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Final Report for Third Round of Groundwater Sampling Abandoned Chemical Disposal Pit (Site 8)

The Naval Surface Warfare Center White Oak Detachment Silver Spring, Maryland

Northern Division Naval Facilities Engineering Command

Contract No. N62472-90-D-1298
Contract Task Order 0111

July 1993

Halliburton NUS CORPORATION

FINAL REPORT FOR THIRD ROUND OF GROUNDWATER SAMPLING ABANDONED CHEMICAL DISPOSAL PIT (SITE 8)

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

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EXECUTIVE SUMMARY

Halliburton NUS Corporation conducted a third round of groundwater sampling and analysis at the Abandoned Chemical Disposal Pit (Site 8), Naval Surface Warfare Center, White Oak Detachment (NSWCWODET) in Silver Spring, Maryland. The purpose of the groundwater investigation was to provide confirmation of potential groundwater contamination in five existing monitoring wells in the immediate vicinity of the Abandoned Chemical Disposal Pit. This investigation is intended to supplement groundwater quality data obtained during previous site investigations, including Phase I and Phase II of the Remedial Investigation (RI). The specific objective of the investigation was to determine the presence and levels of volatile organics, semivolatile organics, polychlorinated biphenyls (PCBs), and metals in groundwater in the vicinity of the site. The data from this third round of groundwater sampling will be used by the Navy in conjunction with previously collected data to evaluate the need for remedial action at the site, and to evaluate potential remedial options during the FS.

The results of the investigation indicate that 1,1,2-trichloroethane and antimony were detected at Site 8 above health-based drinking water standards. The 1,1,2-trichloroethane was detected in well 8GW36, the closest well to the property line on the southeast side of Site 8. Antimony was only detected in the unfiltered sample from well 8GW33, which is located north of Perimeter Road. All other constituents analyzed were below health-based drinking standards.

The water level measurements taken at Site 8 during this investigation suggest that a radial groundwater flow pattern exists nearby. Off-site water level measurements from one or more locations outside the cluster of Site 8 wells and beyond the facility boundary would be useful in confirming the existence of a radial flow pattern near the site. In addition, the apparent seasonal variation of groundwater flow direction indicates the need for water level measurements at different times of year to determine the predominant flow direction and gradient.

1.0 INTRODUCTION

This report presents the results of a third round of groundwater sampling and analysis conducted by Halliburton NUS Corporation at the Abandoned Chemical Disposal Pit (Site 8) of the Naval Surface Warfare Center (NSWC), White Oak Detachment, in Silver Spring, Maryland. The investigation was performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract N62472-90-D-1298, Contract Task Order (CTO) 0111.

The report consists of four sections. Section 1.0 is this introduction, which presents the overall purpose of the third round of groundwater sampling and analysis at Site 8. Section 2.0 presents a brief overview of the site, including site history, the results of previous site investigations, and a description of site geology and hydrogeology. Section 3.0 describes the methods used and results of groundwater sampling and laboratory analyses. Section 4.0 presents a brief summary of the objectives and results of the third round of sampling.

On April 7, 1993 Halliburton NUS Corporation conducted a third round of groundwater sampling at the Abandoned Chemical Disposal Pit (Site 8), Naval Surface Warfare Center, White Oak Detachment (NSWCWODET) in Silver Spring, Maryland. The purpose of this groundwater sampling and analysis was to provide confirmation of potential groundwater contamination in five existing monitoring wells in the immediate vicinity of the Abandoned Chemical Disposal Pit. The specific objective of this investigation was to determine the presence and levels of volatile organics, semivolatile organics, polychlorinated biphenyls (PCBs), and metals in groundwater in the vicinity of the site.

This work is part of the Navy's Installation Restoration Program (IRP), which is designed to identify contamination of Navy and Marine Corps lands and facilities resulting from past operations and to institute corrective measures, as needed. There are typically three distinct phases of investigation and remediation under the IRP program. Phase 1 consists of: (1) a Preliminary Assessment (PA), which examines historical records to determine potential wastes and waste disposal activities conducted at a site and to determine those needing further investigation; and (2) a Site Inspection (SI), which augments the information collected in the Preliminary Assessment. Phase 2 under the IRP program is the Remedial Investigation/Feasibility Study (RI/FS), which characterizes the contamination at a facility and develops options for remediating the site. Phase 3 is the Remedial Design/Remedial Action

(RD/RA), which results in the design of control or cleanup strategies for the contamination and implementation of these strategies.

Initial environmental investigations of the entire NSWCWODET facility, including the Abandoned Chemical Disposal Pit, were conducted under the Navy Assessment and Control of Installation Pollutants (NACIP) program, the precursor to the current Navy IRP program. Phase 1 of that program included the Initial Assessment Study (IAS), completed by the Navy Energy and Environmental Support Activity (NEESA) in 1984. The study included records searches, on-site surveys, personnel interviews, and site ranking. Additional study of several sites, including Site 8, was recommended on the basis of the IAS study. Under Phase 2 of the NACIP program, a Confirmation Study was conducted at NSWCWODET by Malcolm Pirnie, Inc. (1987). At Site 8, this study involved an on-site environmental field investigation to determine the presence of potential groundwater contamination. Groundwater sampling of four monitoring wells installed near Site 8 during the study resulted in recommendations for installation of one additional well and another round of groundwater sampling and analysis.

Phases I and II of the RI (Malcolm Pirnie, Inc. 1992) identified the presence of organic and inorganic chemicals above background levels in groundwater immediately downgradient of the site. Limited soil sampling conducted under the Phase I RI also indicated the presence of metals above background levels at Site 8. The Navy requested that Halliburton NUS conduct a third round of groundwater sampling to confirm the results of previous investigations, and to provide additional analytical data for mercury and semivolatile organic compounds. The laboratory data for these analytes, collected under the Phase II RI, were rejected due to quality assurance/quality control (QA/QC) deficiencies. The data from this third round of groundwater sampling and analysis will be used by the Navy in conjunction with previously collected data to evaluate the need for remedial action at the site, and to evaluate potential remedial options during the FS.

2.0 SITE BACKGROUND INFORMATION

2.1 SITE DESCRIPTION

NSWCWODET is located in Silver Spring, Montgomery County, Maryland. The NSWCWODET facility is located approximately 5 miles north of Washington, D.C., east of New Hampshire Avenue. The facility extends east from New Hampshire Avenue (Montgomery County) across the border into Prince George's County, Maryland as shown on the general location map (Figure 2-1).

NSWCWODET encompasses approximately 732 acres of land bordered to the north by a mixture of residential, park, and industrial/commercial properties; to the east by residential properties; to the southeast by the Harry Diamond Laboratory and U.S. Naval Research Training Center; to the southwest by the Hillandale residential community; and to the west by New Hampshire Avenue.

The Abandoned Chemical Disposal Pit (Site 8) is located on an upland area along the south-central facility boundary at the end of Perimeter Road (Figure 2-2). The location of the disposal pit, as determined by ground-penetrating radar (GPR), is a cleared area at the end of the Perimeter Road, surrounded by wooded areas on the north, east, and west, and a residential area on the south just beyond the property boundary. Paint Branch Creek is located approximately 900 feet east of the pit. Estimates of the pit's size range from 10 feet by 10 feet (NEESA, 1984) to approximately 30 feet by 30 feet (Malcolm Pirnie, Inc., 1992) with a depth of about 12 feet.

2.2 SITE HISTORY

The Navy acquired 870 acres of land in White Oak, Maryland in 1944 for expansion of the Washington Navy Yard-based Naval Ordnance Laboratory (NOL). The mission of the NOL was to carry out research and development for naval ordnance including explosives, projectiles, mines, and related munitions and control systems. In 1969, 137 acres of land were transferred from the NOL to the U.S. Army. This area is now the location of the Harry Diamond Laboratories. In 1974, the NOL was renamed the Naval Surface Weapons Center during consolidation of NOL with the Naval Weapons Laboratory in Dahlgren, Virginia. The facility now serves as a detachment to Dahlgren Division, and has been renamed the Naval Surface Warfare Center, Dahlgren Division Detachment, White Oak.

