Remarks Permits not required because remedial action done unilaterally by Navy.			
5. **Gas Generation Records**	Readily available	Up to date	N/A
Remarks			
6. **Settlement Monument Records**	Readily available	Up to date	N/A
Remarks			
7. **Groundwater Monitoring Records**	Readily available	Up to date	N/A
Remarks			
8. **Leachate Extraction Records**	Readily available	Up to date	N/A
Remarks			
9. **Discharge Compliance Records**			
Air	Readily available	Up to date	N/A
Water (effluent)	Readily available	Up to date	N/A
Remarks Not permitted, not measured			
10. **Daily Access/Security Logs**	Readily available	Up to date	N/A
Remarks			

ftp

3 Wells at Centrifuge may be shut down.

IV. O&M COSTS

1. **O&M Organization**
State in-house
PRP in-house
Federal Facility in-house
Other TtNUS
Contractor for State
Contractor for PRP
Contractor for Federal Facility

2. **O&M Cost Records**
Readily available Up to date
Funding mechanism/agreement in place
Original O&M cost estimate________ Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
Apr. 06	Apr. 07	$70,000	Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ________

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map Gates secured N/A
Remarks Not at Site 4 but within secured area.
A fence separates Site 4 and Parcontee 5 & 6; fence line not inspected.

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
Remarks No signs at Site 4

C. Institutional Controls (ICs)				
1.	**Implementation and enforcement**			
	Site conditions imply ICs not properly implemented	Yes	No	N/A
	Site conditions imply ICs not being fully enforced	Yes	No	N/A
	No signs of ICs being violated.			
	Type of monitoring (*e.g.*, self-reporting, drive by) No regular monitoring			
	Frequency			
	Responsible party/agency Navy			
	Contact: Name / Title / Date / Phone no.			
	Reporting is up-to-date	Yes	No	N/A
	Reports are verified by the lead agency	Yes	No	N/A
	Specific requirements in deed or decision documents have been met	Yes	No	N/A
	Violations have been reported	Yes	No	N/A
	Other problems or suggestions: Report attached			
	Same as other sites. Official IC language not yet adopted.			
2.	**Adequacy** ICs are adequate ICs are inadequate			N/A
	Remarks			

D. General			
1.	**Vandalism/trespassing**	Location shown on site map	No vandalism evident
	Remarks		
2.	**Land use changes on site** N/A		
	Remarks No changes		
3.	**Land use changes off site** N/A		
	Remarks		

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A				
1.	**Roads damaged**	Location shown on site map	Roads adequate	N/A
	Remarks			

B. Other Site Conditions

Remarks____

____

____

____

____

____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent______________ Depth____________
   Remarks____
   ____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths____________ Widths____________ Depths__________
   Remarks____
   ____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent______________ Depth____________
   Remarks____
   ____

4. **Holes** Location shown on site map Holes not evident
   Areal extent______________ Depth____________
   Remarks____
   ____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   Trees/Shrubs (indicate size and locations on a diagram)
   Remarks____
   ____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks____
   ____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent______________ Height____________
   Remarks____
   ____

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident	
	Wet areas	Location shown on site map	Areal extent______________
	Ponding	Location shown on site map	Areal extent______________
	Seeps	Location shown on site map	Areal extent______________
	Soft subgrade	Location shown on site map	Areal extent______________
	Remarks____		
9.	**Slope Instability** Slides	Location shown on site map	No evidence of slope instability
	Areal extent______________		
	Remarks____		
B. Benches	Applicable N/A		
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks____		
C. Letdown Channels	Applicable N/A		
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent______________ Depth____________		
	Remarks____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type______________ Areal extent______________		
	Remarks____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent______________ Depth____________		
	Remarks____		

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent______________ Depth____________ Remarks____ ____			
5.	**Obstructions** Type____________________ No obstructions Location shown on site map Areal extent____________ Size___________ Remarks____ ____			
6.	**Excessive Vegetative Growth** Type__________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent____________ Remarks____ ____			
D. Cover Penetrations Applicable N/A				
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____			
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____			
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____			
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____ ____			
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____ ____			

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring Thermal destruction Collection for reuse Good condition Needs Maintenance Remarks____________________		
2. **Gas Collection Wells, Manifolds and Piping** Good condition Needs Maintenance Remarks____________________		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Needs Maintenance N/A Remarks____________________		
F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks____________________	Functioning	N/A
2. **Outlet Rock Inspected** Remarks____________________	Functioning	N/A
G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent__________ Depth__________ N/A Siltation not evident Remarks____________________		
2. **Erosion** Areal extent__________ Depth__________ *Erosion not evident* Remarks____________________		
3. **Outlet Works** Functioning N/A Remarks____________________		
4. **Dam** Functioning N/A Remarks____________________		

H. Retaining Walls	Applicable	N/A	
1.	**Deformations** Location shown on site map Deformation not evident Horizontal displacement__________ Vertical displacement__________ Rotational displacement__________ Remarks__________		
2.	**Degradation** Location shown on site map Degradation not evident Remarks__________		
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation** Location shown on site map Siltation not evident Areal extent__________ Depth__________ Remarks__________		
2.	**Vegetative Growth** Location shown on site map N/A Vegetation does not impede flow Areal extent__________ Type__________ Remarks__________		
3.	**Erosion** Location shown on site map Erosion not evident Areal extent__________ Depth__________ Remarks__________		
4.	**Discharge Structure** Functioning N/A Remarks__________		
VIII. VERTICAL BARRIER WALLS	Applicable	N/A	
1.	**Settlement** Location shown on site map Settlement not evident Areal extent__________ Depth__________ Remarks__________		
2.	**Performance Monitoring** Type of monitoring__________ Performance not monitored Frequency__________ Evidence of breaching Head differential__________ Remarks__________		

IX. GROUNDWATER/SURFACE WATER REMEDIES — Applicable — N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines — Applicable — N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition — All required wells properly operating — Needs Maintenance — N/A
   Remarks Sump pump electrical contactor needs replacement.
   This can be considered normal due to age of system.

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition — Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available — Good condition — Requires upgrade — Needs to be provided
   Remarks Air filters were cleaned or replaced. System running normally after replacement.

B. Surface Water Collection Structures, Pumps, and Pipelines — Applicable — N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition — Needs Maintenance
   Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition — Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available — Good condition — Requires upgrade — Needs to be provided
   Remarks

Do follow on ~~[illegible]~~ lactate treatment to get better results & knock down rebound from. currently monitored

C. Treatment System	Applicable	N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters____
   Additive (*e.g.*, chelation agent, flocculent)____
   Others____
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually____
   Quantity of surface water treated annually____
   Remarks Will inject lactate into source area
   See Next Page for downgradient treatment area

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks____

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks____

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks____

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks____

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

Site 4 downgradient area

Bldg. 502 Air Stripper

Stripper was running during inspection

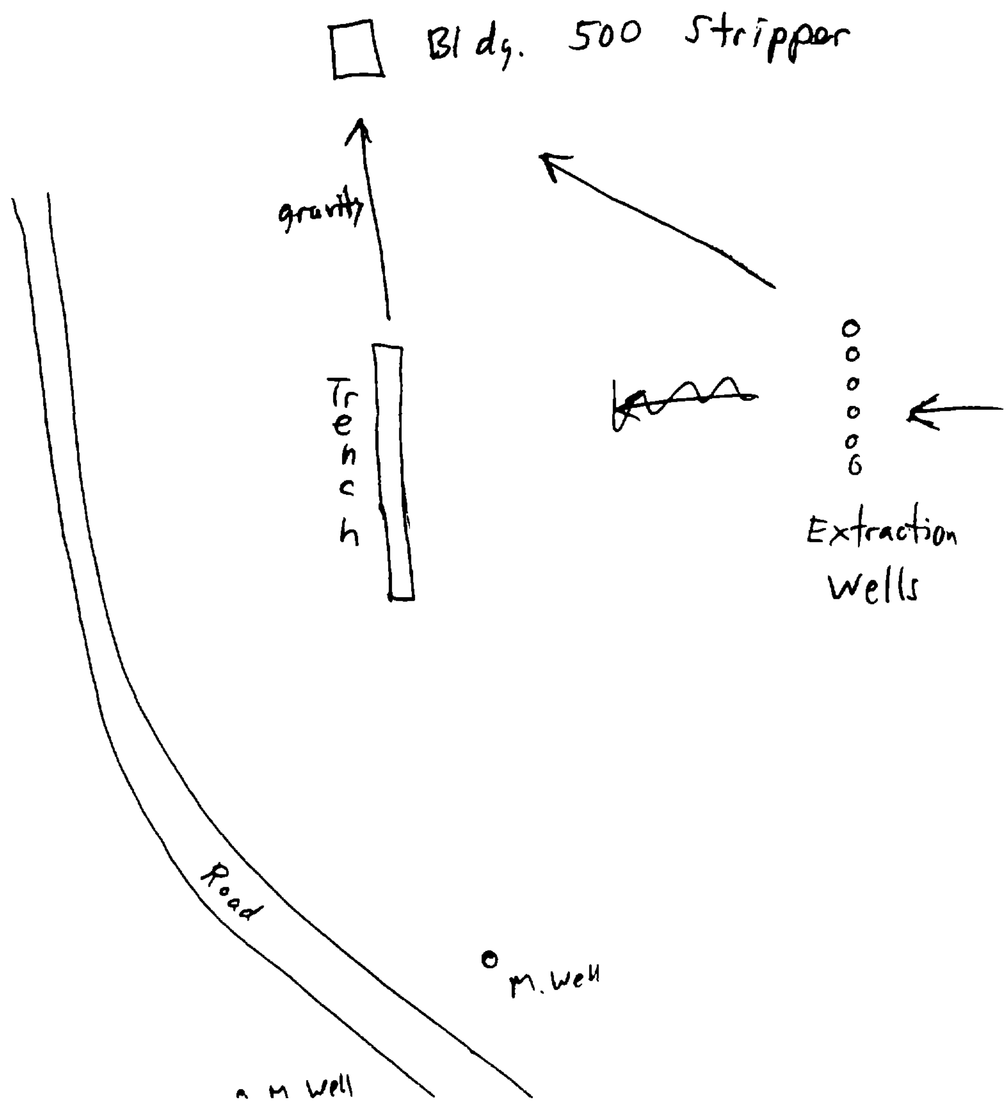
Contact sign on bldg. was worn and needs to be replaced.

Bldg. 500 Underdrain System

Underdrain has pulled finger of plume toward bldg.

Plan is for treatment system to be shut down but

underdrain will continue to drain from sump.



D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks Chuck M

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. Lactate injection will be used at source instead of SVE.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
O & M of Bulding 502, Site W Swale and Bldg 500 Systems appear to be adequate. Minor problems (electrical contactors, flow meters filters), have ~~and~~ been and will need replacement. Monthly O & M visits are performed to address these issues.

