Supplemental Site Investigation Report

For

Tanks 42, 45, and 48
Tank Farm 4

Naval Station Newport
Newport, Rhode Island

Northern Division
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298
Contract Task Order 0143

September 1999

TETRA TECH NUS, INC.

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SUPPLEMENTAL SITE INVESTIGATION REPORT
FOR

TANKS 42, 45, AND 48
TANK FARM 4

NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Environmental Branch, Code 1812BJH
Naval Facilities Engineering Command
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"CLEAN" Contract Task Order No. 0143

September 1999

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STATEMENT OF ACCURACY

As required by the Rhode Island Department of Environmental Management Regulations for Underground Storage Facilities used for Petroleum Products and Hazardous Materials (DEM DWM-UST05-93) Section 14.12 (B) (1), effective December 30, 1993, the undersigned (author) certifies that information presented in this Supplemental Site Investigation Report for Tank 42 (FACID-3644TNO-42), Tank 45 (FACID-3644TNO-45), and Tank 48 (FACID-3644TNO-48), Tank Farm 4 at Naval Station Newport in Newport, Rhode Island, is accurate to the degree specified in this report, the Tanks 38, 42, 45, and 48 Site Investigation Report (Brown & Root Environmental 4/96), and Work Plan Addendum 4 (Brown & Root Environmental 10/96).

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STATEMENT OF ACCURACY

As required by the Rhode Island Department of Environmental Management Regulations for Underground Storage Facilities used for Petroleum Products and Hazardous Materials (DEM DWM-UST05-93) Section 14.12 (B) (2), effective December 30, 1993, the undersigned (facility owner/operator representative) certifies that information presented in this Supplemental Site Investigation Report for Tank 42 (FACID-3644TNO-42), Tank 45 (FACID-3644TNO-45), and Tank 48 (FACID-3644TNO-48), Tank Farm 4 at Naval Station Newport in Newport, Rhode Island, is accurate to the degree specified in this report, the Tanks 38, 42, 45, and 48 Site Investigation Report (Brown & Root Environmental 4/96), and Work Plan Addendum 4 (Brown & Root Environmental 10/96).

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TABLE OF CONTENTS

SECTION			PAGE
1.0	**INTRODUCTION**		1-1
	1.1	AUTHORIZATION	1-1
	1.2	OBJECTIVES AND SCOPE	1-1
	1.3	REPORT ORGANIZATION	1-2
2.0	**BACKGROUND**		2-1
	2.1	TANK FARM 4 LOCATION, FEATURES, AND HISTORY	2-1
	2.2	PREVIOUS INVESTIGATIONS	2-6
	2.3	TANKS 42, 45, AND 48 SITE INVESTIGATIONS	2-6
	2.4	TANK CLOSURE ACTIVITIES	2-7
	2.5	TANK DEMOLITION ACTIVITIES	2-9
	2.6	MONITORING WELL INVENTORY	2-10
	2.7	TANK 50 PILOT STUDY	2-10
3.0	**GEOLOGY, HYDROGEOLOGY, AND WATER RESOURCES**		3-1
	3.1	REGIONAL GEOLOGY	3-1
	3.1.1	Regional Bedrock Geology	3-1
	3.1.2	Regional Surficial Geology	3-2
	3.2	SITE GEOLOGY - SOIL AND BEDROCK CONDITIONS AT TANK FARM 4	3-2
	3.2.1	Surficial Deposits	3-2
	3.2.2	Bedrock	3-2
	3.3	HYDROGEOLOGY	3-3
	3.3.1	Interpretive Water Table Map	3-3
	3.3.2	Hydraulic Conductivity Measurements	3-3
	3.3.3	Horizontal Hydraulic Gradients	3-6
	3.4	GROUNDWATER RESOURCES AND POTENTIAL RECEPTORS	3-6
	3.4.1	Site Wellhead Protection Status	3-7
	3.4.2	Site Groundwater Classification	3-7
	3.4.3	Potential Receptors	3-7
4.0	**TANK 42 – SUPPLEMENTAL SITE INVESTIGATION**		4-1
	4.1	FIELD INVESTIGATION ACTIVITIES	4-1
	4.1.1	Soil Borings, Soil Sampling, and Groundwater Monitoring Well Installation	4-1
	4.1.2	Groundwater Sampling and Groundwater Level Measurements	4-5
	4.1.3	Field Screening and Laboratory Analysis	4-6
	4.2	FINDINGS OF TANK 42 SUPPLEMENTAL SITE INVESTIGATION	4-6
	4.2.1	Subsurface Soils	4-7
	4.2.2	Groundwater	4-10
5.0	**TANK 45 – SUPPLEMENTAL SITE INVESTIGATION**		5-1
	5.1	FIELD INVESTIGATION ACTIVITIES	5-1
	5.1.1	Soil Borings, Soil Sampling, and Groundwater Monitoring Well Installation	5-1

TABLE OF CONTENTS (Continued)

SECTION		PAGE
5.1.2	Groundwater Sampling and Groundwater Level Measurements	5-6
5.1.3	Field Screening and Laboratory Analysis	5-7
5.2	FINDINGS OF TANK 45 SUPPLEMENTAL SITE INVESTIGATION	5-7
5.2.1	Subsurface Soils	5-8
5.2.2	Groundwater	5-14
6.0	**TANK 48 – SUPPLEMENTAL SITE INVESTIGATION**	**6-1**
6.1	FIELD INVESTIGATION ACTIVITIES	6-1
6.1.1	Soil Borings, Soil Sampling, and Groundwater Monitoring Well Installation	6-1
6.1.2	Groundwater Sampling and Groundwater Level Measurements	6-5
6.1.3	Field Screening and Laboratory Analysis	6-5
6.2	FINDINGS OF TANK 48 SUPPLEMENTAL SITE INVESTIGATION	6-6
6.2.1	Subsurface Soils	6-6
6.2.2	Groundwater	6-10
7.0	**SUMMARY AND CONCLUSIONS**	**7-1**
7.1	GENERAL	7-1
7.2	TANK 42	7-1
7.2.1	Tank 42 SSI Summary	7-1
7.2.2	Tank 42 SSI Conclusions	7-2
7.3	TANK 45	7-3
7.3.1	Tank 45 SSI Summary	7-3
7.3.2	Tank 45 SSI Conclusions	7-6
7.4	TANK 48	7-7
7.4.1	Tank 48 SSI Summary	7-7
7.4.2	Tank 48 SSI Conclusions	7-9
8.0	**RECOMMENDATIONS**	**8-1**
8.1	TANK 42 AND 48	8-1
8.1.1	Development of Tank 42 and 48 Remedial Alternatives	8-1
8.1.2	Additional Investigation	8-2
8.1.3	Preparation of the Corrective Action Plan	8-2
8.2	TANK 45	8-2
8.2.1	Development of Tank 45 Remedial Alternatives	8-2
8.2.2	Additional Investigation	8-3
8.2.3	Preparation of the Corrective Action Plan	8-3

REFERENCES

APPENDICES

A SOIL BORING LOGS
B WELL CONSTRUCTION LOGS
C SURVEY DATA
D SAMPLE LOG SHEETS
E ANALYTICAL DATA

TABLE OF CONTENTS (Continued)

TABLES

NUMBER		PAGE
2-1	Summary of Previous Investigations	2-2
3-1	SI Hydraulic Conductivity Results	3-5
4-1	Tank 42 SSI Summary	4-2
4-2	Tank 42 PCA/SI/SSI Comparison of TPH in Soils	4-4
4-3	Tank 42 PCA/SI/SSI Comparison Groundwater Analytical Results Positive Detections	4-11
5-1	Tank 45 - Summary of SSI Soil Borings and Monitoring Wells	5-2
5-2	Tank 45 PCA/SI/SSI Comparison of TPH in Soils	5-5
5-3	Tank 45 PCA/SI/SSI Comparison Groundwater Analytical Results Positive Detections	5-15
6-1	Tank 48 SSI Summary	6-2
6-2	Tank 48 PCA/SI/SSI Comparison of TPH in Soils	6-4
6-3	Tank 48 PCA/SI/SSI Comparison Groundwater Analytical Results Positive Detections	6-12

FIGURES

NUMBER		PAGE
2-1	Location Map	2-3
2-2	Tank Farm 4 Location	2-4
2-3	Location Map - Tank Farm 4	2-5
3-1	Interpreted Water Table Map December 18, 1995	3-4
4-1	Soil and Groundwater Contaminants, June-July 1998; Cross-Section Locus Map - Tank 42	4-8
4-2	Cross-Section A-A' - Tank 42	4-9
5-1	Soil and Groundwater Contaminants, June-July 1998; Cross-Section Locus Plan - Tank 45	5-9
5-2	Cross-Section A-A' - Tank 45	5-10
5-3	Cross-Section B-B' - Tank 45	5-11
6-1	Soil and Groundwater Contaminants, June-July 1998; Cross-Section Locus Plan - Tank 48	6-7
6-2	Cross-Section A-A' - Tank 48	6-8

The name of Naval Education and Training Center (NETC) in Newport, Rhode Island was recently changed to Naval Station Newport. Some portions of this document were prepared prior to this change and therefore refer to the facility as NETC.