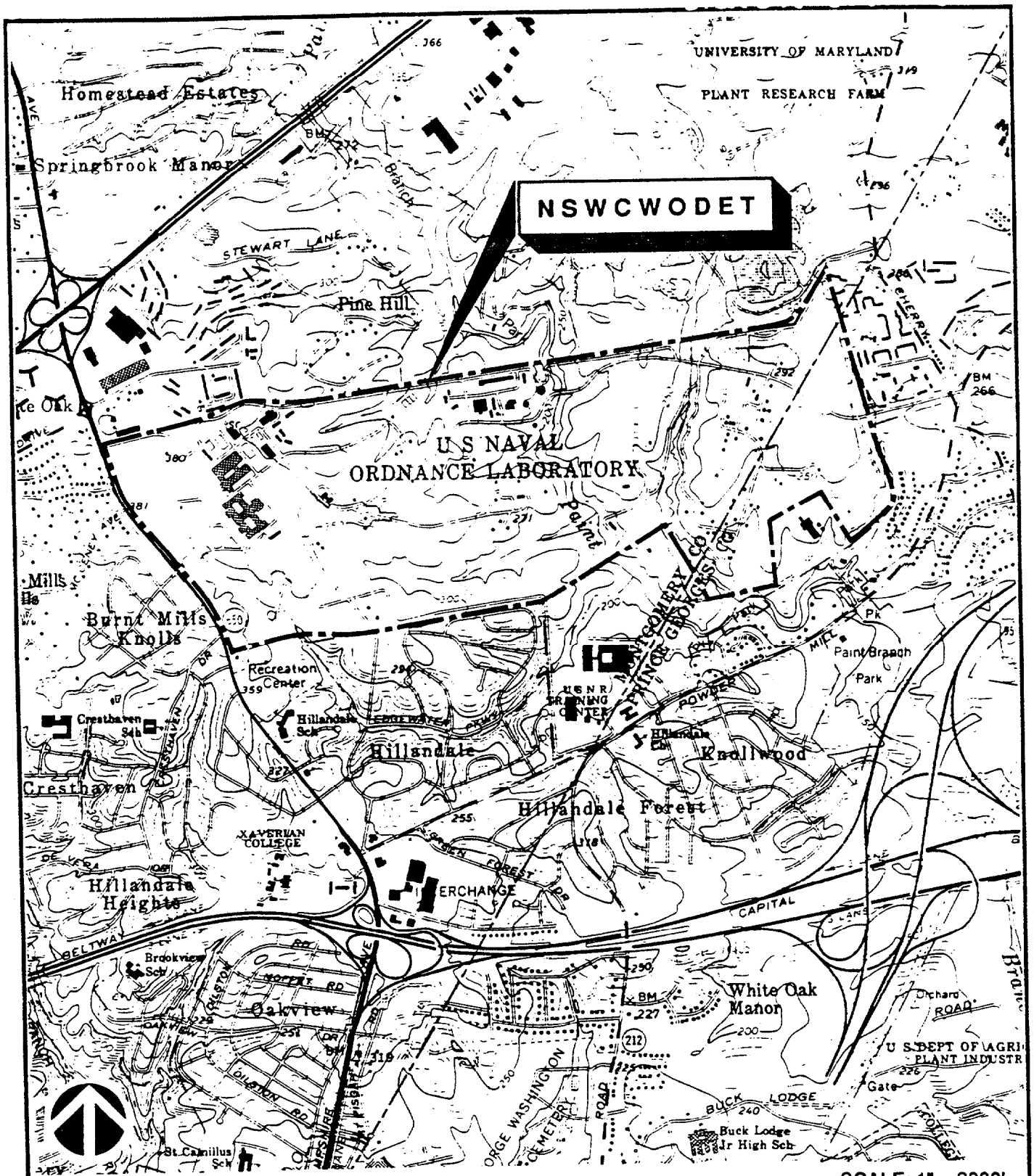

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FIGURE 2-1

FACILITY LOCATION

WHITE OAK, MARYLAND

NSWCWODET RI/FS

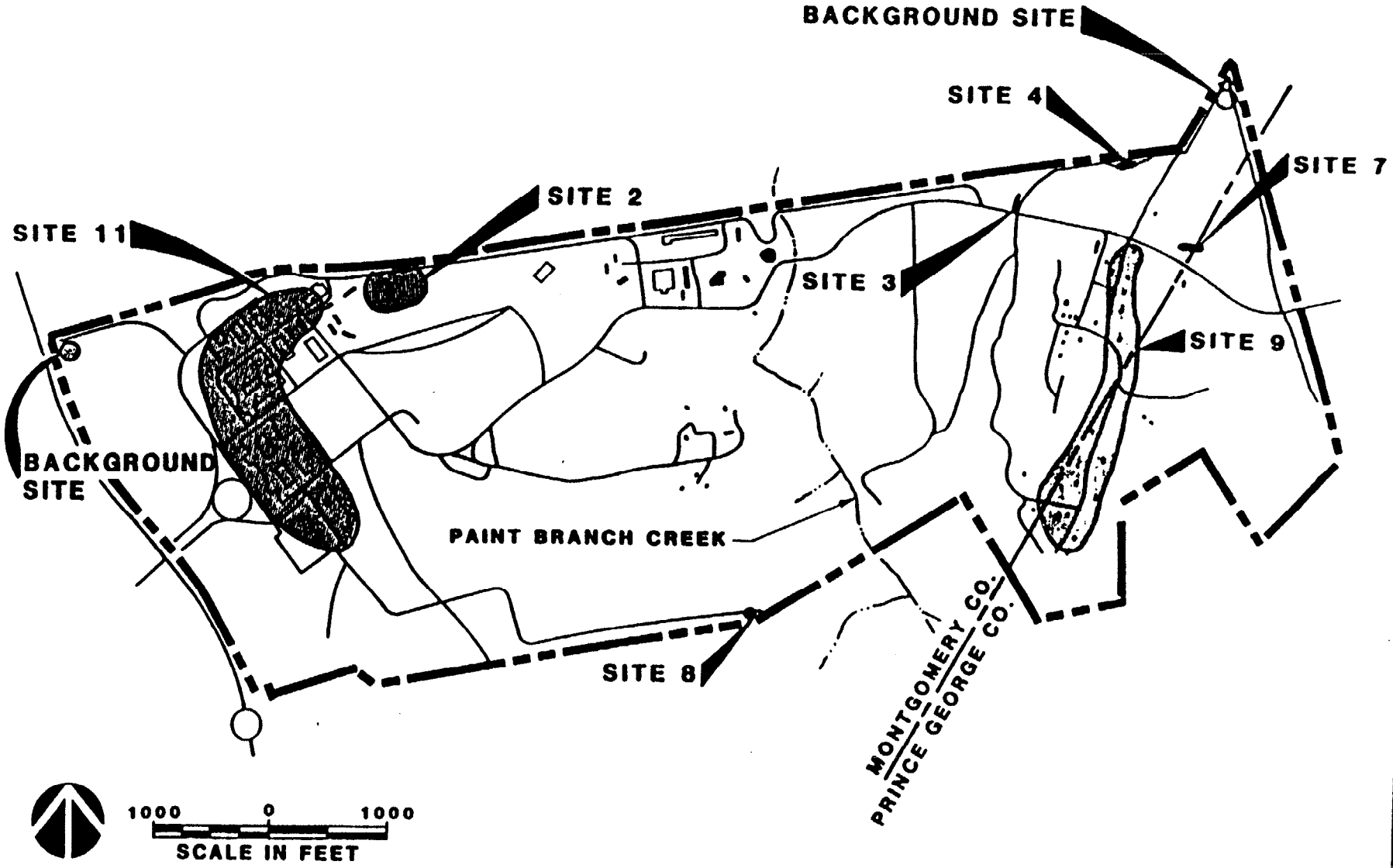

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FIGURE 2-2

SITE LOCATION MAP

WHITE OAK, MARYLAND

NSWCWODET RI/FS

The Abandoned Chemical Disposal Pit (Site 8) is an unlined hole which was used from 1951 to 1971 for disposal of a variety of waste chemicals from various laboratories at the facility. Wastes were reportedly deposited monthly and included acids, mercury, solvents, and numerous unidentified waste chemicals. Based on information collected during the IAS, it was estimated that as much as 60,000 pounds of chemical waste, including 180 pounds of mercury, may have been deposited in the pit over its 20 year period of use (NEESA, 1984). A layer of soil or gravel was reportedly placed on the wastes every two to three months. A number of glass laboratory containers were reportedly broken during disposal at the site. At the time of the work conducted by Halliburton NUS (April 1993), the ground surface in the vicinity of the pit appeared to consist of undisturbed soils with low-growing vegetation covered in part by a paved roadway.

2.3 SUMMARY OF PREVIOUS SITE INVESTIGATIONS

This section presents a summary of existing data from previous investigations of the Abandoned Chemical Disposal Pit (Site 8), by Malcolm Pirnie, Inc. under the RI. This information was reviewed by Halliburton NUS to provide background information for conducting a third round of groundwater sampling under this CTO.

The records search and personnel interviews conducted as part of the IAS of NSWCWODET (NEESA, 1984) concluded that the Abandoned Chemical Disposal Pit presented a potential threat to human health or the environment, because of the mercury and acids disposed there, and the potential for mercury compounds to migrate through groundwater. Based on these findings, the site was recommended for a Confirmation Study under the NACIP program.

As part of the NACIP Program Confirmation Study (Malcolm Pirnie, Inc., 1987), four groundwater monitoring wells (designated 8GW33, 8GW34, 8GW35, and 8GW36) were installed in the area immediately surrounding the suspected disposal site (refer to Figure 3-1). Two rounds of groundwater sampling and analysis were conducted during the Confirmation Study (February and May 1986). In each sampling round, mercury analyses were performed for groundwater samples from each well, with additional metals analyses only for samples collected from monitoring well 8GW35. All metals analyses were performed on unfiltered samples. It was noted in the Confirmation Study report that the groundwater samples contained significant quantities of sediment, which might have resulted in elevated chemical concentrations. Additional analyses performed on groundwater samples during the Confirmation Study were total organic carbon (TOC); total organic halogen (TOX); total dissolved solids (TDS); pH; volatile organic compounds (VOCs); conductivity; and oil and grease.

The results of groundwater analyses performed under the Confirmation Study are summarized in Table 2-1. This table also compares the range of detected concentrations to the appropriate current drinking water regulatory standard [Maximum Contaminant Levels (MCLs)]. Levels of chromium, nickel, and lead detected in groundwater during the study exceed their corresponding drinking water standards. Mercury was detected in each of the four monitoring wells, at concentrations ranging from 0.22 to 1.4 micrograms per liter (μg/L). Cadmium, chromium, copper, nickel, zinc, and lead were also present at detectable concentrations in monitoring well 8GW35. It is of interest to note that concentrations of these metals were consistently higher in the first round of groundwater sampling (February) than in the second round (May). The reason for this is not evident from information presented in the Confirmation Study report. Contamination by VOCs toluene (8GW33) and chloroform (8GW35) was identified at concentrations below MCLs, but it was recommended by Malcolm Pirnie, Inc. that additional sampling be performed to confirm these results. The Confirmation Study also recommended installation of one additional monitoring well, performance of a slug test to characterize site hydrogeologic conditions, and at least one additional round of sampling to better characterize potential groundwater contamination at the site.