An electrical system voltage issue has and continues to occur at the Centrifuge Area System.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B

SITE 4/46 PHOTOGRAPHS

Site 4, Photo 1 – Source area with monitoring wells, looking southeast.

Site 4, Photo 2 – Source area with monitoring wells, looking northwest.

Site 4, Photo 3 – Monitoring well on east side of site, looking north.

Site 4/46, Photo 1 – Building 502 with air stripper, looking northeast.

Site 4/46, Photo 2 – Centrifuge area and extraction wells, looking west.

Site 4/46, Photo 3 – Extraction trench area, looking southwest.

Site 4/46, Photo 4 – Manhole and vent in foreground, treatment building 500 in background, looking west.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area**
Interviewee: **John Feustle, Environmental Engineer**
Agency/Title/etc: **U.S. Army Adelphi Laboratory Center, Garrison Adelphi**
Date: **6 Sep 06**

Background

1. What effects have site operations had on the surrounding community or area?

No known adverse effects.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

None since public water and sewer were provided to several concerned area residents several years ago.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

No

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

Paint Branch is a recreational trout stream, however I am not aware of any recreational uses, as the site is restricted and off limits to non-DOD personnel.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No, not presently.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Other than this 5-year review, no.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

No, not to my knowledge.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Not sure. Looks like air stripper may require long term operation.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

I receive phone calls on an infrequent basis, mostly from contractors who either want to work on the air strippers or monitor GW wells (which are located on U.S. Army property). Due to security concerns at our site, it is generally advisable to notify Army security personnel one or two days prior to any onsite visits by non-Army personnel. When I receive emails or phone calls requesting site access, I always forward these requests to our Security Office. In the event of a heightened state of security, there should be little or no difficulty in obtaining access to the site.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

I don't believe so.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

I have not attended the latest public meeting, so I must defer comment on this question to the Navy or their contractor, CH2MHill.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No. Not at this time.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area**
Interviewee: **Ed Corack, Navy CLEAN Contractor**
Agency/Title/etc: **CH2M HILL Activity Manager**
Date: 8/22/06

Background

1. What effects have site operations had on the surrounding community or area?

At Site 13, cVOC contamination migrates offsite onto the Percontee property. The Navy is actively addressing this problem.

The cVOC plume from Sites 4/46 migrates onto the Army Adelphi Laboratory property. A nearby resident (Irby) sued the Navy, saying his drinking well was adversely affected... the case was dismissed.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There are inherent community concerns, which are addressed at biannual RAB meetings.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

In 2005, there was an ordnance emergency demo by the Army's response team. Also in 2005, there were some leaking cylinders discovered that required emergency response.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

None, other than Irby (case dismissed)

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Yes, long-term monitoring at Sites 7, 9, and 13. Data forwarded.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Yes, new perchlorate criteria.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

For the most part, yes. There has been some tweaking throughout the various remedial actions.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Shaw Environmental and Infrastructure (Shaw E&I) is the onsite O&M and RAC contractor.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Don't know.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. All is going well at this time.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No comments. All is going well at this time.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: **Andy Zarins**
Agency/Title/etc: **MDE/Remedial Project Manager**
Date: **8/15/06**

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
   The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
   There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

   There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

   No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

   Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction; and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SITE 5/13

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Site 5/13 Open Burn Area & Sludge Disposal Area	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90 °F, light to no wind

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- ✓ Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other Zero - Valent Iron Injection
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA - BRAC Site ____________ ________
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ________
   Problems, suggestions: Report attached ________________________

2. **O&M staff** ________________ ________________ ________
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ________
   Problems, suggestions: Report attached ________________________

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ________________________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ________________________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ________________________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ________________________________

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks______			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks______			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks______			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits______	Readily available	Up to date	N/A
	Remarks______			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks______			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks______			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks______			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks______			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks______			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks______			

IV. O&M COSTS

1. **O&M Organization**

State in-house | Contractor for State
PRP in-house | Contractor for PRP
Federal Facility in-house | Contractor for Federal Facility
Other____________________________

2. **O&M Cost Records**

Readily available | Up to date
Funding mechanism/agreement in place
Original O&M cost estimate____________ Breakdown attached

Total annual cost by year for review period if available

From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: ________________________

V. ACCESS AND INSTITUTIONAL CONTROLS   Applicable   N/A

A. Fencing

1. **Fencing damaged**   Location shown on site map   Gates secured   N/A

Remarks________________________

B. Other Access Restrictions

1. **Signs and other security measures**   Location shown on site map   N/A

Remarks no signs

accessible through gap in gate

per contr

no

C. Institutional Controls (ICs)				
1.	**Implementation and enforcement** Site conditions imply ICs not properly implemented Site conditions imply ICs not being fully enforced	Yes Yes	No No	N/A N/A
	Type of monitoring (e.g., self-reporting, drive by) ______ Frequency ______ Responsible party/agency ______ Contact ______ ______ ______ ______ Name Title Date Phone no.			
	Reporting is up-to-date Reports are verified by the lead agency	Yes Yes	No No	N/A N/A
	Specific requirements in deed or decision documents have been met Violations have been reported Other problems or suggestions: *Report attached*	Yes Yes	No No	N/A N/A
2.	**Adequacy** ICs are adequate ICs are inadequate N/A Remarks______			
D. General				
1.	**Vandalism/trespassing** Location shown on site map No vandalism evident Remarks______			
2.	**Land use changes on site** N/A Remarks______			
3.	**Land use changes off site** N/A Remarks______			
VI. GENERAL SITE CONDITIONS				
A. Roads Applicable N/A				
1.	**Roads damaged** Location shown on site map Roads adequate N/A Remarks______			

B. Other Site Conditions
Remarks____

NA VII. LANDFILL COVERS Applicable N/A			
A. Landfill Surface			
1.	**Settlement** (Low spots) Areal extent__________ Depth__________ Remarks__________	Location shown on site map	Settlement not evident
2.	**Cracks** Lengths__________ Widths__________ Depths__________ Remarks__________	Location shown on site map	Cracking not evident
3.	**Erosion** Areal extent__________ Depth__________ Remarks__________	Location shown on site map	Erosion not evident
4.	**Holes** Areal extent__________ Depth__________ Remarks__________	Location shown on site map	Holes not evident
5.	**Vegetative Cover** Grass Trees/Shrubs (indicate size and locations on a diagram) Remarks__________	Cover properly established	No signs of stress
6.	**Alternative Cover (armored rock, concrete, etc.)** Remarks__________	N/A	
7.	**Bulges** Areal extent__________ Height__________ Remarks__________	Location shown on site map	Bulges not evident

8.	**Wet Areas/Water Damage**	Wet areas/water damage not evident	
	Wet areas	Location shown on site map	Areal extent______________
	Ponding	Location shown on site map	Areal extent______________
	Seeps	Location shown on site map	Areal extent______________
	Soft subgrade	Location shown on site map	Areal extent______________
	Remarks____		
9.	**Slope Instability** Slides	Location shown on site map	No evidence of slope instability
	Areal extent______________		
	Remarks____		

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks____		

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent______________	Depth____________	
	Remarks____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type______________	Areal extent______________	
	Remarks____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent______________	Depth____________	
	Remarks____		

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______________ Depth____________
Remarks____
____

5. **Obstructions** Type______________________ No obstructions
Location shown on site map Areal extent______________
Size____________
Remarks____
____

6. **Excessive Vegetative Growth** Type____________________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______________
Remarks____
____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____
____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____
____

E. Gas Collection and Treatment	Applicable	N/A	
1. **Gas Treatment Facilities** Flaring Good condition Remarks______________________________	 Thermal destruction Needs Maintenance	 Collection for reuse	
2. **Gas Collection Wells, Manifolds and Piping** Good condition Remarks______________________________	 Needs Maintenance		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Remarks______________________________	 Needs Maintenance	 N/A	
F. Cover Drainage Layer	Applicable	N/A	
1. **Outlet Pipes Inspected** Remarks______________________________	Functioning	N/A	
2. **Outlet Rock Inspected** Remarks______________________________	Functioning	N/A	
G. Detention/Sedimentation Ponds	Applicable	N/A	
1. **Siltation** Areal extent______________ Siltation not evident Remarks______________________________	Depth____________		N/A
2. **Erosion** Areal extent______________ Erosion not evident Remarks______________________________	Depth____________		
3. **Outlet Works** Remarks______________________________	Functioning	N/A	
4. **Dam** Remarks______________________________	Functioning	N/A	

H. Retaining Walls	Applicable	N/A	
1.	**Deformations** Location shown on site map Deformation not evident Horizontal displacement___________ Vertical displacement______________ Rotational displacement___________ Remarks____		
2.	**Degradation** Location shown on site map Degradation not evident Remarks____		
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation** Location shown on site map Siltation not evident Areal extent_____________ Depth___________ Remarks____		
2.	**Vegetative Growth** Location shown on site map N/A Vegetation does not impede flow Areal extent_____________ Type___________ Remarks____		
3.	**Erosion** Location shown on site map Erosion not evident Areal extent_____________ Depth___________ Remarks____		
4.	**Discharge Structure** Functioning N/A Remarks____		
VIII. VERTICAL BARRIER WALLS	Applicable	N/A	
1.	**Settlement** Location shown on site map Settlement not evident Areal extent_____________ Depth___________ Remarks____		
2.	**Performance Monitoring** Type of monitoring______________________ Performance not monitored Frequency____________________________ Evidence of breaching Head differential_______________________ Remarks____		

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition   All required wells properly operating   Needs Maintenance   N/A
   Remarks__________________________________

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks__________________________________

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks__________________________________

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition   Needs Maintenance
   Remarks__________________________________

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks__________________________________

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks__________________________________

Currently monitored - OVI injection - no longer injecting
M. well on east side closed, not locked.
Good condition

C. Treatment System *Applicable* N/A	
1.	**Treatment Train** (Check components that apply) Metals removal Oil/water separation Bioremediation Air stripping Carbon adsorbers Filters__________ Additive (*e.g.*, chelation agent, flocculent)__________ Others__________ Good condition Needs Maintenance Sampling ports properly marked and functional Sampling/maintenance log displayed and up to date Equipment properly identified Quantity of groundwater treated annually__________ Quantity of surface water treated annually__________ Remarks__________
2.	**Electrical Enclosures and Panels** (properly rated and functional) N/A Good condition Needs Maintenance Remarks__________
3.	**Tanks, Vaults, Storage Vessels** N/A Good condition Proper secondary containment Needs Maintenance Remarks__________
4.	***Discharge Structure and Appurtenances*** N/A Good condition Needs Maintenance Remarks__________
5.	**Treatment Building(s)** N/A Good condition (esp. roof and doorways) Needs repair Chemicals and equipment properly stored Remarks__________
6.	**Monitoring Wells** (pump and treatment remedy) Properly secured/locked Functioning Routinely sampled Good condition All required wells located Needs Maintenance N/A Remarks__________
D. Monitoring Data	
1.	Monitoring Data Is routinely submitted on time Is of acceptable quality
2.	Monitoring data suggests: Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
Properly secured/locked Functioning Routinely sampled Good condition
All required wells located Needs Maintenance N/A
Remarks____
____

X. *OTHER REMEDIES*

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

____
____
____
____
____
____
____
____
____
____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

____
____
____
____
____
____
____
____
____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B

SITES 5 and 13 PHOTOGRAPHS

Site 5/13, Photo 1 – Source area with injection wells to the left of the road, downgradient monitoring wells to the right of the road.