1.0 INTRODUCTION

1.1 AUTHORIZATION

This report presents the results of Supplemental Site Investigations (SSIs) conducted at three underground storage tanks (USTs), Tanks 42 (FACID-3644 TNO42), 45 (FACID-3644 TNO45), and 48 (FACID-3644 TNO48) hereafter referred to as "the tanks", located in Tank Farm 4 at Naval Station Newport (NSN) (formerly the Naval Education and Training Center (NETC)) in Newport, Rhode Island. Tank Farm 4 is located at the northern portion of NETC-Newport, in Portsmouth, Rhode Island. Petroleum releases, identified as heavy fuel oil and possibly diesel fuel, are likely to have occurred at the tanks. Site investigations (SIs) conducted at the tanks in 1995 delineated the extent of petroleum-impacted soils and groundwater, and recommended future actions including additional investigations (SSIs) prior to preparation of Corrective Action Plans (CAPs) (B&R Environmental, 1996a).

This report was prepared by Tetra Tech NUS, Inc. (TtNUS) (formerly Brown & Root Environmental) at the request of the United States Navy, Northern Division (NORTHDIV) of the Naval Facilities Engineering Command (NAVFAC) under Contract Task Order (CTO) Number 0143 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298.

The investigation was conducted in accordance with the requirements of Rhode Island Department of Environmental Management (RIDEM) Regulation DEM-DWM-UST05-93 Section 14.08 and the Final Work Plan and Work Plan Addendum No. 4. This report was prepared in accordance with Section 14.09 of RIDEM regulation DEM-DWMUST05-93, as detailed by the December 1993 RIDEM guidance document entitled: "Regulations For Underground Storage Tank Facilities Used For Petroleum Products And Hazardous Materials" (RIDEM, 1993a).

1.2 OBJECTIVES AND SCOPE

Recommended actions proposed in the Tanks 42, 45, and 48 SIs Report (B&R Environmental 1996a) and approved by RIDEM consisted of a source control and an interim action. The source control action consisted of removing the tank contents and cleaning the tanks. The interim action consisted of ring drain pumping during tank closure activities to remove contaminant mass from

the fill materials surrounding the tanks to reduce petroleum concentrations in media near the tank sites.

The objective of the SSIs was to evaluate the effectiveness of the interim action by sampling groundwater and subsurface soil from zones of petroleum-impacted soil following the interim action. The information gathered during the SSIs will be used to evaluate the need for CAPs in accordance with RIDEM regulations.

The scope of work for the SSIs included: advancing borings in overburden; collecting and analyzing subsurface soil samples; installing overburden groundwater monitoring wells; collecting and analyzing groundwater samples; and performing a survey to provide horizontal and vertical locations of features pertinent to the investigation.

1.3 REPORT ORGANIZATION

Sections 1.0 through 3.0 of this report contain information and data that are common to each of the three tanks. Sections 4.0 through 6.0 describe activities and data specific to SSIs conducted at each tank.

This SSI report is organized as follows:

- Section 1.0, Introduction, presents the authorization for the SSIs, and outlines their objectives and scope.

- Section 2.0, Background, provides a brief summary of Tank Farm 4 background and history; a list of previous Tank Farm 4 investigations; a brief summary of Tanks 42, 45, and 48 SI results; and summarizes Tank Farm 4 activities since the SIs, including tank closure, tank demolition, and monitoring well replacement, rehabilitation, and abandonment.

- Section 3.0, Geology, Hydrogeology, and Water Resources, presents the regional and site-specific geology, hydrogeology, and groundwater resources, and discusses potential receptors of releases from the tank farms.

- Section 4.0, Tank 42 Supplemental Site Investigation, summarizes the SSI field investigations and activities conducted at Tank 42 to evaluate the effectiveness of the interim action. Following the interim action, soil and groundwater samples were collected from zones of petroleum-impacted soil identified during the PCA and SI as exceeding proposed clean-up standards. Findings of field investigations at Tank 42, analytical methods, and results of investigation activities, and a comparison of the SSI results with PCA and SI results are presented.

- Section 5.0, Tank 45 Supplemental Site Investigation, summarizes SSI field investigations and activities conducted at Tank 45 to evaluate the effectiveness of the interim action.

- Section 6.0, Tank 48 Supplemental Site Investigation, summarizes SSI field investigations and activities conducted at Tank 48 to evaluate the effectiveness of the interim action.

- Section 7.0, Summary and Conclusions, summarizes site investigation findings, and presents conclusions pertaining to results of site investigation activities.

- Section 8.0, Recommendations, identifies the recommended remedial alternative and actions to be taken based on the results of the SSIs.

2.0 BACKGROUND

Section 2.0, Background, provides a summary of the Tank Farm 4 site location, description, and history; a list of previous Tank Farm 4 investigations; a summary of Tanks 42, 45, and 48 SI results; and a summary of Tank Farm 4 activities since the SIs, including tank closure, tank demolition, and monitoring well replacement, rehabilitation, and abandonment.

2.1 TANK FARM 4 LOCATION, FEATURES, AND HISTORY

This section presents abbreviated background information concerning the tanks' location, description, and history. A more detailed discussion of the site features and history is presented in the reports listed in Table 2-1.

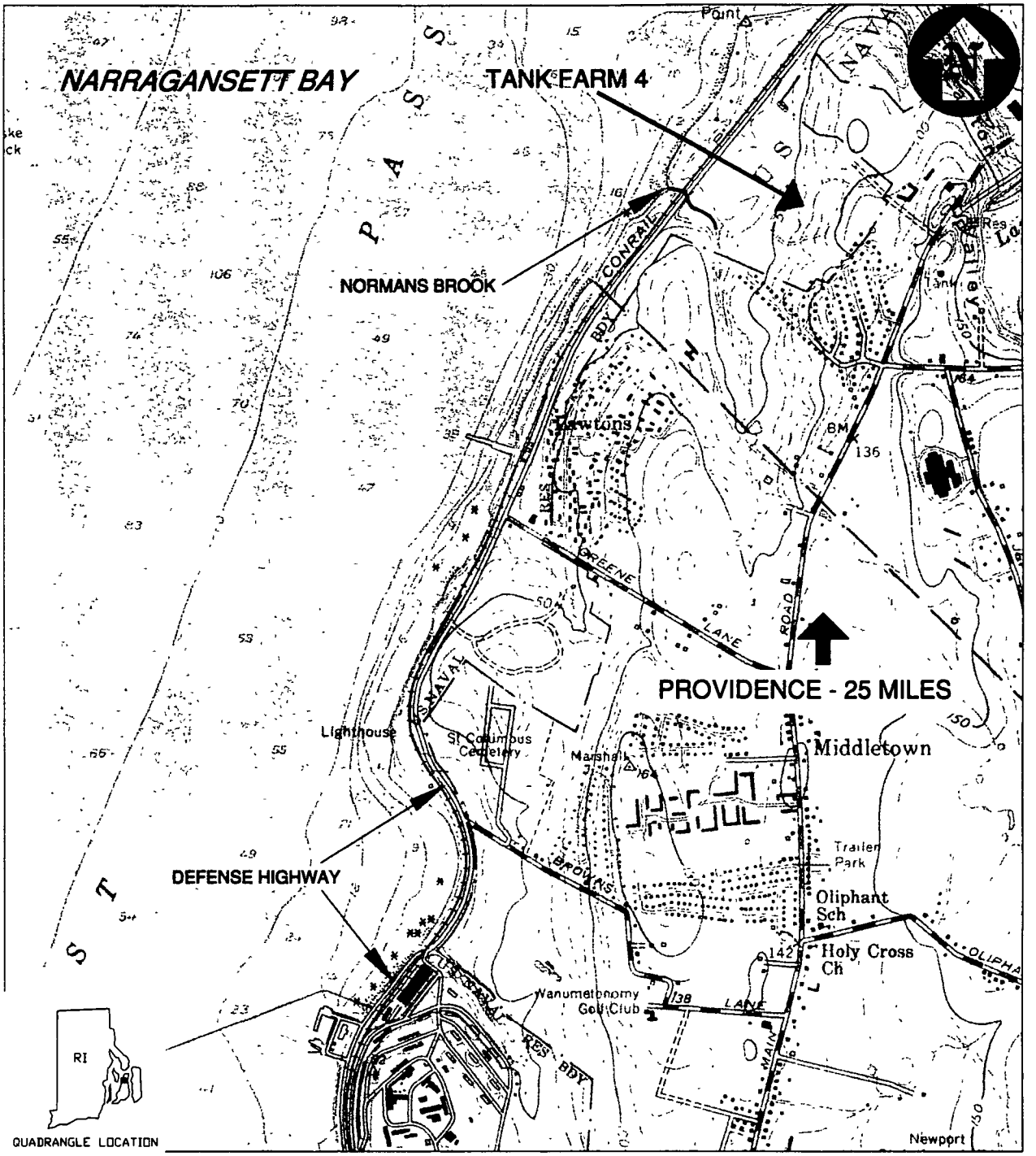
NSN is located in the City of Newport, and Towns of Middletown and Portsmouth, Rhode Island, approximately 25 miles southeast of Providence (Figure 2-1). Tank Farm 4 was constructed in 1942 and 1943 to support the fueling requirements of the Newport-based Atlantic Fleet (TRC, 1994). It covers 90 acres situated in the northern portion of the NSN, in Portsmouth (Figures 2-1 and 2-2), and contained twelve concrete underground storage tanks (USTs) numbered 37 through 48. Each had a capacity of 60,000 barrels (standard petroleum), or approximately 2.52 million gallons, and stored virgin heavy fuel oil, including No. 6 fuel oil or bunker oil and No. 2 fuel oil from World War II until the mid-1970s. Tank Farm 4 was not used for petroleum storage after this time. Tanks 42 and 45 are located in the northern portion of the tank farm, while Tank 48 is located in the southern portion (Figure 2-3).