The Phase I RI, completed by Malcolm Pirnie, Inc. in 1990, included collection and analysis of two soil samples to determine chemical concentrations of semivolatile organics and metals in surficial soil; performance of a Ground Penetrating Radar (GPR) geophysical survey to define the location of the abandoned disposal pit; installation of one additional monitoring well (8GW53); and groundwater sampling from all five monitoring wells in the vicinity of Site 8. The GPR survey indicated that one burial area was present at the site, underneath Perimeter Road. Soil sampling results indicated that chromium, lead, copper, and zinc were present at levels higher than facility-specific background concentrations (Appendix A).

Groundwater samples collected in the Phase I RI were analyzed for VOCs; semi-volatile organics; total and dissolved metals; TOC; TOX; TDS; and TSS. The results of these analyses identified the metals chromium, copper, lead, mercury, and zinc at levels above background concentrations in unfiltered samples. Chromium levels in unfiltered groundwater samples were three to four times higher than the drinking water MCL for chromium (100 μg/L). Levels of lead were approximately six times higher than current action level of 15 μg/L. Mercury levels of 4.5 μg/L detected in Phase I sampling exceeded the MCL in one of the five wells (8GW33). Only zinc (8GW53) was detected in the filtered groundwater samples above background levels. The organic constituents detected in the Phase I RI groundwater samples were chloroform (10 μg/L), 1,1,2-trichloroethane (7 μg/L), and bis(2-ethylhexyl)phthalate (13 to 19 μg/L). The Phase I RI summary data tables are included in Appendix A.

TABLE 2-1
RANGES OF DETECTABLE CHEMICAL CONCENTRATIONS (μg/L)
GROUNDWATER SAMPLE ANALYSES
NSWC-WHITE OAK CONFIRMATION STUDY (1987)

Analyte	Range of Concentration	MCL
INORGANICS		
Cadmium	< 5 - 6	5
Chromium	172 - 267	100
Copper	128 - 258	1300**
Nickel	109 - 282	
Zinc	398 - 801	5000*
Lead	42 - 90	15**
Mercury	0.22 - 1.4	2
ORGANICS		
Toluene	137	1000
Chloroform	5 - 7	100+

MCL - Maximum Contaminant Level
* Secondary Drinking Water Standard
** Action Level for tap water
\+ MCL for total trihalomethanes, including chloroform

All five monitoring wells at Site 8 were resampled during the Phase II RI, completed in October 1992. Each groundwater sample was analyzed for VOCs; semivolatile organics; total and dissolved metals; and PCBs. Total metals concentrations in groundwater decreased from Phase I to Phase II, and only cadmium (5 μg/L) and zinc (17 to 165 μg/L) were detected above background levels in the unfiltered groundwater samples. In the filtered samples, copper (11 to 45 μg/L), lead (7.3 μg/L), and zinc (31 to 138 μg/L) exceeded background levels. Phase II analytical results for mercury and all semivolatile compounds in groundwater were rejected due to QA/QC deficiencies. VOCs detected in groundwater were 1,1,2-trichloroethane, chloroform and methylene chloride, which were present at low levels. The RI Phase II results are presented in Appendix A.

The RI concluded that the decrease in concentration of metals in the groundwater from Phase I to Phase II suggests a reduction in metals leachate generation from the abandoned chemical disposal pit. Water level measurements obtained during the RI indicated the potential for radial migration of contamination from the abandoned pit, although the predominant direction of plume migration appeared to be toward the north.

2.4 SITE GEOLOGY AND HYDROGEOLOGY

The following is a brief summary of regional and local geologic features in the vicinity of the Abandoned Chemical Disposal Pit, as described in the RI report (Malcolm Pirnie, Inc., 1992).

The NSWCWODET lies within the boundary of the Piedmont and Coastal Plain Physiographic Provinces. The boundary between the two provinces is a zone in which the sedimentary units of the Coastal Plain form a wedge-like deposit that thins along its western margin at the fall line. Coastal Plain deposits consist of unconsolidated, interbedded, sand, silt, gravel, and clay. The sediments overlie the igneous and metamorphic rocks of the Piedmont Province.

The Piedmont Province in this region consists of igneous and metamorphic rocks. The piedmont units are covered by Coastal Plain sediments, thick residual soils, or saprolite (weathered bedrock). The saprolite varies greatly in thickness, but ranges between 20 and 50 feet at NSWCWODET.

Two geologic units are present below the Abandoned Chemical Disposal Pit (Site 8). The upper unit is the Upland Sand and Gravel which ranges in thickness from 0 to 10 feet. The underlying unit is the saprolite member (Wds) of the Wissahickon Formation, encountered approximately 5 to 10 feet below ground surface. Fractured gneiss bedrock was encountered at 31 feet below ground surface when the

borehole for monitoring well 8GW53 was drilled during the RI. The Wds Formation ranges in thickness from 20 to 39 feet throughout the site (Malcolm Pirnie, Inc., 1992).

The lithology beneath Site 8 consists of the Upland Sand and Gravel unit, which lies on the saprolite member of the Wissahickon Formation. The average saturated thickness of the water table aquifer, based on 1991 measurements, was 20 feet (Malcolm Pirnie, Inc., 1992). The depth to the water table aquifer at Site 8, determined from water level measurements taken during the Phase II RI, ranged from 28.51 feet to 34.97 feet from the ground surface. Water level measurements obtained during the RI indicated that the predominant groundwater flow direction in the vicinity of Site 8 was to the north.

3.0 ROUND III GROUNDWATER SAMPLING INVESTIGATION

3.1 OBJECTIVES OF INVESTIGATION

Based on results of previous site investigations, the Navy requested that Halliburton NUS perform a third round of groundwater sampling and analysis to expand the available database for the site, and reduce uncertainty regarding the levels of both organic and inorganic constituents in groundwater. Groundwater quality data for mercury and the semivolatile organics was particularly limited due to rejection of data collected during the Phase II RI. Supplemental data for these constituents would allow a more complete assessment of contaminant levels at the site, and would contribute to a better understanding of contaminant migration by analysis of trends in concentrations over time.

In addition, the Phase II RI identified potential radial flow of groundwater contaminants from the site. Additional water level measurements from existing on-site monitoring wells were taken prior to the third round of sampling to provide additional information regarding groundwater flow direction in the vicinity of Site 8.

3.2 GROUNDWATER SAMPLING AND ANALYSIS

This section describes the methods used by Halliburton NUS during the third round of groundwater sampling and analysis at the Abandoned Chemical Disposal Pit, including field measurements, groundwater sampling, laboratory analysis, and data validation.

3.2.1 Field Measurements

Static water-level measurements were taken from each of the five monitoring wells (8GW33 through 8GW36, and 8GW53) at Site 8 during the Round III groundwater sampling investigation (Figure 3-1). Water-level measurements from all five wells were recorded prior to any purging and sampling. An electronic water-level indicator was used to record measurements to the nearest 0.01 foot. Survey data for the top of the PVC riser in each well was used as a reference elevation for determining depths to static water. The water-level indicator was decontaminated with a laboratory detergent solution and rinsed with deionized water before and after each well measurement. The water-level measurements collected were converted into elevations based on RI well survey data for the purpose

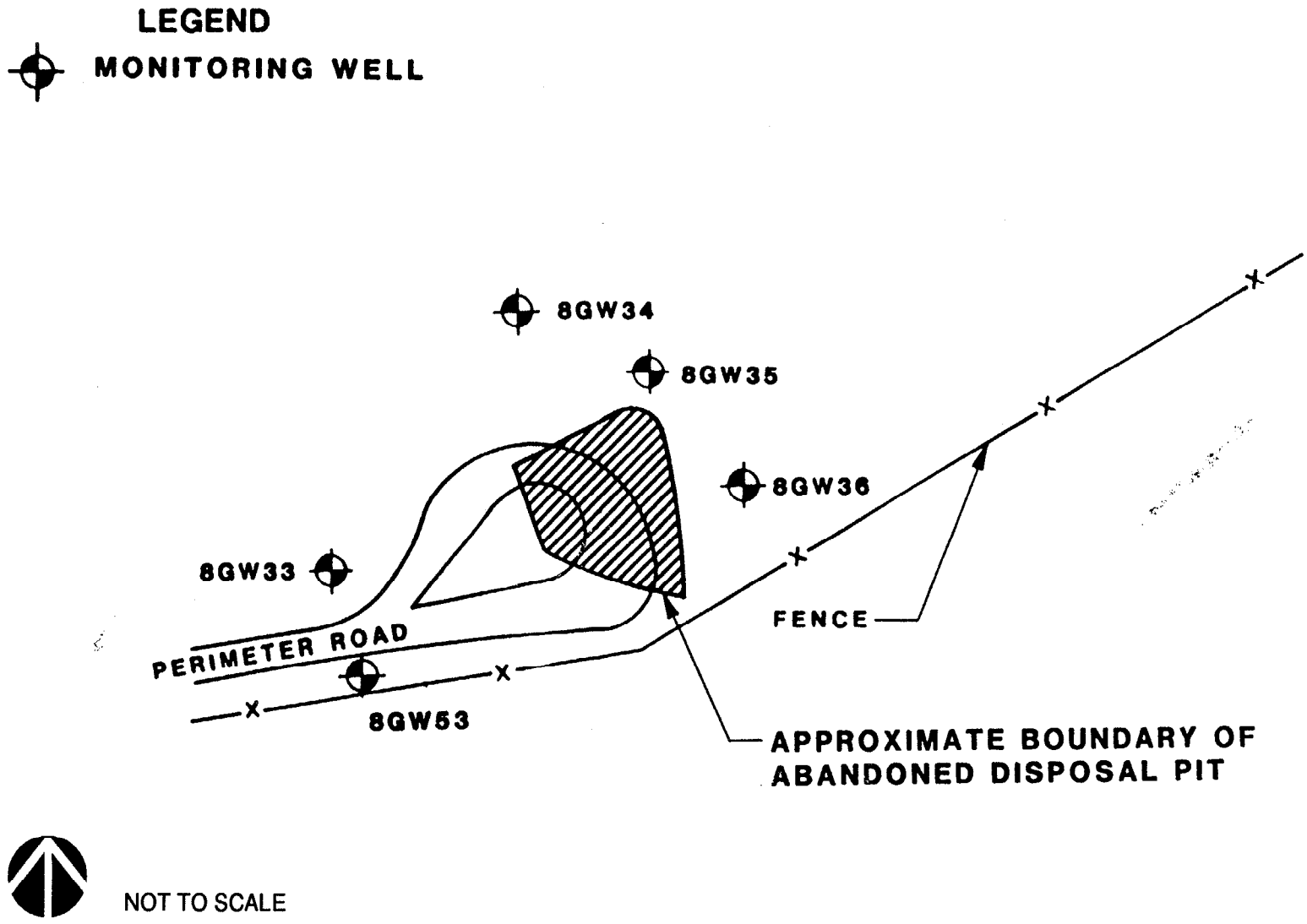

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FIGURE 3-1

SITE 8 – GROUNDWATER SAMPLING LOCATIONS

WHITE OAK, MARYLAND

NSWCWODET RI/FS

of developing a potentiometric surface contour map. Water level measurements and contour mapping were conducted in accordance with Halliburton NUS SOP GH-2.5. The results of water-level measurements are presented in Section 3.3 of this report.