Site 5/13, Photo 2 – Source area with injection wells, looking east.

Site 5/13, Photo 3 – Source area in foreground, monitoring wells in background, looking northwest.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 5/13, Open Burn Area/Sludge Disposal Area**
Interviewee: **John Feustle, Environmental Engineer**
Agency/Title/etc: **U.S. Army Laboratory Center, Garrison Adelphi**
Date: **6 Sep 06**

Background

1. What effects have site operations had on the surrounding community or area?

None.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

No.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

No. Restricted access; secured and patrolled area.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No. Restricted access area.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

No.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Not to my knowledge.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

No. I am not up to date on these two sites.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

N/A.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

N/A.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No.

FIVE-YEAR REVIEW QUESTIONARE

Facility: Former Naval Surface Warfare Center, White Oak, MD
Site(s): Site 4, Chemical Burial Area
Interviewee: Ed Corack, Navy CLEAN Contractor
Agency/Title/etc: CH2M HILL Activity Manager
Date: 8/22/06

Background

1. What effects have site operations had on the surrounding community or area?

At Site 13, cVOC contamination migrates offsite onto the Percontee property. The Navy is actively addressing this problem.

The cVOC plume from Sites 4/46 migrates onto the Army Adelphi Laboratory property. A nearby resident (Irby) sued the Navy, saying his drinking well was adversely affected... the case was dismissed.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There are inherent community concerns, which are addressed at biannual RAB meetings.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

In 2005, there was an ordnance emergency demo by the Army's response team. Also in 2005, there were some leaking cylinders discovered that required emergency response.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

None, other than Irby (case dismissed)

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Yes, long-term monitoring at Sites 7, 9, and 13. Data forwarded.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

[illegible], new perchlorate criteria.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

For the most part, yes. There has been some tweaking throughout the various remedial actions.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Shaw Environmental and Infrastructure (Shaw E&I) is the onsite O&M and RAC contractor.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Don't know.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. All is going well at this time.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No comments. All is going well at this time.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: Andy Zarins
Agency/Title/etc: MDE/Remedial Project Manager
Date: 8/15/06

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
   The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
   There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
   There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
   No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

   Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction; and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SITE 7

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: Site 7, Ordnance Burn Area	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90 °F, light to no wind

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- ✓ Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other In-situ bioremediation
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA, BRAC site ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________
Contact ______________________ ______________ ________ __________
Name Title Date Phone no.
Problems; suggestions; Report attached ______________________________________
____

Agency ______________________
Contact ______________________ ______________ ________ __________
Name Title Date Phone no.
Problems; suggestions; Report attached ______________________________________
____

Agency ______________________
Contact ______________________ ______________ ________ __________
Name Title Date Phone no.
Problems: suggestions: Report attached ______________________________________
____

Agency ______________________
Contact ______________________ ______________ ________ __________
Name Title Date Phone no.
Problems; suggestions; Report attached ______________________________________
____

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

f7

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	~~Readily available~~	Up to date	N/A
	Remarks_______________			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks_______________			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks_______________			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits_______________	Readily available	Up to date	N/A
	Remarks_______________			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks_______________			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks_______________			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks_______________			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks_______________			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks_______________			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks_______________			

IV. O&M COSTS

1. **O&M Organization**
   State in-house — Contractor for State
   PRP in-house — Contractor for PRP
   Federal Facility in-house — Contractor for Federal Facility
   Other____

2. **O&M Cost Records**
   Readily available — Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate________________ Breakdown attached

   Total annual cost by year for review period if available

From________ Date	To________ Date	__________ Total cost	Breakdown attached
From________ Date	To________ Date	__________ Total cost	Breakdown attached
From________ Date	To________ Date	__________ Total cost	Breakdown attached
From________ Date	To________ Date	__________ Total cost	Breakdown attached
From________ Date	To________ Date	__________ Total cost	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: __________________________________

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A
   Remarks Within secured area but no fence around site

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A
   Remarks____

C. Institutional Controls (ICs)				
1.	**Implementation and enforcement**			
	Site conditions imply ICs not properly implemented	Yes	No	N/A
	Site conditions imply ICs not being fully enforced	Yes	No	N/A
	Type of monitoring (*e.g.*, self-reporting, drive by) ______			
	Frequency ______			
	Responsible party/agency ______			
	Contact ______ Name ______ Title	______ Date		______ Phone no.
	Reporting is up-to-date	Yes	No	N/A
	Reports are verified by the lead agency	Yes	No	N/A
	Specific requirements in deed or decision documents have been met	Yes	No	N/A
	Violations have been reported	Yes	No	N/A
	Other problems or suggestions: *Report attached*			
2.	**Adequacy** ICs are adequate ICs are inadequate			N/A
	Remarks______			

D. General			
1.	**Vandalism/trespassing**	Location shown on site map	No vandalism evident
	Remarks______		
2.	**Land use changes on site**	N/A	
	Remarks______		
3.	**Land use changes off site**	N/A	
	Remarks______		

VI. GENERAL SITE CONDITIONS

A. Roads	Applicable	N/A		
1. **Roads damaged**	Location shown on site map	Roads adequate		N/A
Remarks______				

per Contoe - 5 wells for site 4 & 13

B. Other Site Conditions

Remarks____

NA **VII. LANDFILL COVERS** Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent____________ Depth____________
Remarks____

2. **Cracks** Location shown on site map Cracking not evident
Lengths____________ Widths____________ Depths____________
Remarks____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent____________ Depth____________
Remarks____

4. **Holes** Location shown on site map Holes not evident
Areal extent____________ Depth____________
Remarks____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks____

7. **Bulges** Location shown on site map Bulges not evident
Areal extent____________ Height____________
Remarks____

8.	**Wet Areas/Water Damage**		Wet areas/water damage not evident	
	Wet areas		Location shown on site map	Areal extent______
	Ponding		Location shown on site map	Areal extent______
	Seeps		Location shown on site map	Areal extent______
	Soft subgrade		Location shown on site map	Areal extent______
	Remarks______			
9.	**Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
	Areal extent______			
	Remarks______			

B. Benches Applicable N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks______		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks______		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks______		

C. Letdown Channels Applicable N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent______	Depth______	
	Remarks______		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type______	Areal extent______	
	Remarks______		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent______	Depth______	
	Remarks______		

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______________ Depth____________
Remarks____

____

5. **Obstructions** Type______________________ No obstructions
Location shown on site map Areal extent______________
Size____________
Remarks____

____

6. **Excessive Vegetative Growth** Type____________________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______________
Remarks____

____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____

____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____

____

E. Gas Collection and Treatment	Applicable	N/A

1. **Gas Treatment Facilities**
   Flaring   Thermal destruction   Collection for reuse
   Good condition   Needs Maintenance
   Remarks____
   ____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition   Needs Maintenance
   Remarks____
   ____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition   Needs Maintenance   N/A
   Remarks____
   ____

F. Cover Drainage Layer	Applicable	N/A

1. **Outlet Pipes Inspected**   Functioning   N/A
   Remarks____
   ____

2. **Outlet Rock Inspected**   Functioning   N/A
   Remarks____
   ____

G. Detention/Sedimentation Ponds	Applicable	N/A

1. **Siltation** Areal extent______________   Depth____________   N/A
   Siltation not evident
   Remarks____
   ____

2. **Erosion**   Areal extent______________   Depth____________
   Erosion not evident
   Remarks____
   ____

3. **Outlet Works**   Functioning   N/A
   Remarks____
   ____

4. **Dam**   Functioning   N/A
   Remarks____
   ____

H. Retaining Walls	Applicable	N/A	
1.	**Deformations** Horizontal displacement____________ Rotational displacement____________ Remarks____________	Location shown on site map Vertical displacement____________	Deformation not evident
2.	**Degradation** Remarks____________	Location shown on site map	Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation** Areal extent____________ Remarks____________	Location shown on site map Depth____________	Siltation not evident
2.	**Vegetative Growth** Vegetation does not impede flow Areal extent____________ Remarks____________	Location shown on site map Type____________	N/A
3.	**Erosion** Areal extent____________ Remarks____________	Location shown on site map Depth____________	Erosion not evident
4.	**Discharge Structure** Remarks____________	Functioning	N/A
NA	**VIII. VERTICAL BARRIER WALLS**	Applicable	N/A
1.	**Settlement** Areal extent____________ Remarks____________	Location shown on site map Depth____________	Settlement not evident
2.	**Performance Monitoring** Type of monitoring____________ Performance not monitored Frequency____________ Head differential____________ Remarks____________	Evidence of breaching	

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition   All required wells properly operating   Needs Maintenance   N/A
   Remarks____________________

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks____________________

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks____________________

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition   Needs Maintenance
   Remarks____________________

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks____________________

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks____________________

~~Injection & monitoring wells.~~
Lots Mw. data
Will re-inject w/ EOS (will do Pilot test)
~~will start c~~
Remedy completed - saw good results but contam. have rebounded so need to re-inject to bring levels down.
16-20 injection wells. - all new locks, good shape
M. wells in good shape.

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   - Metals removal
   - Oil/water separation
   - Bioremediation In-situ EOS
   - Air stripping
   - Carbon adsorbers
   - Filters Currently inactive
   - Additive (*e.g.*, chelation agent, flocculent)
   - Others Started Lactate - Sw to [illegible] EOS
   - Good condition
   - Needs Maintenance started: in-situ, Na Lactate injection currently inactive will be doing enhanced bio.
   - Sampling ports properly marked and functional
   - Sampling/maintenance log displayed and up to date
   - Equipment properly identified
   - Quantity of groundwater treated annually__________
   - Quantity of surface water treated annually__________

   Remarks__________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks__________

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks__________

4. ***Discharge Structure and Appurtenances***
   N/A Good condition Needs Maintenance
   Remarks__________

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks__________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked ✓ Functioning ✓ Routinely sampled ✓ Good condition
   All required wells located Needs Maintenance N/A
   Remarks__________

D. Monitoring Data

1. Monitoring Data was submitted for Lactate, currently between monitoring.
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
Properly secured/locked   Functioning   Routinely sampled   Good condition
All required wells located   Needs Maintenance   N/A
Remarks____
____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

____
____
____
____
____
____
____
____
____
____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

____
____
____
____
____
____
____
____
____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B

SITE 7 PHOTOGRAPHS

Site 7, Photo 1 – Building 508, source area.