Tank Farm 4 is bordered by Defense Highway (also referred to as Burma Road) to the north/northwest; Norman's Brook to the southwest; residential property to the southeast; and undeveloped woodlands to the north/northeast. The western edge of the tank farm is bounded by Defense Highway, the Penn Central Railroad right-of-way, and open recreational area owned by the Navy. Beyond these properties to the west is Narragansett Bay, located approximately 1,000 feet downgradient of the tank farm.

The site topography generally slopes to the west. Ground elevations at Tank Farm 4 range from approximately 25 feet above mean low water (MLW) in the western corner of the tank farm to 120 feet above MLW in the eastern corner of the site (TRC, 1992; Federici and Associates, 1996).

TABLE 2-1
SUMMARY OF PREVIOUS INVESTIGATIONS
SUPPLEMENTAL SITE INVESTIGATION REPORT, TANK FARM 4
NSN, NEWPORT, RHODE ISLAND

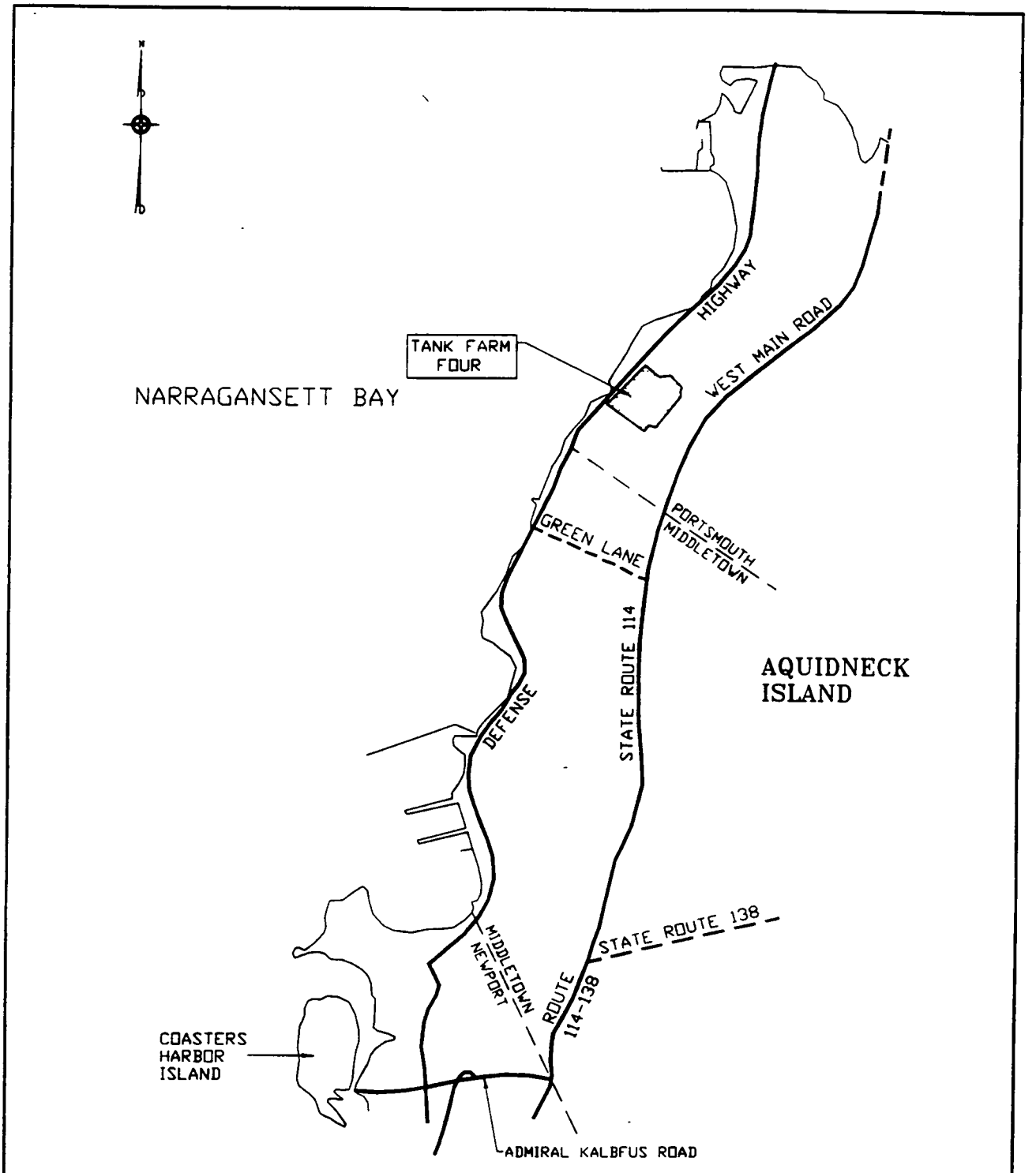
YEAR	DESCRIPTION OF STUDY	CONTRACTOR
1983	Initial Assessment Study - Tank Farm 4	Envirodyne
1992	Phase I Remedial Investigation - Tank Farm 4	TRC
1994	Closure Plan and Conceptual Design Report - Tank Farm 5	TRC
1994	Preliminary Closure Assessment Investigation - Tank Farm 4	Halliburton NUS
1995	Release Characterization Reports - Tanks 38, 42, 45, and 48	Halliburton NUS
1995	Site Investigations - Tanks 38, 42, 45 and 48	B&R Environmental