Field measurements, including pH, temperature, and specific conductance, were recorded at the beginning, middle, and end of purging for each well, according to Halliburton NUS SOP SF-1.1. These measurements were taken to ensure that each well was adequately purged, and that samples would be representative of the groundwater regime.

3.2.2 Sampling Methods

One groundwater sample was collected from each of the five (5) existing monitoring wells at Site 8. In addition, one (1) field duplicate from well 8GW36 was collected and one (1) trip blank accompanied the volatile organic samples during shipment to the laboratory for quality assurance/quality control purposes. No equipment rinsate blanks or field blanks were required since dedicated disposable bailers and rope were used for both purging and sampling. All groundwater samples were collected in accordance with Halliburton NUS SOP SA-1.1. At least three well volumes were eventually purged from each well prior to sampling. Only Well 8GW53 was purged dry during the purging process. The water level in each well was allowed to recover to at least 70 percent prior to sample collection.

All purge water generated during the groundwater investigation was containerized in 55-gallon drums. The drums were marked as to their contents and origin. Purge water from background well 8GW53 was collected in a separate drum. Purge water from the four remaining wells was combined. As directed by the Navy, drums containing purge water were stored on pallets, covered with a tarp, and left at Site 8. Sampling, storage, and appropriate disposal of purge water are being managed by the Navy.

All sample collection, preservation, handling, shipment, and chain-of-custody procedures were in accordance with those specified in the Work Plan. Groundwater samples for VOC analysis were the first aliquots collected from each well. Both filtered and unfiltered samples were collected for metals analysis. Sample preservation and filtering in the field was done in accordance with Halliburton NUS SOP SF-1.2, Section 5.25. All pertinent field data were recorded on sample log sheets and in the field logbook.

3.2.3 Sample Locations

Groundwater samples were collected from each of the five existing monitoring wells at Site 8 (Figure 3-1). A total of six samples, including one duplicate sample, were collected during the sampling event. A trip blank accompanied the VOA sample bottles in order to check for possible cross-contamination of the samples. The sample numbers, collection times, and a description of each sampling location is presented in Table 3-1.

3.2.4 Laboratory Analysis

A total of six (6) groundwater samples, including one blind duplicate, were submitted for laboratory analysis. All groundwater samples were analyzed using the EPA Contract Laboratory Program (CLP) protocol for Target Compound List (TCL) volatiles and semivolatiles, PCBs, and Target Analyte List (TAL) total (unfiltered) and dissolved (filtered) metals. As specified by the Navy, analyses were not performed for cyanide or pesticides. One (1) trip blank, which accompanied the VOC samples during shipment, was also analyzed. The trip blank was analyzed for TCL volatile organics only. Field blanks and rinsate blanks were not collected since dedicated disposable bailers were used for groundwater sample acquisition.

All chemical analyses for the samples collected for this project were performed by Southwest Laboratory of Oklahoma, Inc., a NEESA-certified laboratory. Laboratory quality control complied with NEESA level D, which requires CLP methods and CLP deliverables. Criteria defining NEESA level D requirements are contained in "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-0478; 6/88).

3.2.5 Data Validation

Data validation is an essential and significant aspect of the data evaluation process. Validation of the data was done by Halliburton NUS chemists and consisted of a stringent review of each analytical chemical data package with respect to sample receipt and handling, analytical methods, data reporting, deliverables, document control for compliance with national and regional EPA guidance, and the NEESA program. All compounds were successfully analyzed according to specified methods. Some minor problems were encountered during the analysis which required that data qualifiers be assigned to a limited number of results. The data qualifiers assigned during validation are included in the complete analytical data tables presented in Appendices B and C of this report. A definition of each data qualifier is included at the end of each of these appendices.

TABLE 3-1

SAMPLE DESCRIPTIONS
SITE 8, NSWCWODET
WHITE OAK, MARYLAND

Sample Number	Time (4/7/93)	Description
8GW33-III-040793	1750	Groundwater sample from well 8GW33 located west of chemical waste pit.
8GW34-III-040793	1715	Groundwater sample from well 8GW34 located north of chemical waste pit.
8GW35-III-040793	1645	Groundwater sample from well 8GW35 located north of chemical waste pit.
8GW36-III-040793	1430	Groundwater sample from well 8GW36 located east of chemical waste pit.
8GW53-III-040793	1615	Groundwater sample from well 8GW53 located west-southwest of chemical waste pit.
8GW54-III-040793	1430	Duplicate of sample 8GW36-III-040793.
GWTB-III-040793	0900	Trip blank. Analyzed for volatile organic compounds only.

3.3 GROUNDWATER SAMPLING RESULTS

This section details the results of the third round of groundwater sampling and analysis for the Abandoned Chemical Disposal Pit, and includes a discussion of the sampling results, comparisons of data to available drinking water standards, and an assessment of groundwater flow direction.

3.3.1 Summary of Sampling Results

The organic constituents detected in the third round of groundwater sampling at Site 8 are summarized in Table 3-2. These analyses revealed the presence of two volatile organic compounds, chloroform and 1,1,2-trichloroethane, which are believed to be site-related contaminants. Chloroform was detected at a concentration of 12 μg/L in the sample from monitoring well 8GW35, and at an estimated concentration of 3 μg/L in well 8GW33. The compound 1,1,2-trichloroethane was detected in monitoring well 8GW36 at a concentration of 43 μg/L. Low concentrations of acetone and methylene chloride were detected in the trip blank. These are common laboratory contaminants and are believed to have been introduced during analysis.

Two semivolatile organic compounds, 1,3-dichlorobenzene and di-n-butylphthalate, were detected at low concentrations (2 μg/L or less) in groundwater samples. The compound 1,3-dichlorobenzene was detected in four of the five monitoring wells. Di-n-butylphthalate was detected only in well 8GW36 at extremely low concentrations. Bis(2-ethylhexyl)phthalate was also detected in groundwater samples from the site, but was determined to be a laboratory contaminant based on its presence in laboratory blanks. PCBs were not detected in any of the groundwater samples analyzed. The complete qualified analytical results for volatile organics, semivolatile organics, and PCBs are tabulated in Appendix B.

Analysis of the groundwater samples for inorganic constituents revealed the presence of a number of elements. The results of these analyses are summarized in Tables 3-3 and 3-4 for total and dissolved metals, respectively. Mercury, which has historically been a constituent of interest at the site, was not detected in filtered or unfiltered groundwater samples from any of the five monitoring wells. Appendix C includes the qualified analytical results for total and dissolved inorganic compounds.

3.3.2 Data Assessment

A detailed comparison of the third round of groundwater sampling results to the findings of previous site investigations is beyond the scope of this task. However, the analytical results were compared

TABLE 3-2
SUMMARY OF ORGANIC ANALYTICAL RESULTS (ug/L)
SITE 8, NSWCWODET
White Oak, Maryland

Parameter	MCL	MDL	8GW33	8GW34	8GW35	8GW36	8GW53	8GW54#	GWTB
Volatile Organics									
Choroform	100*	0.7	3 J	U	12	U	U	U	U
1,1,2-Trichloroethane	5	1.2	U	U	U	43	U	40	U
Methylene Chloride	5	1.8	U	3 B	U	U	U	U	2 J
Acetone	NA	7.1	U	8 B	8 B	U	U	U	15
Semivolatile Organics									
1,3-Dichlorobenzene	NA	0.6	2 J	1 J	U	2 J	2 J	2 J	---
Di-n-butylphthalate	NA	2.5	U	U	U	0.6 J	U	U	---
Bis(2-ethylhexyl)phthalate	6	1.9	3 B	1 B	4 B	3 B	6 B	3 B	---

MCL = Maximum Contaminant Level
MDL = Method Detection Limit
* = MCL for total trihalomethanes, including chloroform.
# = Duplicate of Sample 8GW36
J = Positive result, below contract-required quantitation
B = Blank contaminant; not considered present
U = Nondetect
--- = Not Analyzed