Site 7, Photo 2 – Open area downgradient of site, injection wells in background, looking northeast.

Site 7, Photo 3 – Injection well area downgradient of site, source area in background, looking southwest.

Site 7, Photo 4 – Source area, looking northwest.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 7, Ordnance Burn Area**
Interviewee: **John Feustle, Environmental Engineer**
Agency/Title/etc: **U.S. Army Adelphi Laboratory Center, Garrison, Adelphi**
Date: **6 Sep 06**

Background

1. What effects have site operations had on the surrounding community or area?

None.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

None.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

None. Restricted access patrolled area.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

None. Restricted access area.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

No.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

No.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Don't know.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Not aware of any.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Don't know.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area**
Interviewee: **Ed Corack, Navy CLEAN Contractor**
Agency/Title/etc: **CH2M HILL Activity Manager**
Date: **8/22/06**

Background

1. What effects have site operations had on the surrounding community or area?

At Site 13, cVOC contamination migrates offsite onto the Percontee property. The Navy is actively addressing this problem.

The cVOC plume from Sites 4/46 migrates onto the Army Adelphi Laboratory property. A nearby resident (Irby) sued the Navy, saying his drinking well was adversely affected... the case was dismissed.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There are inherent community concerns, which are addressed at biannual RAB meetings.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

In 2005, there was an ordnance emergency demo by the Army's response team. Also in 2005, there were some leaking cylinders discovered that required emergency response.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

None, other than Irby (case dismissed)

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Yes, long-term monitoring at Sites 7, 9, and 13. Data forwarded.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Yes, new perchlorate criteria.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

For the most part, yes. There has been some tweaking throughout the various remedial actions.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Shaw Environmental and Infrastructure (Shaw E&I) is the onsite O&M and RAC contractor.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Don't know.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. All is going well at this time.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No comments. All is going well at this time.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: **Andy Zarins**
Agency/Title/etc: **MDE/Remedial Project Manager**
Date: **8/15/06**

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
   The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
   There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
   There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
   No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

   Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction; and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SITE 9

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Site 9	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD Reg. 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90°F, little to no wind
Remedy Includes: (Check all that apply) ✓ Landfill cover/containment ✓ Access controls ✓ Institutional controls Groundwater pump and treatment Surface water collection and treatment Other In situ bioremediation	Monitored natural attenuation Groundwater containment Vertical barrier walls
Attachments: Inspection team roster attached	Site map attached

II. INTERVIEWS (Check all that apply)
1. **O&M site manager** NA, BRAC ____ Name ____ Title ____ Date Interviewed at site at office by phone Phone no. ______ Problems, suggestions; Report attached ______
2. **O&M staff** ____ Name ____ Title ____ Date Interviewed at site at office by phone Phone no. ______ Problems, suggestions; Report attached ______

Source: Bldg 318
Did Pilot study using lactate - lactate added to sump from former building.
Will inject lactate again to further reduce source concentration.

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency NA
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; Report attached ______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; Report attached ______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; Report attached ______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; Report attached ______

4. **Other interviews** (optional) Report attached.

John Feustle - Environmental Engineer
Andy Zarins - MDE Remedial Project Manager

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	Readily available	Up to date	N/A
Remarks			
2. **Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
Contingency plan/emergency response plan	Readily available	Up to date	N/A
Remarks			
3. **O&M and OSHA Training Records**	Readily available	Up to date	N/A
Remarks			
4. **Permits and Service Agreements** NA			
Air discharge permit	Readily available	Up to date	N/A
Effluent discharge	Readily available	Up to date	N/A
Waste disposal, POTW	Readily available	Up to date	N/A
Other permits	Readily available	Up to date	N/A
Remarks			
5. **Gas Generation Records**	Readily available	Up to date	N/A
Remarks			
6. **Settlement Monument Records**	Readily available	Up to date	N/A
Remarks			
7. **Groundwater Monitoring Records**	Readily available	Up to date	N/A
Remarks See Table 6-1 in 5-YR Review Report			
8. **Leachate Extraction Records**	Readily available	Up to date	N/A
Remarks			
9. **Discharge Compliance Records**			
Air	Readily available	Up to date	N/A
Water (effluent)	Readily available	Up to date	N/A
Remarks			
10. **Daily Access/Security Logs**	Readily available	Up to date	N/A
Remarks			

IV. O&M COSTS NA

1. **O&M Organization**
   State in-house — Contractor for State
   PRP in-house — Contractor for PRP
   Federal Facility in-house — Contractor for Federal Facility
   Other____

2. **O&M Cost Records**
   Readily available — Up to date
   Funding mechanism/agreement in place
   Original O&M cost estimate__________________ Breakdown attached

   Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached
From______	To______	______	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: ____

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing NA

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A
   Remarks____

B. Other Access Restrictions NA

1. **Signs and other security measures** — Location shown on site map — N/A
   Remarks____

C. Institutional Controls (ICs) See Section 6-7 in 5-YR Review

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ______
Frequency ______
Responsible party/agency ______
Contact ______ Name ______ Title ______ Date ______ Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks______

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks______

2. **Land use changes on site** N/A
Remarks______

3. **Land use changes off site** N/A
Remarks______

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks______

B. Other Site Conditions

Remarks No on-going activities

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent____ Depth____
Remarks____

2. **Cracks** Location shown on site map Cracking not evident
Lengths____ Widths____ Depths____
Remarks____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent____ Depth____
Remarks____

4. **Holes** Location shown on site map Holes not evident
Areal extent____ Depth____
Remarks____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks____

7. **Bulges** Location shown on site map Bulges not evident
Areal extent____ Height____
Remarks____

8.	**Wet Areas/Water Damage**		Wet areas/water damage not evident	
	Wet areas		Location shown on site map	Areal extent_____________
	Ponding		Location shown on site map	Areal extent_____________
	Seeps		Location shown on site map	Areal extent_____________
	Soft subgrade		Location shown on site map	Areal extent_____________
	Remarks____			
9.	**Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
	Areal extent_____________			
	Remarks____			

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	Location shown on site map	N/A or okay
	Remarks____		
2.	**Bench Breached**	Location shown on site map	N/A or okay
	Remarks____		
3.	**Bench Overtopped**	Location shown on site map	N/A or okay
	Remarks____		

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	Location shown on site map	No evidence of settlement
	Areal extent_____________	Depth___________	
	Remarks____		
2.	**Material Degradation**	Location shown on site map	No evidence of degradation
	Material type_____________	Areal extent_____________	
	Remarks____		
3.	**Erosion**	Location shown on site map	No evidence of erosion
	Areal extent_____________	Depth___________	
	Remarks____		

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent____________ Depth____________ Remarks____			
5.	**Obstructions** Type________________ No obstructions Location shown on site map Areal extent____________ Size__________ Remarks____			
6.	**Excessive Vegetative Growth** Type________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent____________ Remarks____			
D. Cover Penetrations	Applicable N/A			
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____			
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____			
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____			
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____			
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____			

E. Gas Collection and Treatment Applicable N/A

1. ***Gas Treatment Facilities***
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks____
   ____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks____
   ____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks____
   ____

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks____
   ____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks____
   ____

G. Detention/Sedimentation Ponds Applicable N/A

1. **Siltation** Areal extent____________ Depth__________ N/A
   Siltation not evident
   Remarks____
   ____

2. **Erosion** Areal extent____________ Depth__________
   Erosion not evident
   Remarks____
   ____

3. **Outlet Works** Functioning N/A
   Remarks____
   ____

4. **Dam** Functioning N/A
   Remarks____
   ____

H. Retaining Walls	Applicable	N/A	
1.	**Deformations** Horizontal displacement____ Rotational displacement____ Remarks____	Location shown on site map Vertical displacement____	Deformation not evident
2.	**Degradation** Remarks____	Location shown on site map	Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation** Areal extent____ Depth____ Remarks____	Location shown on site map	Siltation not evident
2.	**Vegetative Growth** Vegetation does not impede flow Areal extent____ Type____ Remarks____	Location shown on site map	N/A
3.	**Erosion** Areal extent____ Depth____ Remarks____	Location shown on site map	Erosion not evident
4.	**Discharge Structure** Remarks____	Functioning	N/A
VIII. VERTICAL BARRIER WALLS	Applicable	N/A	
1.	**Settlement** Areal extent____ Depth____ Remarks____	Location shown on site map	Settlement not evident
2.	**Performance Monitoring** Type of monitoring____ Performance not monitored Frequency____ Head differential____ Remarks____	Evidence of breaching	

IX. GROUNDWATER/SURFACE WATER REMEDIES   Applicable   N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines   Applicable   N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition   All required wells properly operating   Needs Maintenance   N/A
   Remarks____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks____

B. Surface Water Collection Structures, Pumps, and Pipelines   Applicable   N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition   Needs Maintenance
   Remarks____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition   Needs Maintenance
   Remarks____

3. **Spare Parts and Equipment**
   Readily available   Good condition   Requires upgrade   Needs to be provided
   Remarks____

C. Treatment System	Applicable	N/A

1. **Treatment Train** (Check components that apply)
   Metals removal   Oil/water separation   Bioremediation
   Air stripping   Carbon adsorbers
   Filters______________________________
   Additive (*e.g.*, chelation agent, flocculent)______________________________
   Others______________________________
   Good condition   Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually______________
   Quantity of surface water treated annually______________
   Remarks______________________________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A   Good condition   Needs Maintenance
   Remarks______________________________

3. **Tanks, Vaults, Storage Vessels**
   N/A   Good condition   Proper secondary containment   Needs Maintenance
   Remarks______________________________

4. **Discharge Structure and Appurtenances**
   N/A   Good condition   Needs Maintenance
   Remarks______________________________

5. **Treatment Building(s)**
   N/A   Good condition (esp. roof and doorways)   Needs repair
   Chemicals and equipment properly stored
   Remarks______________________________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked   Functioning   Routinely sampled   Good condition
   All required wells located   Needs Maintenance   N/A
   Remarks______________________________

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time   Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained   Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked   Functioning   Routinely sampled   Good condition
   All required wells located   Needs Maintenance   N/A
   Remarks____________________

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Remedial Action not Started.