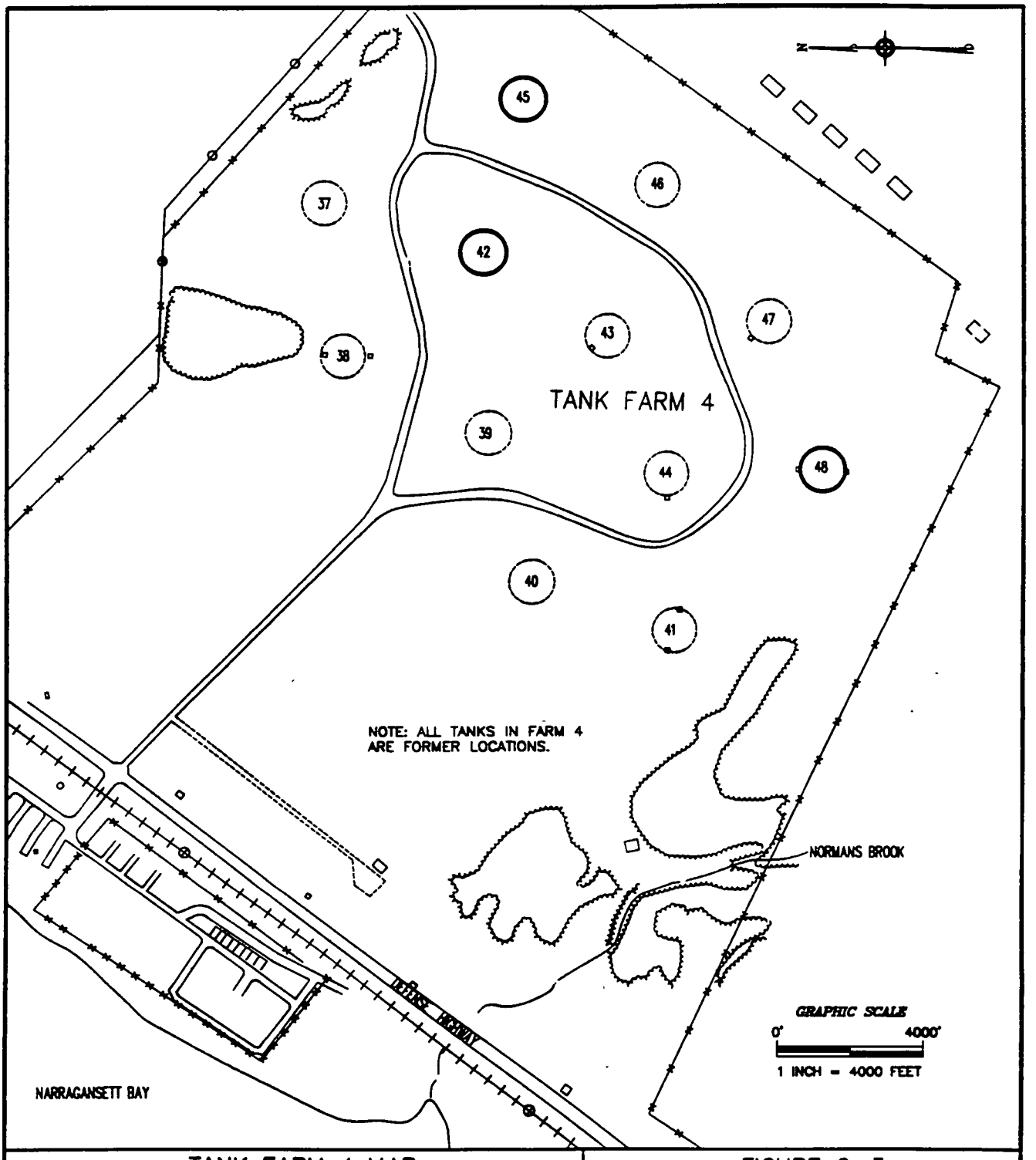
LOCATION MAP	FIGURE 2-1
NSN, NEWPORT, RI	
SUPPLEMENTAL SITE INVESTIGATION REPORT TANK FARM 4	

DRAWN BY:	R G DEWSNAP	REV	0
CHECKED BY	J FORRELLI	DATE:	04 AUG 99
SCALE	AS SHOWN	FILE NO:	\DWG\NETC\SSI\USGS_MAP_2 DWG

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887 (978)658-7899



TANK FARM 4 LOCATION		FIGURE 2-2
NETC – NEWPORT, RI		
SUPPLEMENTAL SITE INVESTIGATION REPORT TANK FARM 4		TETRA TECH NUS, INC.
DRAWN BY: A PUTNAM	REV: 0	55 Jonspin Road Wilmington, MA 01887 (978)658-7899
CHECKED BY: R CLEAVER	DATE: 13 OCT 98	
SCALE: APPROX. 4800 FT	FILE NO. W:\DWG\NETC\SSI\FIG_2-2.DWG	



TANK FARM 4 MAP			FIGURE 2-3
NETC – NEWPORT, RHODE ISLAND			TETRA TECH NUS, INC.
SUPPLEMENTAL SITE INVESTIGATION REPORT			55 Jonspin Road Wilmington, MA 01887 (978)658-7899
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	J. FORRELLI	DATE:	OCTOBER 28, 1998
SCALE:	1" = 4000'	ACAD NAME:	DWG\NETC\SSI\TANKFRM4

2.2 PREVIOUS INVESTIGATIONS

Previous investigations concluded that a supplemental site investigation should be focused on Tanks 42, 45, and 48. Findings of the 1995 Site Investigations for Tanks 42, 45, and 48 are presented in the following section.

2.3 TANKS 42, 45, AND 48 SITE INVESTIGATIONS

Tanks 42, 45, and 48 SIs were conducted following the discovery of petroleum-stained soils and elevated concentrations of TPH in soils at the tanks during the preliminary Closure Assessments (PCAs) performed in October 1994. The SI fieldwork was conducted from November 1995 to January 1996. For a detailed discussion of the results, refer to the Site Investigation Report, Tanks 38, 42, 45, and 48, Tank Farm 4 (B&R Environmental, 1996a). The report also incorporated the results of the PCA field investigations. Based on an evaluation of the data provided in the SIs for Tanks 42, 45, and 48, petroleum releases, identified as heavy fuel oil and possibly diesel fuel, are likely to have occurred at the tanks. Results of structural integrity inspections conducted during closure activities at Tank 42 and Tank Farm 5 indicate that leaks of fuel oil from the tanks may have occurred through cracks on the tank floor and possibly from cracks in the lower portions of tank walls. Petroleum-impacted soils are located at depths adjacent to each tank and in fill materials within the tank sockets.

Petroleum-impacted soils at Tank 42 were identified at SB(soil boring)-123 between 36 to 38 feet below ground surface (bgs) at a concentration of 5,700 mg/kg.

At Tank 45, the boring location, sample depths, and previous TPH concentrations for each boring are as follows:

1. SB-122 at sample depth 34 - 36 feet bgs at a concentration of 11,000 mg/kg
2. SB-330 at sample depth 38 - 40 feet bgs at a concentration of 23,000 mg/kg
3. SB-225 at sample depth 15 - 17 feet bgs at a concentration of 7,100 mg/kg

At Tank 48, petroleum-impacted soils were identified at SB-119 between 27 to 29 feet bgs at a concentration of 5,300 mg/kg.

Low concentrations of TPH in groundwater samples, collected from monitoring wells installed in fill materials downgradient of the tank sockets, indicates that the unconsolidated overburden aquifer is not a significant migration pathway for heavy fuel oil compounds released from the tanks. The fill material within the sockets has a significantly higher hydraulic conductivity than the surrounding bedrock and thus a higher permeability than the surrounding materials. The surrounding bedrock may act to limit the horizontal migration of petroleum and petroleum-impacted groundwater in the unconsolidated aquifer. Impacted groundwater is present in the bedrock aquifer at Tank 48; TPH present at a concentration of 440 mg/L is associated with the migration of petroleum from impacted soils in the bedrock fractures. The extent of impacted groundwater at this location was not determined.

Air monitoring and soil screening with a photoionization detector (PID) was conducted at each tank during the site investigations. No VOCs were detected in the ambient air or in surficial soils at any of the tanks.

The recommended action proposed in the SI Report and approved by RIDEM consisted of a source control and an interim action. Source control consisted of removing tank contents and tank cleaning. The interim action consisted of ring drain pumping during tank closure activities.

To determine the effectiveness of groundwater pumping on soil and groundwater TPH concentrations at Tanks 42, 45, and 48, the SI Report recommended additional groundwater and subsurface soil sampling from zones of petroleum-impacted soil exceeding proposed clean-up standards following completion of the interim action. The need for additional remedial action has been evaluated based on SSI results and on results of the bioremediation pilot test performed at Tank 50.

2.4 TANK CLOSURE ACTIVITIES

The ring-drain system was used to manage the groundwater level at the tanks during closure activities, a period of approximately 1 to 2 months. During the ring drain pumping, an undetermined quantity of groundwater contaminated with petroleum was removed from fill materials within the socket and treated in the on-site water treatment facility. The pumping action was expected to remove contaminant mass from the fill materials surrounding each tank lowering petroleum concentrations at the sites.

Tank 42 closure activities were begun by OHM Remediation Services Corporation (OHM) under contract to the Navy in 1995 and completed by Foster Wheeler Environmental Corporation (FWENC), also under contract to the Navy, in 1997. Tank closure of the eleven other tanks, including Tanks 45 and 48, was conducted in 1996 and 1997 by FWENC. A summary of tank closure activities at each tank is presented below.

Tank 42

Tank 42 contents removal activities (including water, oil, and sludge) were conducted between November 1994 and March 1995. All liquid phases were pumped from the tank directly into Tanks 46 and 37. Closure activities were initiated in September 1995, and included excavating soils from the tank roof and pump chamber, and cutting access ports to the tank. Interior tank surface and pump chamber cleaning operations were conducted between November 1995 and December 1995, using high pressure steam and a diluted water-based industrial degreaser/cleaner solution. All wastewater generated during the tank cleaning was also pumped to Tanks 46 and 37, including groundwater generated by ring drain pumping operations, and wash water generated during tank and equipment cleaning operations. All piping and equipment were dismantled, decontaminated, and removed from the site. Following tank inspections, the tank and pump chamber were ballasted with potable water in December 1995. The Tank 42 pump chamber was not cleaned before OHM demobilized from the site. In 1996 and 1997, FWENC completed Tank Farm 4 closure activities, including the Tank 42 pump chamber cleaning. Additional information on closure activities is included in the "Tank 42 Closure Assessment Report, Tank Farm 4", NSN-Newport, Rhode Island (B&R Environmental, October 1997).