TABLE 3-3
SUMMARY OF TOTAL INORGANIC ANALYTICAL RESULTS (ug/L)
SITE 8, NSWCWODET
White Oak, Maryland

Parameter	MCL	SMCL	IDL	8GW33	8GW34	8GW35	8GW36	8GW53	8GW54#
Aluminum	NA	50-200	34	11300	5750	5160	1460	4750	1870
Antimony	6	NA	16	25.8 L(m)	U	U	U	U	U
Arsenic	50	NA	2	U	2.1 L(m,p)	U	U	U	U
Barium	2000	NA	9	219.0	64.0	136.0	44.2	81.7	44.7
Beryllium	4	NA	1	1.8 L(n)	U	1.5 L(n)	U	U	U
Cadmium	5	NA	3	U	U	U	U	3.6	U
Calcium		NA	230	5000	1670	3450	2520	5540	2570
Chromium	100	NA	6	19.9	11.6	9.0	U	10.8	U
Cobalt	NA	NA	6	13.8	8.5	29.7	10.7	23.4	9.2
Copper	1300+	1000	2	38.2	12.9	14.4	5.1	19.3	3.9
Iron	NA	300	8	22000 L(n)	9840 L(n)	4030 L(n)	1570 L(n)	7230 L(n)	2380 L(n)
Lead	15+	NA	2	14.2	8.0	8.0	3.0	10.1	4.6
Magnesium	NA	NA	193	6240	3580	5390	1950	2880	2100
Manganese	NA	50	2	910.0 L(n)	409.0 L(n)	1090.0 L(n)	383.0 L(n)	1340.0 L(n)	388.0 L(n)
Mercury	2	NA	0.2	U	U	U	U	U	U
Nickel	100	NA	27	32.6	U	U	U	U	U
Potassium	NA	NA	743	6940	4320	2760	1650	3100	1690
Selenium	50	NA	1	U	U	U	U	U	U
Silver	NA	100	2	U	3.2 B	U	U	3.4 B	U
Sodium	NA	NA	252	4050	2700	7740	4140	2630	4420
Thallium	2	NA	3	U	U	U	U	U	U
Vanadium		NA	6	23.5	8.8	15.8	U	7.7	U
Zinc	NA	5000	2	74.1	40.4	38.3	21.8	390.0	30.6

MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
IDL = Instrument Detection Limits
+ = Action level for tap water
# = Duplicate of Sample 8GW36
U = Value is a nondetect as reported by the laboratory
B = Positive result is considered to be an artifact of blank contamination, and should not be considered present
L(m,p) = Positive result is biased low due to low matrix spike and low PDS recovery
L (n) = Positive result is biased low due to negative concentrations reported in the laboratory blanks
L(m) = Positive result is biased low due to low matrix spike recovery

TABLE 3-4
SUMMARY OF DISSOLVED INORGANIC ANALYTICAL RESULTS (ug/L)
SITE 8, NSWCWODET
White Oak, Maryland

Parameter	MCL	SMCL	IDL	8GW33DS	8GW34DS	8GW35DS	8GW36DS	8GW53DS	8GW54DS
Aluminum	NA	50-200	34	230	216	272	211	183	220
Antimony	6	NA	16	U	U	U	U	U	U
Arsenic	50	NA	2	U	U	U	U	U	U
Barium	2000	NA	9	9.1	9.1	31.6	22.0	15.5	22.8
Beryllium	4	NA	1	U	U	U	U	U	U
Cadmium	5	NA	3	U	U	U	U	U	U
Calcium	NA	NA	230	1600	1230	1510	2250	2520	2230
Chromium	100	NA	6	U	U	U	U	U	U
Cobalt	NA	NA	6	U	U	U	U	U	U
Copper	1300	1000	2	U	U	U	9.8	U	U
Iron	NA	300	8	9.6 L(n)	U	9.8 L(n)	20.4 L(n)	U	U
Lead	15+	NA	2	U	U	1.1	U	U	U
Magnesium	NA	NA	193	980	842	2570	1520	883	1520
Manganese	NA	50	2	49.7 L(n)	17.3 L(n)	95.8 L(n)	83.4 L(n)	187.0 L(n)	88.9 L(n)
Mercury	2	NA	0.2	U	U	U	U	U	U
Nickel	100	NA	27	U	U	U	U	U	U
Potassium		NA	743	1550	1460	U	1270	1150	1160
Selenium	50	NA	1	U	U	U	U	U	U
Silver	NA	100	2	U	U	U	U	U	U
Sodium	NA	NA	252	3510	2620	7730	4570	2270	4390
Thallium	2	NA	3	U	U	U	U	U	U
Vanadium	NA	NA	6	U	U	U	U	U	U
Zinc	NA	5000	2	6.1	6.6	14.3	13.3	223.0	9.0

MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
IDL = Instrument Detection Limits
+ = Action level for tap water
# = Duplicate of Sample 8GW36
U = Value is a nondetect as reported by the laboratory
B = Positive result is considered to be an artifact of blank contamination, and should not be considered present
L(m,p) = Positive result is biased low due to low matrix spike and low PDS recovery
L (n) = Positive result is biased low due to negative concentrations reported in the laboratory blanks
L(m) = Positive result is biased low due to low matrix spike recovery

to available drinking water standards as a basis for evaluating the potential significance of the data obtained in the third round of groundwater sampling at Site 8.

Chemical-specific standards pertaining to groundwater quality have been established by the U.S. Environmental Protection Agency (EPA) for a limited number of constituents under the Safe Drinking Water Act (SDWA). Although these standards are only applicable to public water systems that serve at least 25 persons, they are often considered relevant when evaluating contaminants in water that could potentially be used for drinking water. Maximum Contaminant Levels (MCLs) are enforceable standards that take into consideration human health effects, available treatment technologies, and treatment costs. On the other hand, Secondary MCLs (SMCLs) are based on aesthetics (e.g., taste, odor) rather than on toxic effects. SMCLs are merely guidelines which are not legally enforceable.

The available MCLs and SMCLs for analytes detected in Round III sampling are presented in the respective data summary tables (Tables 3-2, 3-3, and 3-4). As shown in Table 3-2, the concentration of 1,1,2-trichloroethane in well 8GW36 (43 μg/l) exceeds the MCL of 5 μg/l. The concentrations of other organic constituents were lower than their corresponding MCLs.

In the filtered metals samples, no inorganic constituents exceeded the MCLs (Table 3-4). However, the antimony concentration in the unfiltered sample from well 8GW33 did exceed the MCL (Table 3-3). The SMCLs for aluminum and magnesium were exceeded in several of the filtered samples, and these constituents in addition to iron exceeded the SMCLs in the unfiltered samples. Comparison of the results of the total and filtered inorganic analysis indicate that most of the inorganics present in the groundwater are associated with particulates greater than 0.45 microns in size.

3.3.3 Hydrogeologic Assessment

Static water levels were measured in all five monitoring wells in the vicinity of the Abandoned Chemical Disposal Pit prior to groundwater sampling. The depth-to-water measurements were recorded to the nearest 0.01 foot from reference points corresponding to the surveyed top of PVC casing. These measurements were conducted after the well caps had been removed in order to equalize pressures, but prior to any purging or sampling. Water level measurements for all wells were obtained within one hour. These water level measurements are reported in Table 3-5.

The water levels measured during this investigation were significantly higher than those reported in the Phase II RI report. Water levels in the five monitoring wells ranged from 7.87 feet to 12.80 feet higher than the levels measured in corresponding wells during the August 1991 sampling round. It is

TABLE 3-5

WATER LEVEL MEASUREMENTS
SITE 8, NSWCWODET
WHITE OAK, MARYLAND
APRIL 7, 1993

Well Number	Time (4/7/93)	Reference (TPVC) Elevation (feet MSL)	Water-Level Indicator Reading (feet)	Groundwater Elevation (feet MSL)
8GW33	0940	286.36	27.91	258.45
8GW34	0935	279.44	20.83	258.61
8GW35	0930	278.46	18.69	259.77
8GW36	0920	278.97	19.57	259.40
8GW53	0900	282.26	24.33	257.93

important to note that immediately preceding the third round of groundwater sampling at the site, there had been heavy precipitation over the region during the months of February and March. This precipitation appears to have caused a flux of recharge to the groundwater, resulting in the substantially higher water levels, compared with earlier phases of the RI.

All Site 8 monitoring wells are screened primarily in the saprolitic facies of the Wissahickon Formation (Malcolm Pirnie, Inc. 1991). Four of the PVC monitoring wells (8GW33-8GW36) have 30-foot screens that normally straddle the water table. However, one of these wells (8GW34) had water levels above the top of screen on the date the Round III groundwater sampling was performed (April 7, 1993). The fifth monitoring well at Site 8 (8GW53) has a 10-foot screen. On the date of sampling, the top of the screen for Well 8GW53 was 2.65 feet below the water level. Since Site 8 is situated on a topographically high tract of the NSWCWODET, the area surrounding the site is expected to be a recharge zone to the shallow surface aquifer from direct infiltration. The horizontal groundwater flow directions typically reflect the topography in a radial pattern emanating from the center of the water surface high point. The vertical variance of water table elevations at Site 8 (based on April 7, 1993 measurements) was 1.84 feet (259.77-257.93 feet above mean sea level) (Table 3-5). Water table elevations obtained during other phases of the RI reflected a slightly greater variance, and therefore a more pronounced gradient.

Figure 3-2 shows the water table elevations (based on measurements made on April 7, 1993) in a plan view with respect to the approximate well locations. The elevations are contoured at 0.5-foot intervals to give an interpretation of the water table surface and corresponding flow directions which are perpendicular to the contour lines of equal elevation. The map reflects at least a temporary reversal in groundwater flow direction under the site from those previously reported in the RI. This is not unexpected since radial flow is suspected in the area, and with seasonally high water table elevations even subtle shifts in the groundwater high could reflect temporary reversals in flow direction on a localized basis. However, the water table map is not drawn to scale, since horizontal survey data is not available for Site 8. Therefore, quantitative analyses of groundwater gradients cannot be adequately determined.

Radial flow has been confirmed by water level measurements obtained during this third round of water level measurements. It appears that the Site 8 vicinity is sensitive to seasonal variations in the groundwater table. No other hydrogeologic investigations were conducted during the groundwater sampling investigation conducted by Halliburton NUS.