B. Adequacy of O&M NA

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	**Early Indicators of Potential Remedy Problems** NA
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
D.	**Opportunities for Optimization** NA
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B

SITE 9 PHOTOGRAPHS

Site 9, Photo 1 – Former source area and monitoring well, looking southwest.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 9, Former Building 318**
Interviewee: John Feustle, Environmental Engineer
Agency/Title/etc: U.S. Army Adelphi Laboratory Center, Garrison, Adelphi
Date: 6 Sep 06

Background

1. What effects have site operations had on the surrounding community or area?

None.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

No.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

No. Area is fenced and difficult to access.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

No.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Don't know.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Don't know.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Don't know.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Don't know.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area**
Interviewee: **Ed Corack, Navy CLEAN Contractor**
Agency/Title/etc: **CH2M HILL Activity Manager**
Date: 8/22/06

Background

1. What effects have site operations had on the surrounding community or area?

At Site 13, cVOC contamination migrates offsite onto the Percontee property. The Navy is actively addressing this problem.

The cVOC plume from Sites 4/46 migrates onto the Army Adelphi Laboratory property. A nearby resident (Irby) sued the Navy, saying his drinking well was adversely affected... the case was dismissed.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

There are inherent community concerns, which are addressed at biannual RAB meetings.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

In 2005, there was an ordnance emergency demo by the Army's response team. Also in 2005, there were some leaking cylinders discovered that required emergency response.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

None, other than Irby (case dismissed)

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Yes, long-term monitoring at Sites 7, 9, and 13. Data forwarded.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Yes, new perchlorate criteria.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

For the most part, yes. There has been some tweaking throughout the various remedial actions.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Shaw Environmental and Infrastructure (Shaw E&I) is the onsite O&M and RAC contractor.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Don't know.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. All is going well at this time.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No comments. All is going well at this time.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: Andy Zarins
Agency/Title/etc: MDE/Remedial Project Manager
Date: 8/15/06

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SITE 11

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: Site 11 - Industrial Wastewater Disposal Area	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90 °F, light to no wind

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other In-situ treatment with $KMnO_4$
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA - BRAC site ______ ______
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
   Name   Title   Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ____________________________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ____________________________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions: Report attached ____________________________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; Report attached ____________________________________

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

TT-9et CD

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks______________________			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks______________________			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks______________________			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits______________	Readily available	Up to date	N/A
	Remarks______________________			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks______________________			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks______________________			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks Some			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks______________________			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks______________________			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks______________________			

IV. O&M COSTS NA

1. **O&M Organization**
State in-house | Contractor for State
PRP in-house | Contractor for PRP
Federal Facility in-house | Contractor for Federal Facility
Other________________________________

2. **O&M Cost Records**
Readily available | Up to date
Funding mechanism/agreement in place
Original O&M cost estimate____________ Breakdown attached

Total annual cost by year for review period if available

From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached
From______ (Date)	To______ (Date)	______ (Total cost)	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ________________________________

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map Gates secured N/A
Remarks Part of Construction Site - No access control

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
Remarks________________________________

C. Institutional Controls (ICs)			
1. **Implementation and enforcement**			
Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (e.g., self-reporting, drive by) ____________________

Frequency ____________________

Responsible party/agency ____________________

Contact ____________ ____________ ______ ______

Name Title Date Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: Report attached

____

2. **Adequacy** ICs are adequate ICs are inadequate N/A

Remarks____________________

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident

Remarks____________________

2. **Land use changes on site** N/A

Remarks____________________

3. **Land use changes off site** N/A

Remarks____________________

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A

Remarks____________________

Copy of LUC-RD

B. Other Site Conditions

Remarks____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent______________ Depth____________
Remarks____

2. **Cracks** Location shown on site map Cracking not evident
Lengths____________ Widths__________ Depths__________
Remarks____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent______________ Depth____________
Remarks____

4. **Holes** Location shown on site map Holes not evident
Areal extent______________ Depth____________
Remarks____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks____

7. **Bulges** Location shown on site map Bulges not evident
Areal extent______________ Height____________
Remarks____

8. **Wet Areas/Water Damage**	Wet areas/water damage not evident		
Wet areas	Location shown on site map	Areal extent_____________	
Ponding	Location shown on site map	Areal extent_____________	
Seeps	Location shown on site map	Areal extent_____________	
Soft subgrade	Location shown on site map	Areal extent_____________	
Remarks_____________			
9. **Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
Areal extent_____________			
Remarks_____________			
B. Benches	Applicable	N/A	
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)			
1. **Flows Bypass Bench**	Location shown on site map	N/A or okay	
Remarks_____________			
2. **Bench Breached**	Location shown on site map	N/A or okay	
Remarks_____________			
3. **Bench Overtopped**	Location shown on site map	N/A or okay	
Remarks_____________			
C. Letdown Channels	Applicable	N/A	
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1. **Settlement**	Location shown on site map	No evidence of settlement	
Areal extent_____________	Depth___________		
Remarks_____________			
2. **Material Degradation**	Location shown on site map	No evidence of degradation	
Material type_____________	Areal extent_____________		
Remarks_____________			
3. **Erosion**	Location shown on site map	No evidence of erosion	
Areal extent_____________	Depth___________		
Remarks_____________			

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent______________ Depth____________
Remarks____
____

5. **Obstructions** Type______________________ No obstructions
Location shown on site map Areal extent______________
Size____________
Remarks____
____

6. **Excessive Vegetative Growth** Type__________________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent______________
Remarks____
____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____
____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____
____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____
____

E. Gas Collection and Treatment	Applicable	N/A
1. **Gas Treatment Facilities** Flaring — Thermal destruction — Collection for reuse Good condition — Needs Maintenance Remarks______________________________		
2. **Gas Collection Wells, Manifolds and Piping** Good condition — Needs Maintenance Remarks______________________________		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition — Needs Maintenance — N/A Remarks______________________________		

F. Cover Drainage Layer	Applicable	N/A
1. **Outlet Pipes Inspected** Remarks______________________________	Functioning	N/A
2. **Outlet Rock Inspected** Remarks______________________________	Functioning	N/A

G. Detention/Sedimentation Ponds	Applicable	N/A
1. **Siltation** Areal extent______________ Depth___________ N/A Siltation not evident Remarks______________________________		
2. **Erosion** Areal extent______________ Depth___________ Erosion not evident Remarks______________________________		
3. **Outlet Works** Functioning N/A Remarks______________________________		
4. **Dam** Functioning N/A Remarks______________________________		

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
Horizontal displacement__________ Vertical displacement__________
Rotational displacement__________
Remarks__________

2. **Degradation** Location shown on site map Degradation not evident
Remarks__________

I. Perimeter Ditches/Off-Site Discharge Applicable N/A

1. **Siltation** Location shown on site map Siltation not evident
Areal extent__________ Depth__________
Remarks__________

2. **Vegetative Growth** Location shown on site map N/A
Vegetation does not impede flow
Areal extent__________ Type__________
Remarks__________

3. **Erosion** Location shown on site map Erosion not evident
Areal extent__________ Depth__________
Remarks__________

4. **Discharge Structure** Functioning N/A
Remarks__________

VIII. VERTICAL BARRIER WALLS Applicable N/A

1. **Settlement** Location shown on site map Settlement not evident
Areal extent__________ Depth__________
Remarks__________

2. **Performance Monitoring** Type of monitoring__________
Performance not monitored
Frequency__________ Evidence of breaching
Head differential__________
Remarks__________

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks NA

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks NA

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks

C. Treatment System	Applicable	N/A	From Dec 04 - Jan 05

4 Plumes
VOC 1
VOC 2
Hex. Chrome
NDMA
perchlorate

1. **Treatment Train** (Check components that apply)
   - Metals removal — Oil/water separation — Bioremediation (Enhanced In-Situ) Currently Inactive
   - Air stripping — Carbon adsorbers
   - Filters
   - Additive (e.g., chelation agent, flocculent)
   - Others Initial injection wells remain & need to be abandoned. They are currently open to atmosphere.
   - Good condition — Needs Maintenance
   - Sampling ports properly marked and functional
   - Sampling/maintenance log displayed and up to date
   - Equipment properly identified
   - Quantity of groundwater treated annually
   - Quantity of surface water treated annually
   - Remarks Remedy for VOC, hex chrome and perchlorate is MNA. For VOC2: In-situ treatment w/ $KMnO_4$

2. **Electrical Enclosures and Panels** (properly rated and functional)
   - N/A — Good condition — Needs Maintenance
   - Remarks

3. **Tanks, Vaults, Storage Vessels**
   - N/A — Good condition — Proper secondary containment — Needs Maintenance
   - Remarks

4. ***Discharge Structure and Appurtenances***
   - N/A — Good condition — Needs Maintenance
   - Remarks

5. **Treatment Building(s)**
   - N/A — Good condition (esp. roof and doorways) — Needs repair
   - Chemicals and equipment properly stored
   - Remarks

6. **Monitoring Wells** (pump and treatment remedy)
   - Properly secured/locked — Functioning — Routinely sampled — Good condition
   - All required wells located — Needs Maintenance — N/A
   - Remarks Existing not used/accessible. Will install new [illegible]

D. Monitoring Data — limited - see TT

1. Monitoring Data
   - Is routinely submitted on time — Is of acceptable quality

2. Monitoring data suggests:
   - Groundwater plume is effectively contained — Contaminant concentrations are declining

Very limited GW monitoring has been performed due to proximity of Site 11 to active construction area.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks Will install new

X. *OTHER REMEDIES*

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

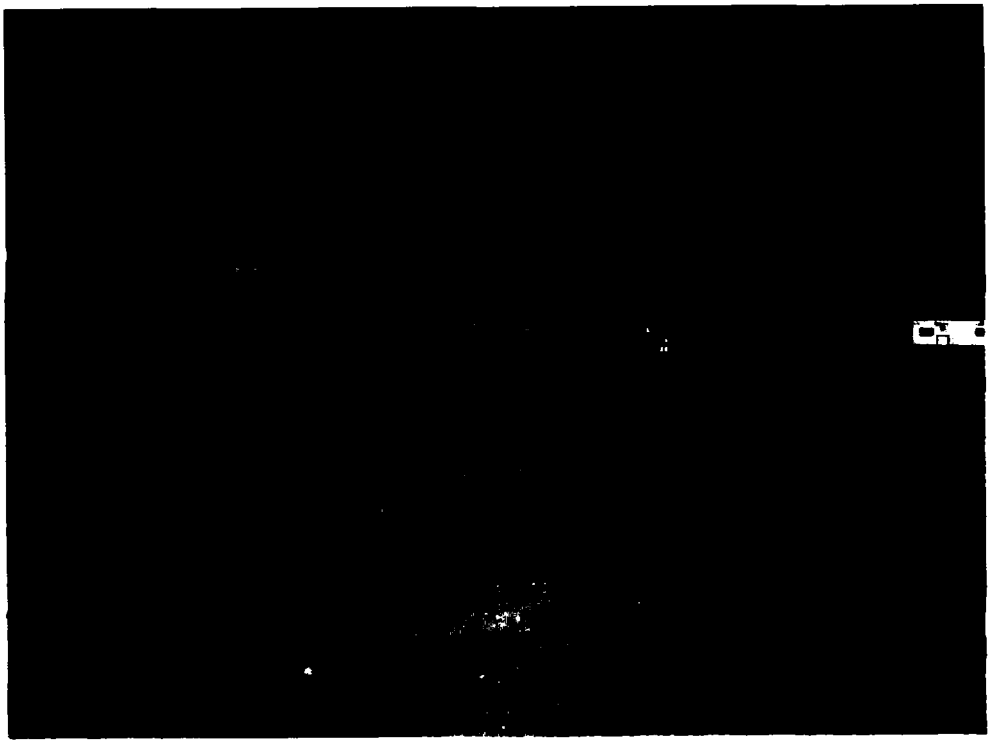
B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
	____
	____
	____
	____
	____
	____
	____
	____
	____
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
	____
	____
	____
	____
	____
	____
	____
	____
	____