Tank 45

Closure activities for Tank 45 were initiated in June 1996, and included excavating soils from the tank top and pump chamber, and cutting access ports to the tank. Tank 45 contents removal activities (including water, oil, and sludge) were conducted during July 1996. The water phase was pumped from the tank directly into Tank 43 for treatment and discharge to the POTW. When all water was removed, the oil/sludge layer was pumped to 21,000 gallon above-ground frac tanks and transferred onto transporters for off-site disposal. Interior tank surface and pump chamber cleaning operations were conducted between July 1996 and August 1996, using high-pressure steam and a diluted water-based industrial degreaser/cleaner solution. All wastewater generated

during the tank cleaning was also pumped to Tank 43, including groundwater generated by ring drain pumping operations, and wash water generated during tank and equipment cleaning operations. All piping and equipment were dismantled, decontaminated, and removed from the site. In January 1997, blind flanges were installed on the tank's exterior side, within the pump room. Following tank inspections, the tank and pump chamber were ballasted with potable water on January 24, 1997. Additional information on closure activities is included in the "(Draft) Tank 45 Closure Assessment Report, Tank Farm 4", NSN-Newport, Rhode Island (FWENC, 1998).

Tank 48

Closure activities for Tank 48 were initiated in June 1996, and included excavating soils from the tank top and pump chamber, and cutting access ports to the tank. Tank 48 contents removal activities (including water, oil, and sludge) were conducted from June 1996 through August 1996. The water phase was pumped from the tank directly into Tank 43 for treatment and discharge to the POTW. When all water was removed, the oil/sludge layer was pumped to 21,000 gallon above-ground frac tanks and transferred onto transporters for off-site disposal. Interior tank surface and pump chamber cleaning operations were conducted between August 1996 and September 1996, using high-pressure steam and a diluted water-based industrial degreaser/cleaner solution. All wastewater generated during the tank cleaning was also pumped to Tank 43, including groundwater generated by ring drain pumping operations. All piping and equipment were dismantled, decontaminated, and removed from the site. In February 1997, blind flanges were installed at the pipe entrances into the tank, on the tank's exterior side and within the pump room. Following tank inspections, the tank and pump chamber were ballasted with potable water in February 1997. Additional information on closure activities is included in the "(Draft) Tank 48 Closure Assessment Report, Tank Farm 4", NSN-Newport, Rhode Island (FWENC, 1999).

2.5 TANK DEMOLITION ACTIVITIES

All tanks in Tank Farm 4, including Tanks 42, 45, and 48, were demolished by the Navy's RAC contractor, Foster Wheeler Environmental Corporation, from late 1997 through early 1998 as part of UST closure activities conducted by the Navy under Rhode Island regulations. The tanks were imploded individually, with the demolition objective being to collapse and separate the tank roof from the tank walls while maintaining the basic structural integrity of the tank floor and side walls. A 15-foot layer of sand was placed into the tank to absorb the shock from the collapsing tank roof

and to avoid formation of void spaces between the tank floor and collapsed roof. The ballast water was removed from the tanks and pump rooms prior to sand placement. Following tank demolition, each tank site was backfilled with certified clean fill.

2.6 MONITORING WELL INVENTORY

Tank Farm 4 demolition activities involving disturbing and regrading soils located in areas surrounding the tanks resulted in damaging and destroying several monitoring wells. A monitoring well inventory was conducted in February 1998 following the completion of tank demolition activities to determine the condition of monitoring wells located within the Tank Farm 4 site. Wells that could not be located (and presumed destroyed during tank closure activities) included three wells proposed for sampling during the SSIs: MW-123 at Tank 42, MW-122 at Tank 45, and MW-119 at Tank 48. Replacement monitoring wells were installed to collect the groundwater samples needed to assess the effectiveness of the interim action. In addition, three other wells were found to be damaged: MW-330 at Tank 45 and MW-424, and MW-425 at Tank 48. Well rehabilitation was performed to ensure the wells were serviceable for collecting groundwater samples needed to assess the effectiveness of the interim action. Abandonment of destroyed wells was performed in accordance with RIDEM regulations.

2.7 TANK 50 PILOT STUDY

Impacted media have been identified at other tanks at Tank Farms 4 and 5, including Tank 50. A screening evaluation of potential remedial technologies was conducted following the Tank 50 SI to screen technologies for effectiveness, implementability, and cost with regard to virgin petroleum-impacted soils and groundwater. Characterization of soils and groundwater conducted throughout the Tank Farms 4 and 5 PCAs indicated that the nature of the impacted media at Tank 50 in Tank Farm 5 is typical of impacted media identified at other tanks. Results of the Tank 50 screening evaluation are expected to be applicable tank farm-wide, with data review on a tank-by-tank basis.

Potential technologies screened in the Tank 50 evaluation included: 1) Institutional Controls, 2) Excavation with Off-site Disposal or Treatment, 3) Thermally Enhanced Air Sparging, and 4) In-situ Bioremediation. Based on an evaluation of technologies relative to one another, the Tank 50 Technology Screening Evaluation Report (B&R Environmental, 1996c) recommended that in-situ

bioremediation be selected as the preferred technology for remediating petroleum-impacted soils, and that treatability studies be performed to evaluate its effectiveness. FWENC carried out bioremediation bench and pilot scale studies at Tank 50 in 1996. The studies indicated that limited in-situ bioventing/biosparging is feasible in the vicinity of Tank 50, but that this technology will not reduce the hydrocarbon concentrations in all areas below 5,000 mg/kg within a reasonable period of time due to the high concentrations of heavy fuel fractions (FWENC, 1997).

3.0 GEOLOGY, HYDROGEOLOGY, AND WATER RESOURCES

This section summarizes the regional and site-specific geology, hydrogeology, and water resources information. A more detailed discussion is presented in the SI report, (B&R Environmental, 1996a).

The regional geology discussion is based on published reports and data collected during the SI. Much of this information was also discussed in the Phase I Remedial Investigation (TRC, 1992) and is summarized below. Results of the site-specific geologic, hydrogeologic, and water resources data collected during investigative tasks associated with the SI are also reported here.

3.1 REGIONAL GEOLOGY

The following section summarizes the regional bedrock and surficial geology pertinent to this investigation.

3.1.1 Regional Bedrock Geology

NSN is located at the southeastern end of the Narragansett Basin. The rocks of the Narragansett Basin are non-marine sedimentary rocks of Pennsylvanian age, predominately conglomerates, sandstones, shales, and anthracite. Many folds and some faults occur throughout the basin, but the character and amount of the folding and faulting are not clearly known.

The bedrock of the Narragansett Basin has been divided into five units that include the Rhode Island Formation, which underlies NSN. The Rhode Island Formation is the most extensive and thickest of the Pennsylvania formations in Rhode Island. The Rhode Island Formation in the northern portion of the basin is not metamorphosed. However, in the southern portion of the basin, such as in the vicinity of the NSN, the unit is metamorphosed. Rocks are schists of various grades, phyllites, conglomerates, and feldspathic quartzite. Thin beds of metaanthracite and anthracite were mined from many areas within the basin.

3.1.2 R gional Surficial Geology

Overlying the Pennsylvanian rocks of the Narragansett Basin are surficial deposits of Pleistocene glacial sediments. The unconsolidated glacial material ranges from 1 to 150 feet thick, and is thicker in the valleys and thinner in the uplands. The glacial material consists of a loose till, and outwash deposits are characterized by sands, silty sands, and gravels. These glacial deposits were derived from shale, sandstone, conglomerate, and in a few places, coal (TRC, 1992).

3.2 SITE GEOLOGY - SOIL AND BEDROCK CONDITIONS AT TANK FARM 4

The unconsolidated surficial units at Tank Farm 4 were extensively reworked during the facility development. These surficial units consist of gravely silty sands. The tank sockets were blasted and excavated into the upper bedrock. The excavated bedrock materials were reused as fill material during the tanks' construction. Excavated soils were graded during tank farm construction to provide camouflage.

The following section describes the site geology based on field data generated during the PCA and SI studies.

3.2.1 Surficial Deposits

Results of the subsurface investigations indicate that the undisturbed surficial deposits typify regional surficial deposits. Deposits identified on site include gravely silty-sand (outwash), and fill materials. Tank Farm 4 demolition activities involved disturbing and regrading soils located in areas surrounding the tanks. Following tank demolition, each tank site was backfilled with certified clean fill.

3.2.2 Bedrock

Bedrock from cores collected from two borings advanced during the Tank 48 SI was identified as a light-gray phyllite consisting primarily of silica, mica, and chlorite. The rock is similar to bedrock core collected from Tank 50 at Tank Farm 5, and is assumed to underlie the remainder of Tank Farm 4.