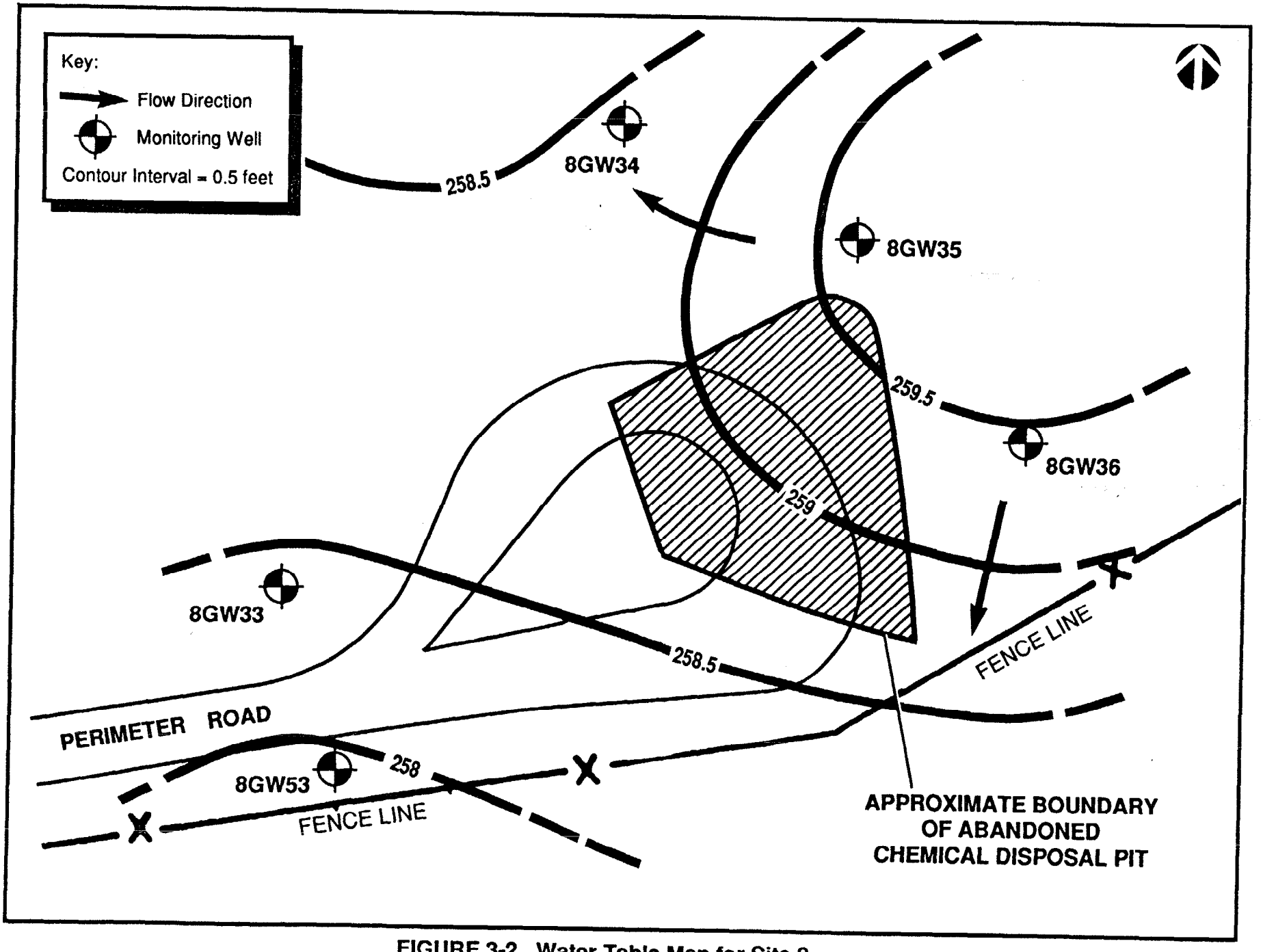

FIGURE 3-2. Water Table Map for Site 8

4.0 SUMMARY AND CONCLUSIONS

This report presents the results of a third round of groundwater sampling and analysis conducted by Halliburton NUS at the Abandoned Chemical Disposal Pit (Site 8) of the Naval Surface Warfare Center (NSWS), White Oak Detachment, in Silver Spring, Maryland. The purpose of the investigation was to provide confirmation of potential groundwater contamination in five existing monitoring wells in the immediate vicinity of the Abandoned Chemical Disposal Pit. The specific objective of this investigation was to determine the presence and levels of volatile organics, semivolatile organics, polychlorinated biphenyls (PCBs), and metals in groundwater in the vicinity of the site.

The Navy requested that Halliburton NUS conduct a third round of groundwater sampling to confirm the results of previous investigations, and to provide additional analytical data for mercury and semivolatile organics. The laboratory data for these analytes, collected under the Phase II RI, were rejected due to quality assurance/quality control (QA/QC) deficiencies. The data from this third round of groundwater sampling and analysis will be used by the Navy in conjunction with previously collected data to evaluate the need for remedial action at the site, and to evaluate potential remedial options during the FS.

On April 7, 1993, Halliburton NUS collected groundwater samples from five monitoring wells at the Abandoned Chemical Waste Disposal Pit (Site 8). The samples were analyzed for the presence of TCL volatiles and semivolatiles, PCBs, and TAL total (unfiltered) and dissolved (filtered) metals. Analyses were not performed for cyanide or pesticides.

Only 1,1,2-trichloroethane and antimony were detected at Site 8 above health-based drinking water standards. The 1,1,2-trichloroethane was only detected in well 8GW36, the closest well to the property line on the southeast side of Site 8. Antimony was only detected in the unfiltered sample from well 8GW33, which is located north of Perimeter Road. The antimony in this well is associated with particulates over 0.45 microns in size.

The water level measurements taken at Site 8 suggest that a radial groundwater flow pattern exists nearby. Off-site water level measurements from one or more locations outside the cluster of Site 8 wells and beyond the facility boundary would be useful in confirming the existence of a radial flow pattern in the vicinity of the site. In addition, the apparent seasonal variation of groundwater flow direction indicates the need for water level measurements at different times of year to determine the predominant flow direction and gradient.

REFERENCES

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APPENDIX A

ANALYTICAL DATA TABLES - RI PHASES I AND II
NSWC - WHITE OAK
ABANDONED CHEMICAL DISPOSAL PIT
SITE 8

(SOURCE: MALCOLM PIRNIE, INC., 1992)

SITE 8 - ABANDONED CHEMICAL DISPOSAL PIT
SURFICIAL SOIL ANALYTICAL RESULTS
(Phase I - 1989)

Parameter	Sample Locations		Detection Limit	Units
	8SL1	8SL2		
METALS:				
Cadmium	U	U	0.78	mg/kg
Chromium	14.6	58.5	0.70	mg/kg
Copper	7.7	12.4	0.30	mg/kg
Lead	30.0	57.2	3.60	mg/kg
Mercury	U	U	0.15	mg/kg
Zinc	28.1	47.7	0.50	mg/kg
SEMIVOLATILE ORGANICS:				
Benzoic Acid	U	280 JX	2,500	ug/kg

Notes: U - Not detected.
J - Compound is present but below the detection limit.
X - EPA CLP criteria not met for confirmation but compound is present.

Source: Malcolm Pirnie, Inc., 1992.

28-May-92

SITE 8 - ABANDONED CHEMICAL DISPOSAL PIT
GROUNDWATER ANALYTICAL RESULTS

(Phase I - 1989)

Parameter	Sample Locations					Detection Limit	Units
	8GW33	8GW34	8GW35	8GW36	8GW53		
TOTAL METALS:							
Cadmium	U	U	U	U	U	5.0	ug/l
Chromium	395.0	162.0	381.0	344.0	462.0	7.0	ug/l
Copper	505.0	167.0	357.0	269.0	452.0	3.0	ug/l
Lead	106.0	57.3	102.0	101.0	123.0	28.0	ug/l
Mercury	4.5	0.51	U	U	U	0.20	ug/l
Zinc	1,280.0	385.0	910.0	876.0	1,350.0	3.0	ug/l
FILTERED METALS:							
Cadmium	U	2.7	U	U	U	5.0	ug/l
Chromium	U	U	U	U	U	7.0	ug/l
Copper	U	U	U	U	U	3.0	ug/l
Lead	U	U	U	U	U	28.0	ug/l
Mercury	U	U	U	U	U	0.20	ug/l
Zinc	16.8	24.3	18.2	18.1	37.6	3.0	ug/l
pH	8.30	4.80	5.10	4.80	6.00	--	su
TOC	1,700	600	1,100	1,100	500	500	ug/l
TOX	8	18	11	U	--	8	ug/l
TDS	U	U	U	22	U	20	mg/l
TSS	14,800	3,920	9,410	9,000	11,100	4	mg/l
VOLATILE ORGANICS:							
Chloroform	U	U	10	U	U	5	ug/l
1,1,2-Trichloroethane	U	U	U	7	U	5	ug/l
SEMIVOLATILE ORGANICS:							
bis(2-ethylhexyl)phthalate	19	U	13	7 J	15	10	ug/l

Notes: U - Not detected.
J - Compound is present but below the detection limit.

03-Jun-92

Source: Malcolm Pirnie, Inc., 1992.

BACKGROUND WELLS
GROUNDWATER ANALYTICAL RESULTS
(Phase I - 1989)

Parameter	Sample Locations		Detection Limit	Units
	BGW16	BGW40		
TOTAL METALS:				
Cadmium	7.6	U	3.0	ug/l
Chromium	213.0	97.2	7.0	ug/l
Copper	135.0	50.5	3.0	ug/l
Lead	51.9	50.7	28.0	ug/l
Mercury	1.2	U	0.20	ug/l
Zinc	101.0	244.0	3.0	ug/l
Chromium VI	U	U	10.0	ug/l
FILTERED METALS:				
Cadmium	4.3	U	3.0	ug/l
Chromium	U	U	7.0	ug/l
Copper	U	U	3.0	ug/l
Lead	U	U	28.0	ug/l
Mercury	U	U	0.20	ug/l
Zinc	34.4	36.2	3.0	ug/l
Chromium VI	U	U	10.0	ug/l
pH	4.70	4.60	—	su
TOC	12,500	1,100	500	ug/l
TOX	U	11	8	ug/l
TDS	116	150	20	mg/l
TSS	5,150	2,920	4	mg/l
VOLATILE ORGANICS:	U	U	—	ug/l
SEMIVOLATILE ORGANICS:	U	U	—	ug/l

Note: U - Not detected.