APPENDIX B

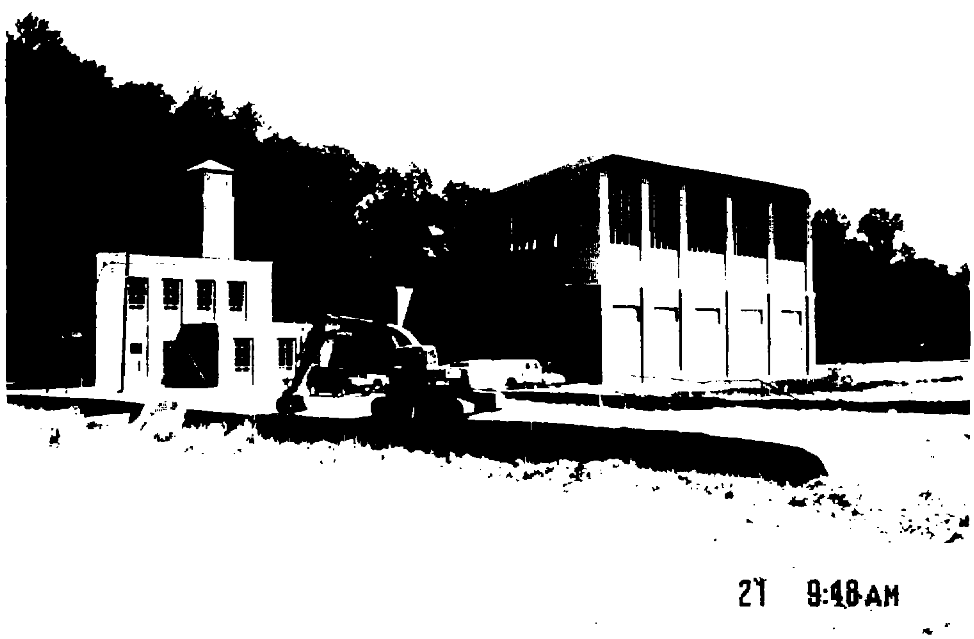
SITE 11 PHOTOGRAPHS



Site 11, Photo 1 – Former source area, looking north.

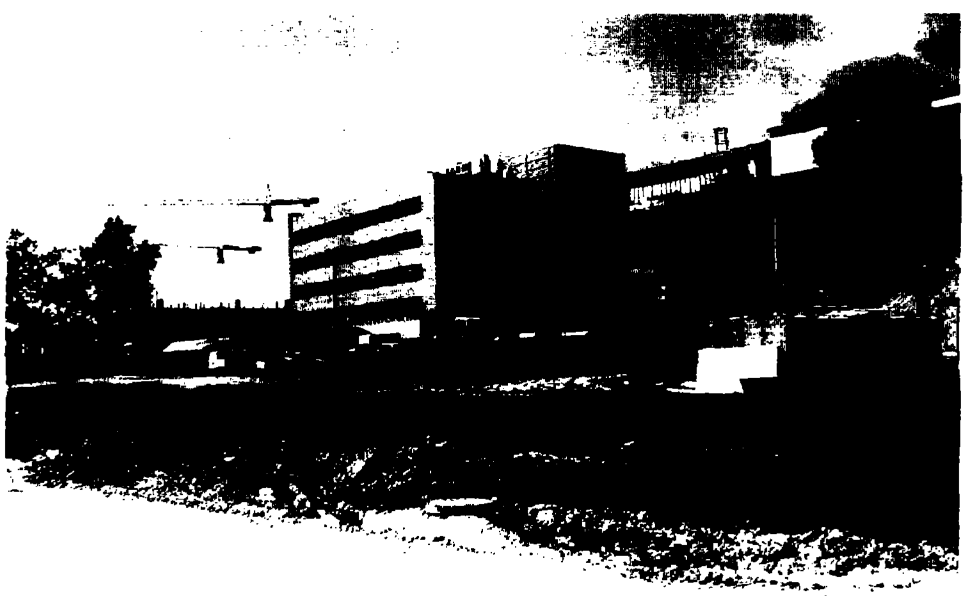
Site 11, Photo 2 – VOC plume no. 2, looking south.

Site 11, Photo 3 – In-situ injection well (white) and monitoring well (yellow), looking west.



Site 11, Photo 4 – Downgradient portion of site, power plant in background, looking northeast.

Site 11, Photo 5 – In-situ injection wells and surrounding construction site.



Site 11, Photo 6 – Overview of site, looking southwest.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 11, Industrial Wastewater Disposal Area**
Interviewee: **Scott Nesbit**
Agency/Title/etc: **Tetra Tech NUS, Project Manager**
Date: **22-August-2006**

Background

1. What effects have site operations had on the surrounding community or area?

No effects have been noted on the surrounding community.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

The tenants (FDA) at the Federal Research Center have shown an interest in the progress of the remedial activities and monitoring efforts. The National Treasury Employees Union (NTEU) representatives are members of the White Oak Restoration Advisory Board (NTEU represents the FDA employees) and have reviewed reports, work plans, and monitoring data to ensure that FDA employees are not exposed to elevated contaminant levels.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

No.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

The General Services Administration is in the process of constructing a new campus for the FDA at Site 11.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

TtNUS has conducted the post-RA monitoring at the site since November 2004. The next monitoring event is scheduled for September 2006.

TtNUS has participated in the White Oak BRAC Clean-up Team and Restoration Advisory Board since their inception. The BCT meets quarterly to semi-annually, the RAB now meets semi-annually. The progress of work at Site 11 is discussed at all BCT and RAB meetings.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

None.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

A standard was promulgated for perchlorate since signature of the ROD for Site 11 Groundwater. The location of monitoring network may require revision based on the new standard.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

MNA was selected as the remedy for 3 plumes (VOC Plume No. 1, Cr VI, and perchlorate) at Site 11. Construction of the FDA campus has delayed the BCT from establishing the groundwater monitoring well network necessary to monitor this remedy. The installation of a limited number of wells is scheduled for the fall 2006; monitoring data will be collected to evaluate the MNA remedy performance at that time.

Enhanced bioremediation with MNA was selected as the remedy for VOC Plume No. 2. Aquifer enhancement was completed in 2004. Monitoring data collected to date shows limited success in creating the conditions needed to accelerate contaminant degradation; however, the BCT has agreed that no additional action is needed at the present time. Monitoring will continue to determine if contaminant concentrations are being reduced at an acceptable rate.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Monitoring will be conducted semi-annually during the upcoming year and eventually will be conducted annually. When the entire monitoring well network is established at Site 11, it is believed that sampling will be completed by 2 field staff during a period of one week.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

No significant changes have been made to the monitoring program.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

It is believed that the monitoring program is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: **Andy Zarins**
Agency/Title/etc: **MDE/Remedial Project Manager**
Date: **8/15/06**

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

   Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction; and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SITE 49

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Site 49	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90 °F, light to no wind

Remedy Includes: (Check all that apply)

- ✓ Landfill cover/containment
- ✓ Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other In-situ chemical oxidation
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA, BRAC site ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

2. **O&M staff** ______ ______ ______
   Name Title Date
   Interviewed at site at office by phone Phone no. ______
   Problems, suggestions; Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________
Contact ______________________ ______________ ________ __________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ______________________

Agency ______________________
Contact ______________________ ______________ ________ __________
Name | Title | Date | Phone no
Problems; suggestions; Report attached ______________________

Agency ______________________
Contact ______________________ ______________ ________ __________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ______________________

Agency ______________________
Contact ______________________ ______________ ________ __________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ______________________

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks__________			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks__________			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks__________			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits__________	Readily available	Up to date	N/A
	Remarks__________			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks__________			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks__________			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks__________			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks__________			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks__________			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks__________			

[illegible] Begin well construction next week : In-situ chemical oxidation

IV. O&M COSTS

1. **O&M Organization**

State in-house	Contractor for State
PRP in-house	Contractor for PRP
Federal Facility in-house	Contractor for Federal Facility

Other____

2. **O&M Cost Records**

Readily available   Up to date

Funding mechanism/agreement in place

Original O&M cost estimate________________   Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached
			Breakdown attached

3. ***Unanticipated or Unusually High O&M Costs During Review Period***

Describe costs and reasons: ____

V. ACCESS AND INSTITUTIONAL CONTROLS   Applicable   N/A

A. Fencing

1. ***Fencing damaged***   *Location shown on site map*   *Gates secured*   N/A

Remarks____

B. Other Access Restrictions

1. **Signs and other security measures**   Location shown on site map   N/A

Remarks most of [illegible] [illegible] gate from side of base but trespassing is possible through holes ~~[illegible]~~ in gutter and stream

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ____________________

Frequency ____________________

Responsible party/agency ____________________

Contact ____________ ____________ ________ ________

Name   Title   Date   Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions: *Report attached*

____

____

____

____

2. Adequacy   ICs are adequate   ICs are inadequate   N/A

Remarks ____________________

____

____

D. General

1. Vandalism/trespassing   Location shown on site map   No vandalism evident

Remarks ____________________

____

2. Land use changes on site   N/A

Remarks ____________________

____

3. Land use changes off site   N/A

Remarks ____________________

____

VI. GENERAL SITE CONDITIONS

A. Roads   Applicable   N/A

1. Roads damaged   Location shown on site map   Roads adequate   N/A

Remarks ____________________

____

No CVCs, will have other monthly report

B. Other Site Conditions

Remarks____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
Areal extent__________ Depth__________
Remarks____

2. **Cracks** Location shown on site map Cracking not evident
Lengths__________ Widths__________ Depths__________
Remarks____