The bedrock surface is characterized by a zone of highly altered and fractured rock. Locally, this zone consists of a silty soil. The competent rock is fractured primarily along bedding planes. Some clay alteration products and iron-oxide staining are present along bedding planes in several highly fractured zones. Petroleum product was found in fractures and in fracture zones in the two SI bedrock borings at Tank 48.

3.3 HYDROGEOLOGY

The hydrogeology at Tank Farm 4 was evaluated using monitoring wells installed during the PCA and the SI. Because so many wells were damaged, a complete round of groundwater levels could not be performed during the SSI investigation. Therefore, the groundwater conditions that were observed during previous investigations will be used in this report as a basis for interpreting data. A complete description of the hydrogeologic conditions is presented in the SI report, (B&R Environmental, 1996a). Groundwater elevations were measured in December 1995 and were used to construct an interpretive water table map (Figure 3-1). The water table map is termed interpretive because data used to compile the map was collected from wells screened several feet below the water table.

3.3.1 Interpretive Water Table Map

The relative elevation of each monitoring well was determined by a State of Rhode Island-registered land surveyor, and the depth of the water table was established using water level measurements collected in December 1995. An interpretive water table map (Figure 3-1) was compiled for Tank Farm 4 from these data. Groundwater flow directions were estimated from this map. Groundwater generally flows southwest toward Narragansett Bay. These groundwater flow directions were used to evaluate the data collected during the SSI field investigation.

3.3.2 Hydraulic Conductivity Measurements

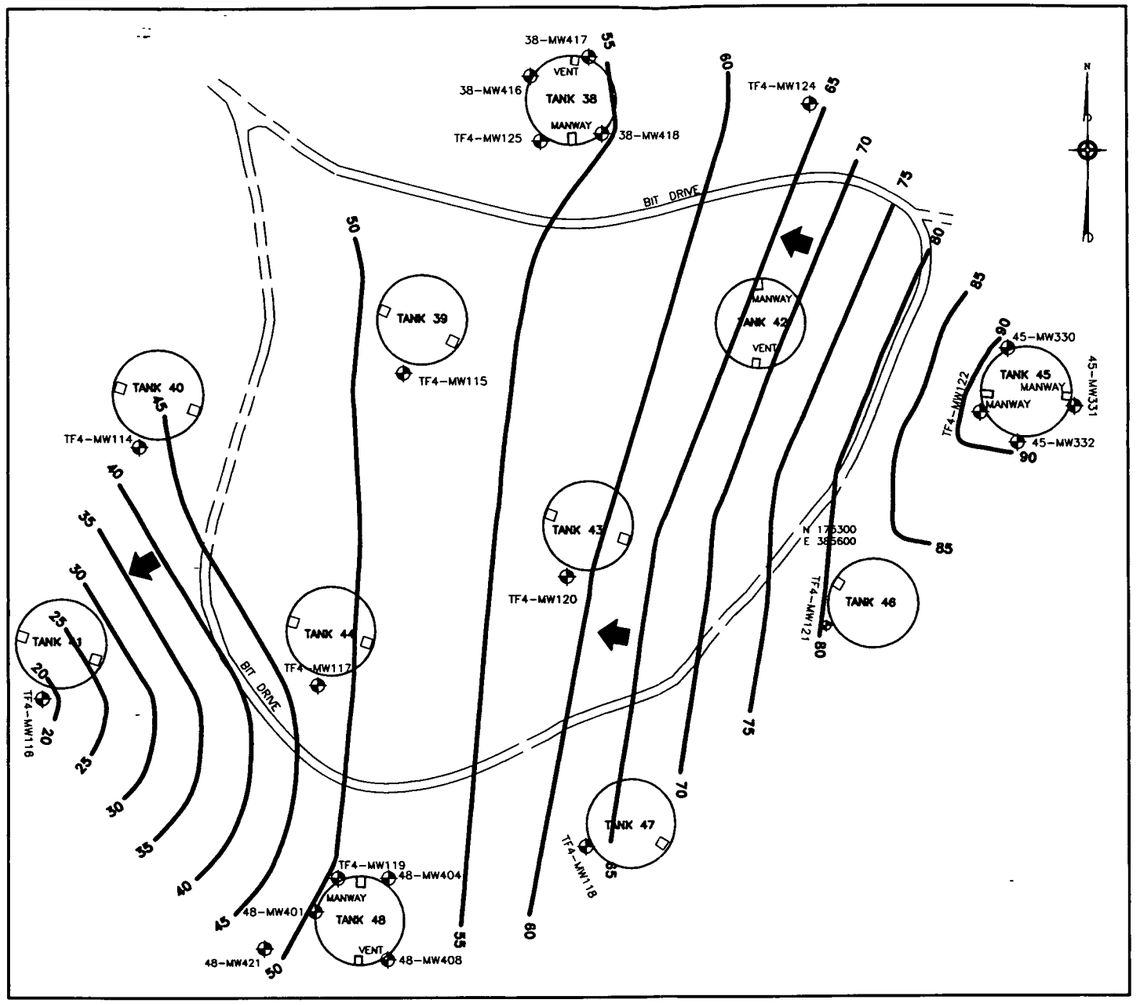
The hydraulic conductivity of the fill, overburden, and bedrock units was measured during the SI conducted at Tank Farm 4, Tank 45 and Tank 48 (B&R Environmental, 1996a). The results of these tests are presented on Table 3-1. A complete discussion of the field methods and additional details concerning interpretive methods are presented in the SI report (B&R Environmental, 1996a).

LEGEND

48-MW422 — MONITORING WELL LOCATION WITH IDENTIFIER

35 — INTERPRETED GROUNDWATER CONTOUR LINE

INTERPRETED GROUNDWATER FLOW DIRECTION



ELEVATIONS

I D	GW ELEV
TF4-MW 124	63. 54
TF4-MW 125	54. 62
38-MW 416	54. 63
38-MW 417	54 63
38-MW 418	54 63
TF4-MW 115	51 37
TF4-MW 114	44. 28
TF4-MW 116	18. 15
TF4-MW 120	57. 96
TF4-MW 117	48 60
TF4-MW 122	91. 66
45-MW 330	91 70
45-MW 331	91 57
45-MW 332	90. 55
TF4-MW 121	80 18
TF4-MW 118	62. 90
TF4-MW 119	50 16
48-MW 401	50. 17
48-MW 404	50 12
48-MW 408	50 15
48-MW 421	49 13

GRAPHIC SCALE

0' 200' 400'

1 INCH = 200 FEET

NOTES:

1) BASE MAP FROM PLAN BY LOUIS FEDERICI & ASSOCIATES, 235 PROMENADE STREET, PROVIDENCE, RI & AVAILABLE PLANS
2) BITUMINOUS DRIVE LOCATION FROM ABOVE PLAN & AVAILABLE PLANS AND IS TO BE CONSIDERED APPROXIMATE.
3) GRID COORDINATES BASED ON THE STATE OF RHODE ISLAND GRID COORDINATE SYSTEM (NAD 1983).
4) GROUNDWATER ELEVATIONS FROM TANK 42 WERE NOT USED FOR THIS MAP DUE TO PUMPING OF THE RING DRAIN AT THE TIME OF GROUNDWATER MEASUREMENTS
5) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
6) PLAN NOT TO BE USED FOR DESIGN

INTERPRETED WATER TABLE MAP – DEC. 18, 1995			FIGURE 3–1
NETC–NEWPORT, RI			
SUPPLEMENTAL SITE INVESTIGATION REPORT TANK FARM 4			TETRA TECH NUS, INC.
DRAWN BY:	R.G DEWSNAP	REV: 1	55 Jonspin Road Wilmington, MA 01887 (978)658–7899
CHECKED BY	R CLEAVER	DATE: 14 OCT 98	
SCALE.	1" = 200'	FILE NO.: G.\DWG\NETC\SSI\GW_CONTR	

TABLE 3-1
SI HYDRAULIC CONDUCTIVITY RESULTS
TANKS 45 and 48, TANK FARM 4
SUPPLEMENTAL SITE INVESTIGATION REPORT
NSN, NEWPORT, RHODE ISLAND

Tank No.	Well No.	Inside Diam. (inches)	Well Screen Depth Interval (ft bgs)	Stratigraphic Unit Classification	Soil/Rock Description	Bulk Hydraulic Conductivity	
						ft/day	cm/sec
45	MW-330[1]	2	28-38	Fill (socket)	gravelly silty SAND, sandy GRAVEL	17.14	6.1E-03
48	MW-408[1]	2	37-42	Fill (socket)	silty sandy GRAVEL, sandy GRAVEL	16.76	5.9E-03
48	MW-409	2	17-22	Outwash	silty sandy GRAVEL	3.71	1.4E-03
48	MW-421	2	11-16	Outwash	silty sandy GRAVEL, silty gravelly SAND	1.66	5.9E-04
48	MW-422	2	19-24	Fill (ramp)	gravelly silty SAND	7.02	2.5E-03
48	MW-424	2	26-41	Bedrock	thinly bedded, gray phyllite	2.95	1.0E-03
48	MW-425	2	26.5-41.5	Bedrock	thinly bedded, gray phyllite, with some highly fractured zones	1.32	4.7E-04

Legend:

ft bgs - feet below ground surface
ft/day - feet per day
cm/sec - centimeters per second
(1) - Wells with oscillatory-responses

These data indicate that in-situ soils have a hydraulic conductivity between 1.4E-03 and 5.9E-04 centimeters per second (cm/sec), while the fill surrounding the tanks has a hydraulic conductivity between 5.9E-03 and 6.1E-03 cm/sec. The hydraulic conductivity of the bedrock was between 1.0E-03 and 4.7E-04 cm/sec (Table 3-1).