Source: Malcolm Pirnie, Inc., 1992.

08-Jun-92

SITE 8 - ABANDONED CHEMICAL DISPOSAL PIT
GROUNDWATER ANALYTICAL RESULTS
(PHASE II - 1991)

Parameter	Sample Locations					Detection Limit	Units
	8GW33	8GW34	8GW35	8GW36	8GW53		
TOTAL METALS:							
Cadmium	U	U	U	5.0	U	5.0	ug/l
Chromium	63	U	U	2.9	U	10	ug/l
Copper	131	51	15	53	36	25	ug/l
Lead	29	6.9	5.2	8.2	2.5	3	ug/l
Mercury	R	R	R	R	R	0.2	ug/l
Zinc	159	17	42	165	27	20	ug/l
FILTERED METALS:							
Cadmium	U	U	U	U	U	5.0	ug/l
Chromium	U	U	U	U	U	10	ug/l
Copper	45	U	11	20	U	25	ug/l
Lead	7.3	U	U	U	U	3	ug/l
Mercury	R	R	R	R	R	0.2	ug/l
Zinc	31	138	39	60	51	20	ug/l
PCBs (1)	U	U	U	U	U	1.0	ug/l
VOLATILE ORGANICS:							
Chloroform	U	U	8	U	U	5	ug/l
1,1,2-Trichloroethane	U	U	U	4	U	5	ug/l
Methylene Chloride	10	13	U	U	U	5	ug/l
Acetone	R	R	U	U	U	10	ug/l
SEMIVOLATILES:							
bis(2-ethylhexyl)phthalate	R	R	R	R	R	10	ug/l

NOTES: (1) The PCB compound for which values are given here is AR1260.
U - Not detected.
R - Quantitation Rejected

Source: Malcolm Pirnie, Inc., 1992.

18-May-92

BACKGROUND WELLS
GROUNDWATER ANALYTICAL RESULTS
(PHASE II - 1991)

Parameter	Sample Locations		Detection Limit	Units
	BGW16	BGW40		
TOTAL METALS:				
Cadmium	U	U	5	ug/l
Chromium	109	U	10	ug/l
Copper	190	35	25	ug/l
Lead	47	3.4	3	ug/l
Mercury	R	R	0.2	ug/l
Zinc	101	26	20	ug/l
FILTERED METALS:				
Cadmium	U	U	5	ug/l
Chromium	U	U	10	ug/l
Copper	U	11	25	ug/l
Lead	U	U	3	ug/l
Mercury	R	R	0.2	ug/l
Zinc	13	17	20	ug/l
PCBs (1)	U	U	1.0	ug/l
NITROAROMATICS:				
RDX	U	R	1.6	ug/l
VOLATILE ORGANICS:	U	U	5	ug/l
SEMIVOLATILE ORGANICS:	U	U	10	ug/l

NOTES: (1) The PCB compound for which values are given is AR1260
U Not detected above method detection limit
R - Quantitation Rejected

Source: Malcolm Pirnie, Inc., 1992.

APPENDIX B

QUALIFIED ORGANIC ANALYTICAL RESULTS (INCLUDING TIC'S) FROM ROUND III SAMPLING

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TCL AQUEOUS VOLATILES (ug/L)

Trip Blank

CLIENT ID:		GW33		GW34		GW35		GW36		GW53		GW54		GWTB-111	
LAB ID:		13177.09		13177.07		13177.05		13177.03		13177.01		13177.11		13177.18	
ANALYTE	CRDL														
CHLOROMETHANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
BROMOMETHANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROETHANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	10	U	3	B	10	U	10	U	10	U	10	U	2	J
ACETONE	10	10	U	8	B	8	B	10	U	10	U	10	U	15	
CARBON DISULFIDE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROFORM	10	3	J	10	U	12		10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-BUTANONE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
BROMODICHLOROMETHAN	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPI	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
DIBROMOCHLOROMETHAN	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	10	U	10	U	10	U	43		10	U	40		10	U
BENZENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPF	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
BROMOFORM	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANON	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-HEXANONE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETH	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
TOLUENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROBENZENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
STYRENE	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
XYLENES(TOTAL)	10	10	U	10	U	10	U	10	U	10	U	10	U	10	U
DILUTION FACTOR:		1.0		1.0		1.0		1.0		1.0		1.0		1.0	

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TCL AQUEOUS SEMIVOLATILES (ug/L)

CLIENT ID:		GW33		GW34		GW35		GW36		GW53		GW54	
LAB ID:		13177.09		13177.07		13177.05		13177.03		13177.01		13177.11	
ANALYTE	CRDL												
PHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
Bis(2-CHLOROETHYL)ETHER	10	10	U	10	U	11	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	2	J	1	J	11	U	2	J	2	J	2	J
1,4-DICHLOROBENZENE	10	10	U	10	U	11	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	10	U	10	U	11	U	10	U	10	U	10	U
2-METHYLPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
2,2'-OXYBIS(1-CHLOROPROPANI	10	10	U	10	U	11	U	10	U	10	U	10	U
4-METHYLPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
N-NITROSO-DI-N-PROPYLAMIN	10	10	U	10	U	11	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	10	U	10	U	11	U	10	U	10	U	10	U
NITROBENZENE	10	10	U	10	U	11	U	10	U	10	U	10	U
ISOPHORONE	10	10	U	10	U	11	U	10	U	10	U	10	U
2-NITROPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
Bis(2-CHLOROETHOXY)METHANE	10	10	U	10	U	11	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	10	U	10	U	11	U	10	U	10	U	10	U
NAPHTHALENE	10	10	U	10	U	11	U	10	U	10	U	10	U
4-CHLOROANILINE	10	10	U	10	U	11	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	10	U	10	U	11	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	10	U	10	U	11	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	10	U	10	U	11	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	10	U	10	U	11	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	25	U	25	U	27	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	10	U	10	U	11	U	10	U	10	U	10	U
2-NITROANILINE	25	25	U	25	U	27	U	25	U	25	U	25	U
DIMETHYLPHTHALATE	10	10	U	10	U	11	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	10	U	10	U	11	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	10	U	10	U	11	U	10	U	10	U	10	U
3-NITROANILINE	25	25	U	25	U	27	U	25	U	25	U	25	U
ACENAPHTHENE	10	10	U	10	U	11	U	10	U	10	U	10	U

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TCL AQUEOUS SEMIVOLATILES (ug/L)

CLIENT ID:		GW33		GW34		GW35		GW36		GW53		GW54	
LAB ID:		13177.09		13177.07		13177.05		13177.03		13177.01		13177.11	
ANALYTE	CRDL												
2,4-DINITROPHENOL	25	25	U	25	U	27	U	25	U	25	U	25	U
4-NITROPHENOL	25	25	U	25	U	27	U	25	U	25	U	25	U
DIBENZOFURAN	10	10	U	10	U	11	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	10	U	10	U	11	U	10	U	10	U	10	U
DIETHYLPHTHALATE	10	10	U	10	U	11	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYLETHI	10	10	U	10	U	11	U	10	U	10	U	10	U
FLUORENE	10	10	U	10	U	11	U	10	U	10	U	10	U
4-NITROANILINE	25	25	U	25	U	27	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	25	U	25	U	27	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMINE	10	10	U	10	U	11	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYLETHE	10	10	U	10	U	11	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	10	U	10	U	11	U	10	U	10	U	10	U
PENTACLOROPHENOL	25	25	U	25	U	27	U	25	U	25	U	25	U
PHENANTHRENE	10	10	U	10	U	11	U	10	U	10	U	10	U
ANTHRACENE	10	10	U	10	U	11	U	10	U	10	U	10	U
CARBAZOLE	10	10	U	10	U	11	U	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	10	10	U	10	U	11	U	0.6	J	10	U	10	U
FLUORANTHENE	10	10	U	10	U	11	U	10	U	10	U	10	U
PYRENE	10	10	U	10	U	11	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	10	U	10	U	11	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	10	U	10	U	11	U	10	U	10	U	10	U
BENZO(A)ANTHRACENE	10	10	U	10	U	11	U	10	U	10	U	10	U
CHRYSENE	10	10	U	10	U	11	U	10	U	10	U	10	U
Bis(2-ETHYLHEXYL)PHTHALATE	10	3	B	1	B	4	B	3	B	6	B	3	B
DI-N-OCTYLPHTHALATE	10	10	U	10	U	11	U	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	10	10	U	10	U	11	U	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	10	10	U	10	U	11	U	10	U	10	U	10	U
BENZO(A)PYRENE	10	10	U	10	U	11	U	10	U	10	U	10	U
INDENO(1,2,3-CD)PYRENE	10	10	U	10	U	11	U	10	U	10	U	10	U
DIBENZ(A,H)ANTHRACENE	10	10	U	10	U	11	U	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE	10	10	U	10	U	11	U	10	U	10	U	10	U
DILUTION FACTOR:		1.0		1.0		1.0		1.0		1.0		1.0	

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TCL AQUEOUS PCBS (ug/L)

CLIENT ID:		GW33		GW34		GW35		GW36		GW53		GW54	
LAB ID:		13177.09		13177.07		13177.05		13177.03		13177.01		13177.11	
ANALYTE	CRDL												
AROCLOR-1016	1.0	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)
AROCLOR-1221	2.0	2.0	UL(s)	2.0	UL(s)	2.0	UL(s)	2.0	UL(s)	2.0	UL(s)	2.0	UL(s)
AROCLOR-1232	1.0	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)
AROCLOR-1242	1.0	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)
AROCLOR-1248	1.0	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)
AROCLOR-1254	1.0	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)
AROCLOR-1260	1.0	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)	1.0	UL(s)
DILUTION FACTOR:		1.0		1.0		1.0		1.0		1.0		1.0	

Summary of Tentatively Identified Compounds (TICs)
Remaining After Data Qualification

Fraction	Named TIC
Volatile	Unknown(s) Unknown alkane
Semivolatile	None

Data Qualifier Key:

U	-	Value is a nondetect as reported by the laboratory.
B	-	Positive result is considered to be an artifact of blank contamination, and should not be considered present.
UL(s)	-	Nondetected result is considered to be bias low based on low surrogate recovery.
J	-	Positive result reported at concentration level below that of its CRQL.