3. **Erosion** Location shown on site map Erosion not evident
Areal extent__________ Depth__________
Remarks____

4. **Holes** Location shown on site map Holes not evident
Areal extent__________ Depth__________
Remarks____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
Remarks____

7. **Bulges** Location shown on site map Bulges not evident
Areal extent__________ Height__________
Remarks____

8. **Wet Areas/Water Damage**	Wet areas/water damage not evident		
Wet areas	Location shown on site map	Areal extent_____	
Ponding	Location shown on site map	Areal extent_____	
Seeps	Location shown on site map	Areal extent_____	
Soft subgrade	Location shown on site map	Areal extent_____	
Remarks_____			
9. **Slope Instability**	Slides	Location shown on site map	No evidence of slope instability
Areal extent_____			
Remarks_____			

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
   Remarks_____

2. **Bench Breached** Location shown on site map N/A or okay
   Remarks_____

3. **Bench Overtopped** Location shown on site map N/A or okay
   Remarks_____

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
   Areal extent_____ Depth_____
   Remarks_____

2. **Material Degradation** Location shown on site map No evidence of degradation
   Material type_____ Areal extent_____
   Remarks_____

3. **Erosion** Location shown on site map No evidence of erosion
   Areal extent_____ Depth_____
   Remarks_____

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent__________ Depth__________
Remarks____

5. **Obstructions** Type_______________ No obstructions
Location shown on site map Areal extent__________
Size__________
Remarks____

6. **Excessive Vegetative Growth** Type_______________
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent__________
Remarks____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks____

E. Gas Collection and Treatment	Applicable	N/A	
1. **Gas Treatment Facilities** Flaring Good condition Remarks______	 Thermal destruction Needs Maintenance	 Collection for reuse	
2. **Gas Collection Wells, Manifolds and Piping** Good condition Remarks______	 Needs Maintenance		
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Remarks______	 Needs Maintenance	 N/A	
F. Cover Drainage Layer	Applicable	N/A	
1. **Outlet Pipes Inspected** Remarks______	Functioning	N/A	
2. **Outlet Rock Inspected** Remarks______	Functioning	N/A	
G. Detention/Sedimentation Ponds	Applicable	N/A	
1. **Siltation** Areal extent______ Siltation not evident Remarks______	Depth______		N/A
2. **Erosion** Areal extent______ Erosion not evident Remarks______	Depth______		
3. **Outlet Works** Remarks______	Functioning	N/A	
4. **Dam** Remarks______	Functioning	N/A	

H. Retaining Walls		Applicable	N/A
1.	**Deformations** Location shown on site map Deformation not evident Horizontal displacement________ Vertical displacement________ Rotational displacement________ Remarks________		
2.	**Degradation** Location shown on site map Degradation not evident Remarks________		
I. Perimeter Ditches/Off-Site Discharge		Applicable	N/A
1.	**Siltation** Location shown on site map Siltation not evident Areal extent________ Depth________ Remarks________		
2.	**Vegetative Growth** Location shown on site map N/A Vegetation does not impede flow Areal extent________ Type________ Remarks________		
3.	**Erosion** Location shown on site map Erosion not evident Areal extent________ Depth________ Remarks________		
4.	**Discharge Structure** Functioning N/A Remarks________		
VIII. VERTICAL BARRIER WALLS		Applicable	N/A
1.	**Settlement** Location shown on site map Settlement not evident Areal extent________ Depth________ Remarks________		
2.	**Performance Monitoring** Type of monitoring________ Performance not monitored Frequency________ Evidence of breaching Head differential________ Remarks________		

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks__________

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks__________

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks__________

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks__________

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks__________

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks__________

3 mon. wells - all locked, North border NCPPC

C. Treatment System Applicable N/A Source: Bldg. 427

1. **Treatment Train** (Check components that apply) COC = TCE
   - Metals removal
   - Oil/water separation
   - Bioremediation
   - Air stripping
   - Carbon adsorbers
   - Filters
   - Additive (*e.g.*, chelation agent, flocculent)
   - Others In-situ oxidation Sodium permanganate - 10 wells TB installed
   - Good condition changed Needs Maintenance
   - Sampling ports properly marked and functional To start construction [illegible]
   - Sampling/maintenance log displayed and up to date
   - Equipment properly identified
   - Quantity of groundwater treated annually
   - Quantity of surface water treated annually

   Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks

D. Monitoring Data

1. Monitoring Data - Not currently monitored
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

3 wells up top - located
+ 2 [illegible] - located

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
Properly secured/locked Functioning Routinely sampled Good condition
All required wells located Needs Maintenance N/A
Remarks____

X. *OTHER REMEDIES*

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B

SITE 49 PHOTOGRAPHS

Site 49, Photo 1 – Source area on opposite slope in background, looking west.

Site 49, Photo 2 – Paint Branch just downgradient of slope below source area, looking south.

Site 49, Photo 3 – Monitoring wells downgradient of source area, looking north, note facility fence line in background.

Site 49, Photo 4 – Monitoring wells downgradient of source area, looking northwest.

Site 49, Photo 5 – Building 427, source area.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: **Andy Zarins**
Agency/Title/etc: **MDE/Remedial Project Manager**
Date: **8/15/06**

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.
No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction; and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.

SWMU 87

APPENDIX A

INSPECTION CHECKLIST

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: SWMU 87	**Date of inspection:** 6-21-06
Location and Region: White Oak, MD; Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, 90°F, little to no wind

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- ✓ Access controls
- ✓ Institutional controls
- Groundwater pump and treatment
- Surface water collection and treatment
- Other In-Situ bioremediation
- ✓ Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls

Attachments: Inspection team roster attached   Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** NA - BRAC site ________ ________
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. ________
   Problems, suggestions;   Report attached ________

2. **O&M staff** ________ ________ ________
   Name   Title   Date
   Interviewed   at site   at office   by phone   Phone no. ________
   Problems, suggestions;   Report attached ________

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________________
Contact ______________________________ ____________________ ________ ____________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ____
____

Agency ______________________________
Contact ______________________________ ____________________ ________ ____________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ____
____

Agency ______________________________
Contact ______________________________ ____________________ ________ ____________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ____
____

Agency ______________________________
Contact ______________________________ ____________________ ________ ____________
Name | Title | Date | Phone no.
Problems; suggestions; Report attached ____
____

4. **Other interviews** (optional) Report attached.

____
____
____
____
____
____
____
____
____

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1. **O&M Documents**			
O&M manual	Readily available	Up to date	N/A
As-built drawings	Readily available	Up to date	N/A
Maintenance logs	Readily available	Up to date	N/A
Remarks______			
2. **Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
Contingency plan/emergency response plan	Readily available	Up to date	N/A
Remarks______			
3. **O&M and OSHA Training Records**	Readily available	Up to date	N/A
Remarks______			
4. **Permits and Service Agreements**			
Air discharge permit	Readily available	Up to date	N/A
Effluent discharge	Readily available	Up to date	N/A
Waste disposal, POTW	Readily available	Up to date	N/A
Other permits______	Readily available	Up to date	N/A
Remarks______			
5. **Gas Generation Records**	Readily available	Up to date	N/A
Remarks______			
6. **Settlement Monument Records**	Readily available	Up to date	N/A
Remarks______			
7. **Groundwater Monitoring Records**	Readily available	Up to date	N/A
Remarks______			
8. **Leachate Extraction Records**	Readily available	Up to date	N/A
Remarks______			
9. **Discharge Compliance Records**			
Air	Readily available	Up to date	N/A
Water (effluent)	Readily available	Up to date	N/A
Remarks______			
10. **Daily Access/Security Logs**	Readily available	Up to date	N/A
Remarks______			

No construction yet. 6 weeks out

IV. O&M COSTS

1. **O&M Organization**
State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other______________________________

2. **O&M Cost Records**
Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate____________ Breakdown attached

Total annual cost by year for review period if available

From______ Date	To______ Date	______ Total cost	Breakdown attached
From______ Date	To______ Date	______ Total cost	Breakdown attached
From______ Date	To______ Date	______ Total cost	Breakdown attached
From______ Date	To______ Date	______ Total cost	Breakdown attached
From______ Date	To______ Date	______ Total cost	Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ______________________________

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A
Remarks Gate shut not secured

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A
Remarks none

C. Institutional Controls (ICs)				
1.	**Implementation and enforcement**			
	Site conditions imply ICs not properly implemented	Yes	No	N/A
	Site conditions imply ICs not being fully enforced	Yes	No	N/A
	Type of monitoring (*e.g.*, self-reporting, drive by) ______			
	Frequency ______			
	Responsible party/agency ______			
	Contact ______ Name ______ Title ______ Date ______ Phone no.			
	Reporting is up-to-date	Yes	No	N/A
	Reports are verified by the lead agency	Yes	No	N/A
	Specific requirements in deed or decision documents have been met	Yes	No	N/A
	Violations have been reported	Yes	No	N/A
	Other problems or suggestions: *Report attached*			
2.	**Adequacy** ICs are adequate ICs are inadequate			N/A
	Remarks______			
D. General				
1.	**Vandalism/trespassing** Location shown on site map No vandalism evident			
	Remarks______			
2.	**Land use changes on site** N/A			
	Remarks______			
3.	**Land use changes off site** N/A			
	Remarks______			
VI. GENERAL SITE CONDITIONS				
A. Roads	Applicable N/A			
1.	**Roads damaged** Location shown on site map Roads adequate			N/A
	Remarks______			

B. Other Site Conditions	
Remarks________________	
VII. LANDFILL COVERS Applicable N/A	
A. Landfill Surface	
1.	**Settlement** (Low spots) Location shown on site map Settlement not evident Areal extent________ Depth________ Remarks________________
2.	**Cracks** Location shown on site map Cracking not evident Lengths________ Widths________ Depths________ Remarks________________
3.	**Erosion** Location shown on site map Erosion not evident Areal extent________ Depth________ Remarks________________
4.	**Holes** Location shown on site map Holes not evident Areal extent________ Depth________ Remarks________________
5.	**Vegetative Cover** Grass Cover properly established No signs of stress Trees/Shrubs (indicate size and locations on a diagram) Remarks________________
6	**Alternative Cover (armored rock, concrete, etc.)** N/A Remarks________________
7.	**Bulges** Location shown on site map Bulges not evident Areal extent________ Height________ Remarks________________

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
Wet areas Location shown on site map Areal extent______________
Ponding Location shown on site map Areal extent______________
Seeps Location shown on site map Areal extent______________
Soft subgrade Location shown on site map Areal extent______________
Remarks____
____

9. **Slope Instability** Slides Location shown on site map No evidence of slope instability
Areal extent______________
Remarks____
____

B. Benches Applicable N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** Location shown on site map N/A or okay
Remarks____
____