3.3.3 Horizontal Hydraulic Gradients

The horizontal hydraulic gradient represents the change in head, measured in feet per horizontal foot of travel through a medium. Groundwater in an isotropic homogeneous aquifer will flow from areas of higher head to areas of lower head along flow lines that intersect the contour lines at right angles. The horizontal hydraulic gradient or slope was calculated using the December 1995 interpretive water table map. The average horizontal hydraulic gradient at Tank Farm 4 is approximately 0.06 feet per foot.

The fill material within the socket has a significantly higher hydraulic conductivity, and thus a higher permeability than the surrounding bedrock. The surrounding bedrock acts as a lower permeability barrier, limiting the horizontal migration of petroleum. To migrate by advective forces, the petroleum must rise through the aquifer (due to its lighter specific gravity with respect to water) until it encounters more permeable in-situ soils or fill material overlying bedrock. At that point, driven by the groundwater gradient, the petroleum may migrate horizontally.

The ability of the socket to minimize migration of petroleum was noted during previous investigations conducted at Tank 50, Tank Farm 5. TPH concentrations in soils within the tank socket were as high as 65,000 mg/kg, while TPH concentrations in soil samples collected from borings approximately 150 feet hydraulically downgradient of the tank were below detection limits (B&R Environmental, 1996a). A similar situation exists at Tank Farm 4, and is discussed in Sections 4.0 through 6.0.

3.4 GROUNDWATER RESOURCES AND POTENTIAL RECEPTORS

The following subsections summarize groundwater resources and identify potential receptors.

3.4.1 Site Wellhead Protection Status

Tank Farm 4 is not located within a designated wellhead protection area (RIDEM "Rules and Regulations for Groundwater Quality", Section 18 and Appendix IV) (RIDEM, 1993b).

3.4.2 Site Groundwater Classification

The groundwater beneath the tanks at Tank Farm 4 is classified by RIDEM as "GA-Non-Attainment" (GA-NA). Class GA represents groundwater resources suitable for public or private drinking water use without treatment. Non-attainment areas (NA) are those areas that have pollutant concentrations greater than the groundwater quality standards for the applicable classification. The goal for the non-attainment areas is restoration to the groundwater quality consistent with the standards of the applicable class. (Groundwater at Tank Farm 4 is not currently used for drinking water purposes; also, the tanks at Tank Farm 4 are not located within a designated wellhead protection area.)

3.4.3 Potential Receptors

Previous investigations did not identify any private or public potable water supply wells located on or downgradient of the site. Tank Farm 4 and land hydraulically downgradient of the tank farm to Narragansett Bay is owned by the federal government (Town of Middletown, 1958).

No known private wells or basements exist that could potentially be affected by the petroleum release.

4.0 TANK 42 - SUPPLEMENTAL SITE INVESTIGATION

As recommended in the SI Report (B&R Environmental, 1996a), the SSI was conducted to determine the effectiveness of ring-drain pumping to reduce petroleum mass in soils and groundwater at Tank 42 during tank closure activities ("interim action"). Following the interim action, additional soil and groundwater samples were collected from zones of petroleum-impacted soil identified during the SI as exceeding proposed clean-up standards. Sample results are compared to results of analyses conducted during the SI. The SI Report summarizes field investigation activities conducted previously at Tank 42, during the SI, and during the Preliminary Closure Assessment (PCA). This section describes field investigation activities conducted at Tank 42 during the SSI, and summarizes the findings of this investigation.

4.1 FIELD INVESTIGATION ACTIVITIES

The SSI field activities at Tank 42 were conducted by TtNUS in June and July 1998. Objectives at Tank 42 were to: (1) collect a soil sample from a comparable zone where petroleum-impacted soils exceeding the action level had been sampled in former boring SB-123, prior to completion of the interim action; (2) complete this new boring (SB-801) as a replacement groundwater monitoring well for destroyed well MW-123; and (3) install an additional boring/well downgradient of SB-801 to investigate potential petroleum migration in the unconsolidated overburden. A description of each field investigation activity is presented in the sections that follow, including: overburden soil borings, soil sampling, and groundwater monitoring well installation; groundwater sampling and groundwater level measurements; and field screening and laboratory analysis. A summary of SSI soil borings and monitoring wells that were sampled at Tank 42 during the SSI is presented as Table 4-1.

4.1.1 Soil Borings, Soil Sampling, and Groundwater Monitoring Well Installation

Several wells installed at Tank 42 during previous investigations were damaged and/or buried during recent tank closure activities. During the SSI field effort at Tank 42, a Rhode Island-registered surveyor, resurveyed the location of destroyed or buried monitoring wells and/or soil borings, established the present ground surface elevations, and set a stake at each location with the new ground elevations. The new ground surface elevations were used to determine the sample depth intervals for the new SSI borings. Also as part of the SSI activities at Tank 42, four

TABLE 4-1
TANK 42 SSI SUMMARY
TANK 42 - SUMMARY OF SSI SOIL BORINGS AND MONITORING WELLS
TANK FARM 4
NSN, NEWPORT, RHODE ISLAND

Soil Borings	Ground Surface Elevation July 1998 (ft, MLW)	Depth of Boring (ft, bgs)	Sampled Interval Depth (ft, bgs)	Sampled Interval Elevation (ft, MLW)	Purpose	Notes
SB-801	89.84	39.5	37.5 - 39.5	50.3 - 52.3	Determine effectiveness of interim action by collecting soil sample from overburden petroleum-impacted zone observed in PCA SB-123	Advanced in socket located 6.6 ft from SB-123; completed as MW-801
SB-806	87.79	20.0	14.0 - 16.0	71.4 - 73.8	Investigate potential petroleum migration in the unconsolidated overburden further downgradient of SB-801	Located 31.1 ft downgradient of SB-801 outside tank socket; completed as MW-806

Monitoring Wells	Ground Surface Elevation July 1998 (ft, MLW)	Groundwater Elevation, July 7, 1998 (ft, MLW)	Screen Length (ft)	Screen Interval Elevation (ft, MLW)	Purpose	Notes
MW-801	89 84	64.35	10.0	51.0 - 61.0	Determine effectiveness of interim action on groundwater quality	Replacement well for MW-123 (destroyed during tank demolition); sampled 7/8/98
MW-806	87.79	71.79	10.0	71.8 - 81.8	Investigate potential petroleum migration in the unconsolidated overburden further downgradient of MW-801	Water level too low for sampling on 7/8/98

Notes:
bgs = below ground surface
ft = feet
MLW = mean low water

former monitoring wells were properly abandoned in accordance with RIDEM regulations, including wells MW-123, MW-407, MW-411, and MW-413. A summary of groundwater monitoring well abandonment activities was presented in the Tank Farm 4 Groundwater Monitoring Well Abandonment Summary Report (B&R Environmental, 1998).

To meet the objectives of the SSI, two new overburden soil borings were advanced at Tank 42 using drive and wash drilling methods with 4-inch casing. Both borings were completed as groundwater monitoring wells (MW-801 and MW-806). Wells were constructed of 2-inch inner diameter, flush joint, threaded Schedule 40 PVC, with 10-foot factory-slotted well screens, and steel protective casings. All newly installed wells were developed according to standard protocols. Further details on well construction are presented in the Monitoring Well Construction Logs, attached as Appendix B. Drilling was conducted by a TtNUS subcontractor, Maher Environmental, with oversight by TtNUS.

MW-801 was installed to collect a soil sample from the interval coinciding with (or in closest proximity to) the highest TPH concentration as previously observed during the advancement of former adjacent well MW-123 (petroleum-impacted soils had been observed in MW-123 from approximately 36 to 38 feet bgs, see Table 4-2), and as a replacement well for previously destroyed well, MW-123. MW-801 was advanced to 39.5 feet bgs, and the well screen was installed from 28.8 to 38.8 feet bgs. (The well screen of former well MW-123 had been installed from 33 to 38 feet bgs, to correspond with the estimated depth of the ring drain.) One soil sample was collected from MW-801 from 37.5 to 39.5 feet bgs using a split-barrel sampler, and was sent for laboratory analysis of TPH.