APPENDIX C

QUALIFIED INORGANIC ANALYTICAL RESULTS FROM ROUND III SAMPLING

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TAL AQUEOUS INORGANICS (ug/L)

CLIENT ID:			GW33		GW34		GW35		GW36		GW53	
LAB ID:			1317709		1317707		1317705		1317703		1317701	
ANALYTE	CRDL	IDL										
ALUMINUM	200.0	79.0	11300		5750		5160		1460		4750	
ANTIMONY	60.0	24.0	25.8	L(m)	24.0	UL(m)	24.0	UL(m)	24.0	UL(m)	24.0	UL(m)
ARSENIC	10.0	2.0	2.0	UL(m)	2.1	L(m,p)	2.0	UL(m,p)	2.0	UL(m)	2.0	UL(m)
BARIUM	200.0	8.0	219.0		64.0		136.0		44.2		81.7	
BERYLLIUM	5.0	1.0	1.8	L(n)	1.0	UL(n)	1.5	L(n)	1.0	UL(n)	1.0	UL(n)
CADMIUM	5.0	2.0	2.0	U	2.0	U	2.0	U	2.0	U	3.6	
CALCIUM	5000.0	246.0	5000		1670		3450		2520		5540	
CHROMIUM	10.0	4.0	19.9		11.6		9.0		4.0	U	10.8	
COBALT	50.0	5.0	13.8		8.5		29.7		10.7		23.4	
COPPER	25.0	3.0	38.2		12.9		14.4		5.1		19.3	
IRON	100.0	8.0	22000	L(n)	9840	L(n)	4030	L(n)	1570	L(n)	7230	L(n)
LEAD	3.0	1.0	14.2		8.0		8.0		3.0		10.1	
MAGNESIUM	5000.0	149.0	6240		3580		5390		1950		2880	
MANGANESE	15.0	2.0	910.0	L(n)	409.0	L(n)	1090.0	L(n)	383.0	L(n)	1340.0	L(n)
MERCURY	0.2	0.2	0.20	UJ(d)	0.20	UJ(d)	0.20	UJ(d)	0.20	UJ(d)	0.20	UJ(d)
NICKEL	40.0	27.0	32.6		27.0	U	27.0	U	27.0	U	27.0	U
POTASSIUM	5000.0	888.0	6940		4320		2760		1650		3100	
SELENIUM	5.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
SILVER	10.0	3.0	3.0	UL(n)	3.2	B	3.0	UL(n)	3.0	UL(n)	3.4	B
SODIUM	5000.0	442.0	4050		2700		7740		4140		2630	
THALLIUM	10.0	2.0	2.0	U	2.0	U	2.0	UL(p)	2.0	UL(p)	2.0	U
VANADIUM	50.0	4.0	23.5		8.8		15.8		4.0	U	7.7	
ZINC	20.0	3.0	74.1		40.4		38.3		21.8		390.0	

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TAL AQUEOUS INORGANICS (ug/L)

CLIENT ID:			GW54	
LAB ID:			1317711	
ANALYTE	CRDL	IDL		
ALUMINUM	200.0	79.0	1870	
ANTIMONY	60.0	24.0	24.0	UL(m)
ARSENIC	10.0	2.0	2.0	UL(m)
BARIUM	200.0	8.0	44.7	
BERYLLIUM	5.0	1.0	1.0	UL(n)
CADMIUM	5.0	2.0	2.0	U
CALCIUM	5000.0	246.0	2570	
CHROMIUM	10.0	4.0	4.0	U
COBALT	50.0	5.0	9.2	
COPPER	25.0	3.0	3.9	
IRON	100.0	8.0	2380	L(n)
LEAD	3.0	1.0	4.6	
MAGNESIUM	5000.0	149.0	2100	
MANGANESE	15.0	2.0	388.0	L(n)
MERCURY	0.2	0.2	0.20	UJ(d)
NICKEL	40.0	27.0	27.0	U
POTASSIUM	5000.0	888.0	1690	
SELENIUM	5.0	3.0	3.0	U
SILVER	10.0	3.0	3.0	UL(n)
SODIUM	5000.0	442.0	4420	
THALLIUM	10.0	2.0	2.0	U
VANADIUM	50.0	4.0	4.0	U
ZINC	20.0	3.0	30.6	

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TAL AQUEOUS DISSOLVED INORGANICS (ug/L)

CLIENT ID:			GW33DS		GW34DS		GW35DS		GW36DS		GW53DS	
LAB ID:			1317710		1317708		1317706		1317704		1317702	
ANALYTE	CRDL	IDL										
ALUMINUM	200.0	79.0	230		216		272		211		183	
ANTIMONY	60.0	24.0	24.0	U	24.0	U	24.0	U	24.0	U	24.0	U
ARSENIC	10.0	2.0	2.0	U	2.0	UL(p)	2.0	U	2.0	U	2.0	U
BARIUM	200.0	8.0	9.1		9.1		31.6		22.0		15.5	
BERYLLIUM	5.0	1.0	1.0	UL(n)	1.0	UL(n)	1.0	UL(n)	1.0	UL(n)	1.0	UL(n)
CADMIUM	5.0	2.0	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
CALCIUM	5000.0	246.0	1600		1230		1510		2250		2520	
CHROMIUM	10.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
COBALT	50.0	5.0	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
COPPER	25.0	3.0	3.0	U	3.0	U	3.0	U	9.8		3.0	U
IRON	100.0	8.0	9.6	L(n)	8.0	UL(n)	9.8	L(n)	20.4	L(n)	8.0	UL(n)
LEAD	3.0	1.0	1.0	U	1.0	U	1.1		1.0	U	1.0	U
MAGNESIUM	5000.0	149.0	980		842		2570		1520		883	
MANGANESE	15.0	2.0	49.7	L(n)	17.3	L(n)	95.8	L(n)	83.4	L(n)	187.0	L(n)
MERCURY	0.2	0.2	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
NICKEL	40.0	27.0	27.0	U	27.0	U	27.0	U	27.0	U	27.0	U
POTASSIUM	5000.0	888.0	1550		1460		888	U	1270		1150	
SELENIUM	5.0	3.0	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
SILVER	10.0	3.0	3.0	UL(n)	3.0	UL(n)	3.0	UL(n)	3.0	UL(n)	3.0	UL(n)
SODIUM	5000.0	442.0	3510		2620		7730		4570		2270	
THALLIUM	10.0	2.0	2.0	U	2.0	UL(p)	2.0	UL(p)	2.0	U	2.0	U
VANADIUM	50.0	4.0	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
ZINC	20.0	3.0	6.1		6.6		14.3		13.3		223.0	

CLEAN CTO 111
NSWC WHITEOAK, WHITEOAK, MARYLAND
SOUTHWEST LABORATORY OF OKLAHOMA

TAL AQUEOUS DISSOLVED INORGANICS (ug/L)

CLIENT ID:			GW54DS	
LAB ID:			1317715	
ANALYTE	CRDL	IDL		
ALUMINUM	200.0	79.0	220	
ANTIMONY	60.0	24.0	24.0	U
ARSENIC	10.0	2.0	2.0	U
BARIUM	200.0	8.0	22.8	
BERYLLIUM	5.0	1.0	1.0	UL(n)
CADMIUM	5.0	2.0	2.0	U
CALCIUM	5000.0	246.0	2230	
CHROMIUM	10.0	4.0	4.0	U
COBALT	50.0	5.0	5.0	U
COPPER	25.0	3.0	3.0	U
IRON	100.0	8.0	8.0	UL(n)
LEAD	3.0	1.0	1.0	U
MAGNESIUM	5000.0	149.0	1520	
MANGANESE	15.0	2.0	88.9	L(n)
MERCURY	0.2	0.2	0.20	U
NICKEL	40.0	27.0	27.0	U
POTASSIUM	5000.0	888.0	1160	
SELENIUM	5.0	3.0	3.0	U
SILVER	10.0	3.0	3.0	UL(n)
SODIUM	5000.0	442.0	4390	
THALLIUM	10.0	2.0	2.0	U
VANADIUM	50.0	4.0	4.0	U
ZINC	20.0	3.0	9.0	

Data Qualifier Key:

U	-	Value is a nondetect as reported by the laboratory.
B	-	Positive result is considered to be an artifact of blank contamination, and should not be considered present.
L(m,p)	-	Positive result is biased low due to low matrix spike and low PDS recovery.
UL(m,p)	-	Nondetect is biased low due to low matrix spike recovery and low PDS recovery.
L(n)	-	Positive result is biased low due to negative concentrations reported in the laboratory blanks.
L(m)	-	Positive result is biased low due to low matrix spike recovery.
UL(n)	-	Nondetect is biased low due to negative concentrations reported in the laboratory blanks.
UL(m)	-	Nondetect is biased low due to low matrix spike recovery.
UJ(d)	-	Nondetect is estimated as a result of laboratory duplicate imprecision.
UL(p)	-	Nondetect is biased low as a result of low PDS recovery.