2. **Bench Breached** Location shown on site map N/A or okay
Remarks____
____

3. **Bench Overtopped** Location shown on site map N/A or okay
Remarks____
____

C. Letdown Channels Applicable N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** Location shown on site map No evidence of settlement
Areal extent______________ Depth____________
Remarks____
____

2. **Material Degradation** Location shown on site map No evidence of degradation
Material type______________ Areal extent______________
Remarks____
____

3. **Erosion** Location shown on site map No evidence of erosion
Areal extent______________ Depth____________
Remarks____
____

4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent______________ Depth____________ Remarks____
5.	**Obstructions** Type______________________ No obstructions Location shown on site map Areal extent______________ Size____________ Remarks____
6.	**Excessive Vegetative Growth** Type____________________ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent______________ Remarks____
D. Cover Penetrations	Applicable N/A
1.	**Gas Vents** Active Passive Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
2.	**Gas Monitoring Probes** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
3.	**Monitoring Wells** (within surface area of landfill) Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
4.	**Leachate Extraction Wells** Properly secured/locked Functioning Routinely sampled Good condition Evidence of leakage at penetration Needs Maintenance N/A Remarks____
5.	**Settlement Monuments** Located Routinely surveyed N/A Remarks____

E. Gas Collection and Treatment Applicable N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks____

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks____

G. Detention/Sedimentation Ponds Applicable N/A

1. **Siltation** Areal extent____________ Depth__________ N/A
   Siltation not evident
   Remarks____

2. **Erosion** Areal extent____________ Depth__________
   Erosion not evident
   Remarks____

3. **Outlet Works** Functioning N/A
   Remarks____

4. **Dam** Functioning N/A
   Remarks____

H. Retaining Walls	Applicable	N/A	
1. **Deformations**	Location shown on site map	Deformation not evident	
Horizontal displacement________ Vertical displacement________ Rotational displacement________ Remarks________			
2. **Degradation**	Location shown on site map	Degradation not evident	
Remarks________			
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1. **Siltation**	Location shown on site map	Siltation not evident	
Areal extent________ Depth________ Remarks________			
2. **Vegetative Growth**	Location shown on site map	N/A	
Vegetation does not impede flow Areal extent________ Type________ Remarks________			
3. **Erosion**	Location shown on site map	Erosion not evident	
Areal extent________ Depth________ Remarks________			
4. **Discharge Structure**	Functioning	N/A	
Remarks________			
VIII. VERTICAL BARRIER WALLS	Applicable	N/A	
1. **Settlement**	Location shown on site map	Settlement not evident	
Areal extent________ Depth________ Remarks________			
2. **Performance Monitoring**	Type of monitoring________		
Performance not monitored Frequency________ Evidence of breaching Head differential________ Remarks________			

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks___

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks___

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks___

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks___

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks___

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks___

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters____________________
   Additive (*e.g.*, chelation agent, flocculent)____________________
   Others____________________
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually____________________
   Quantity of surface water treated annually____________________
   Remarks____________________

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks____________________

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks____________________

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks____________________

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks____________________

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks____________________

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked ✓ Functioning ✓ Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks____
   ____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

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B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

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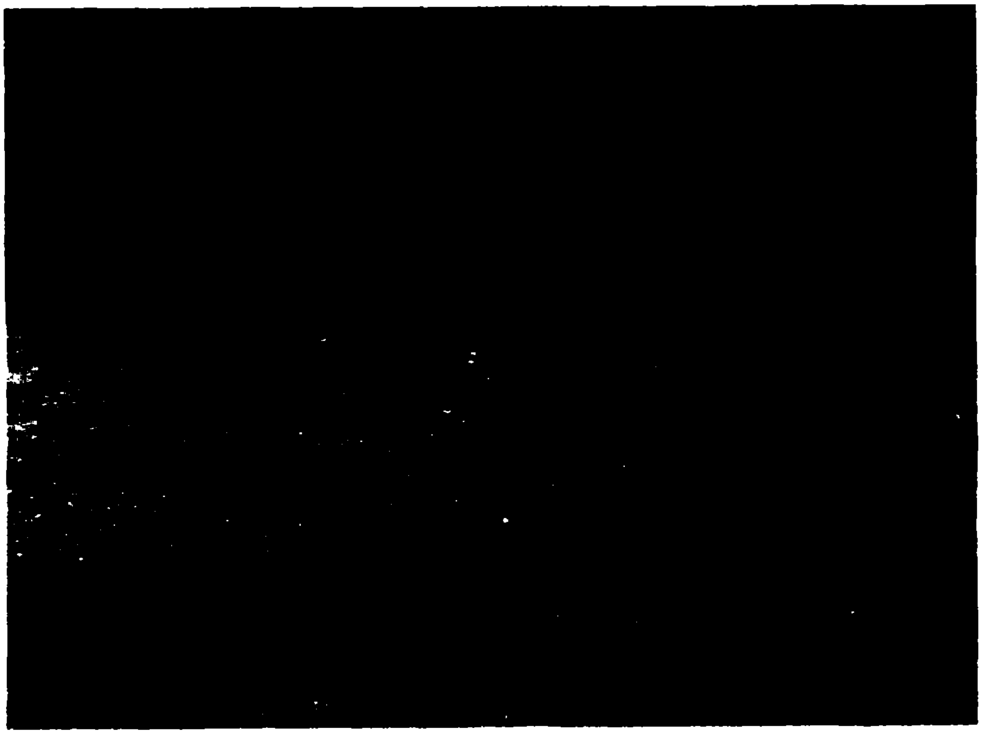
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

APPENDIX B



SWMU 87, Photo 1 – Former source area, looking west.

SWMU 87, Photo 2 – Monitoring wells downgradient of site, Paint Branch is to the right.

SWMU 87, Photo 3 – Area downgradient of site, bunker is in background.

SWMU 87, Photo 4 – Area downgradient of site, looking north.

APPENDIX C

FIVE-YEAR REVIEW QUESTIONNAIRES

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **SWMU 87, Building 611**
Interviewee: Scott Nesbit
Agency/Title/etc: Tetra Tech NUS, Project Manager
Date: 22-August-2006

Background

1. What effects have site operations had on the surrounding community or area?

No effects have been noted on the surrounding community.

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

No concerns have been noted.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.

No.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

No.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?

No.

6. Are you aware of any uses of the groundwater at or downgradient of the site?

No.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

TtNUS completed the investigation and remedial design for SWMU 87. Remedial Action is scheduled for implementation in the fall 2006.

TtNUS has participated in the White Oak BRAC Clean-up Team and Restoration Advisory Board since their inception. The BCT meets quarterly to semi-annually, the RAB now meets semi-annually. The progress of work at SWMU 87 is discussed frequently at BCT and RAB meetings.

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

None.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

Nonc.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

The remedy has not yet been implemented.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

O&M activities will commence in the fall 2006 and will consist of periodic groundwater sampling. Sampling will be conducted bi-weekly to quarterly during year 1 and semi-annually thereafter.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

NA.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

The plan for long-term monitoring at the site is being reviewed by the BCT.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

No.

FIVE-YEAR REVIEW QUESTIONARE

Facility: **Former Naval Surface Warfare Center, White Oak, MD**
Site(s): **Site 4, Chemical Burial Area; Site 5/13, Open Burn Area/Sludge Disposal Area; Site 7, Ordnance Burn Area; Site 9, Former Building 318; Site 11, Industrial Wastewater Disposal Area; Site 49, Building 427 to Paint Branch; SWMU 87, Building 611; and OU2 – Apple Orchard Landfill**
Interviewee: **Andy Zarins**
Agency/Title/etc: **MDE/Remedial Project Manager**
Date: **8/15/06**

Background

1. What effects have site operations had on the surrounding community or area?
   None

2. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
   Detonating explosives and undiscovered hazardous wastes. In the first case old fuses were found and detonated, alarming nearby residents. In the second case, old gas cylinders were found, with nearby residents wondering if more hazardous waste was still around.

3. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, give details.
   See above.

4. Are you aware of any recreational uses of the surface water, such as fishing, boating, or other casual uses?

   There are none.

5. Are you aware of any intrusive activities being conducted on the cap or uses of the site other than monitoring or maintenance?
The FDA is constructing new buildings at Site 11 and buildings are being/were demolished at all other sites, excluding OU-2.

6. Are you aware of any uses of the groundwater at or downgradient of the site?
There is/was some residential use of the groundwater downgradient of Site 4.

State and Local Considerations (Regulatory)

1. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

There have been periodic site visits to these sites in order to note well construction, remediation progress, and the condition of OU-2 landfill cap cover. Results were as follows: OU-2 landfill cover is well maintained; Site 11 EOS injection and aquifer fracturing was monitored; Site 4 pilot test was monitored, and SWMU 87 monitoring well construction was observed. There is on-going site visits at all of these sites in order to

2. Have there been any complaints, violations, or other compliance issues related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No.

3. Have there been any changes in regulations or cleanup levels since implementation that may impact the site?

   Perchorate PRGs were issued at 22.5 ug/l.

Performance, Operation, and Maintenance Problems

1. Is the remedy functioning as intended by the decision documents? How well is the remedy performing?

Site 4: Pump and treat and air stripping has lowered the concentrations; with a pilot test for bioremediation is in progress; the Remedial design is being finalized; Site 7 and Site 9 aquifers were injected with sodium lactate with a decline in contaminant concentrations, but clean-up standards have not been met; Site 11, VOC plume #2 was injected with sodium lactate with no reduction in contaminants, natural attenuation and lon-term monitoring are the remedies in place for the whole site; Sites 5/13 aquifer was injected with zero-valent iron solution with a decline in contaminants, clean-up standards have not been met yet; Site 49 is to be injected with permanganate with the remedial action currently on-going; SWMU 87 is to be injected with sodium lactate with the remedial action currently on-going; OU-2 had an impermeable cover constructed, combined with long-term monitoring of groundwater, there was no migration of contaminants to nearby streams.

2. Describe the O&M staff and activities. If there is not a continuous on-site presence, describe the staff and frequency of site inspections and activities.

Contractor does periodic maintenance and quarterly sampling; there is contractor activity with on-going remediation.

3. Have there been any significant changes in the O&M requirements, operational adjustments, maintenance schedules, or sampling routines since start up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe the changes and impacts.

Site 4/46 will have some well abandonment and may have cessation of the air stripper unit in the future; Site 11 monitoring wells are being relocated due to FDA building construction and

Sites 5/13 has some groundwater contamination off-site which is to be remediated in the near future.

4. Do you have any comments or feedback on the adequacy of the implemented remedy? Are all the right constituents included? Is the monitoring frequency adequate?

No comments. The right constituents are included and the monitoring frequency is adequate.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None.