MW-806 was installed downgradient of MW-801, to investigate potential petroleum migration in the unconsolidated overburden further downgradient of the tank, outside the tank socket. MW-806 was advanced to 20 feet bgs, and soil samples were collected at 5-foot intervals, beginning at 4 feet bgs. The soil sample exhibiting the highest flame ionization detector (FID) field screening reading or other evidence of petroleum impact was to be selected for laboratory analysis of TPH; if no evidence of petroleum impact was observed, the soil sample from the estimated water table was to be selected for analysis. Laboratory analysis of TPH was performed on one

TABLE 4-2
TANK 42 PCA/SI/SSI COMPARISON OF TPH IN SOILS[1]
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	MW-123 and SB-801			Additional Boring
Investigation	PCA		SSI	SSI
B ring	MW-123		SB-801[2]	SB-806[3]
Date Advanced	November 1994		June 1998	June 1998
Ground Elevation (ft, MLW)	88.9[4]		89.8	87.8
Boring Depth (ft, bgs)	39.0		39.5	20.0
EOB (ft, MLW)	49.9		50.3	67.8
Sample Interval Depth (ft, bgs)				
Top	32.0	36.0	37.5	14.0
Bottom	34.0	38.0	39.5	16.0
Sample Interval Elevation (ft, MLW)				
Top	56.9	52.9	52.3	73.8
Bottom	54.9	50.9	50.3	71.8
TPH (mg/kg)	ND	5,700	4,400	ND

Notes:

bgs = below ground surface
ft = feet
MLW = mean low water
EOB = end of boring
ND = not detected
PCA = Preliminary Closure Assessment
SI = Site Investigation
SSI = Supplemental Site Investigation
[1] No soil samples were collected from the vicinity of the SSI samples during the SI phase.
[2] SB-801 located 6.6 ft from SB-123.
[3] SB-806 located 31.1 ft downgradient of SB-801.
[4] Ground elevation prior to tank demolition

soil sample collected from 14 to 16 feet bgs, the interval immediately above bedrock (altered bedrock encountered at approximately 16 feet bgs). No evidence of petroleum was observed while drilling this boring. The well screen for MW-806 was installed from 6 to 16 feet bgs, immediately above bedrock.

Soil descriptions and any observed visual or olfactory evidence of the possible presence of petroleum, and FID screening results were noted on boring logs for each boring/well (Boring Logs are attached as Appendix A).

4.1.2 Groundwater Sampling and Groundwater Level Measurements

Static groundwater level measurements were obtained from Tank Farm 4 wells, including wells at Tank 42, on July 7, 1998, prior to groundwater sampling activities. Measurements were conducted using an electronic water level indicator (M-scope) and were measured to the nearest 0.01 foot from the top of each PVC well riser. This information was collected to provide data on approximate groundwater flow direction(s) at the site. All newly installed soil borings and monitoring wells were surveyed for location and elevation by a surveyor registered in the State of Rhode Island. Depth to groundwater measurements were converted to elevations, as provided in Table 4-1.

Groundwater sampling of MW-801 was conducted on July 8, 1998 (well MW-806 at Tank 42 was observed to be nearly dry, and could not be sampled). The static water level in the well was measured, the well volume calculated, and three well volumes of water were purged by bailing with a new, pre-cleaned disposable bailer. Field measurements of pH, temperature, and conductivity, collected after each well volume, were used to determine water chemistry stabilization prior to sample collection. Field measurements of dissolved oxygen, turbidity, and salinity were also recorded for each well volume. Samples, poured directly from the bailer into the appropriate pre-preserved sample containers, were labeled and stored on ice until delivery to the analytical laboratory. Groundwater samples were analyzed for VOCs, SVOCs, TPH, and RCRA metals (total/unfiltered and dissolved/field-filtered).

4.1.3 Field Screening and Laboratory Analysis

Soil samples, drilling wash water, groundwater samples, and purge water were visually inspected for the presence of petroleum during SSI activities (sheens, stains, odors, free product). These observations were recorded on sample log sheets and/or boring logs. In addition, soil samples were screened for volatile organics with a FID using the jar headspace technique (see Boring Logs, Appendix A).

Samples were collected and laboratory analyses performed in accordance with Naval Facilities Engineering Service Center (NFESC) data quality Level C requirements, as described in the Final Work Plan (HNUS, 1994) and the Final Work Plan Addendum 4 (B&R Environmental 1996b). EPA-approved analytical methods were used for all samples that were submitted for laboratory analysis. Soil and groundwater samples were analyzed for TPH by Method 418.1. Groundwater samples were also analyzed for VOCs by Method 8260; for SVOCs by Method 8270; and for RCRA metals (unfiltered/total and field-filtered/dissolved) by Method 6010. Laboratory analyses were conducted by Mitkem Corporation of Warwick, Rhode Island. Mitkem is a NFESC-approved laboratory. Laboratory analytical results are presented in Appendix E. Analytical results were not validated, but did undergo a minimum level data review by a TtNUS staff chemist.

All environmental samples collected as part of the SSI, including QC samples, were stored and shipped in accordance with chain-of-custody procedures outlined in the project-specific Quality Assurance/Quality Control Plan prepared as part of the Work Plan.

4.2 FINDINGS OF TANK 42 SUPPLEMENTAL SITE INVESTIGATION

A discussion of results for the soil and groundwater sampling conducted at Tank 42 during the SSI is presented below. As recommended in the SI Report and the Work Plan for this SSI, groundwater and soil sampling results are also compared to analytical results from corresponding samples collected during the SI, as applicable. This discussion supplements additional, more comprehensive sampling and analytical data previously obtained during the PCA and the SI, which are summarized in the SI Report (B&R Environmental, 1996a).

4.2.1 Subsurface Soils

As summarized in Section 4.1.1, during the SSI field effort at Tank 42 two soil samples were collected from borings SB-801 (soil boring for MW-801) and SB-806 (soil boring for MW-806), and were analyzed for TPH by Method 418.1. Figures 4-1 and 4-2 show a cross-section locus plan and cross-section A-A', respectively, to present a depiction of soil sampling in the vicinity of Tank 42.

SB-801 (replacement well for MW-123) was advanced approximately 6 feet downgradient of Tank 42, within the tank socket area, to a total depth of 39.5 feet bgs, and encountered the top of altered bedrock at approximately 39 feet bgs. A petroleum sheen was noted on the drilling washwater beginning at approximately 17 feet bgs. The soil sample collected from SB-801 for TPH analysis was collected from a depth interval (37.5 to 39.5 feet bgs) corresponding to a previously collected TPH-contaminated soil sample from former adjacent well MW-123, as reported in the SI report, and as summarized in Table 4-2. A heavy petroleum sheen and oil drops in washwater were observed at this depth. The sample consisted of ring-drain gravels above altered schist. The gravels were noted to be heavily impacted by petroleum, as exhibited by visual observations and elevated FID readings (see Boring Logs, Appendix A). As indicated in Table 4-2, laboratory analysis of the SSI soil sample from SB-801 (37.5 to 39.5 feet bgs) detected TPH at a level of 4,400 mg/kg, which is below the proposed clean-up level of 5,000 mg/kg for depths greater than 15 feet, and is somewhat lower than the previous sample collected from MW-123 (pre-interim action), where TPH was detected at 5,700 mg/kg.

SB-806 was advanced approximately 28 feet downgradient of Tank 42 (outside the tank socket area), and downgradient of SB-801, to a total depth of 20 feet bgs, to investigate potential migration of petroleum observed in upgradient boring SB-801. The top of altered bedrock was encountered at approximately 16 feet bgs. No indications of petroleum impact were observed, based on visual inspection of subsurface soil samples and drilling washwater, and FID jar headspace readings. One soil sample was collected from SB-806 for TPH analysis, from a depth interval of 14 to 16 feet bgs, corresponding to the depth immediately above probable top of bedrock. As indicated in Table 4-2, analytical results indicated TPH was not detected in this sample.

LEGEND

38-SB415 — SOIL BORING LOCATION WITH IDENTIFIER

TF4-MW125 — MONITORING WELL LOCATION WITH IDENTIFIER

42-SS02 — SURFACE SOIL SAMPLE LOCATION WITH IDENTIFIER

P1 — SOIL PROBING SAMPLE LOCATION WITH IDENTIFIER

LIMITS OF BEDROCK RAMP

LIMITS OF EXCAVATION

TPH — TOTAL PETROLEUM HYDROCARBONS

ND — NOT DETECTED

SB-801 / MW-801	
SOIL SAMPLE	
TPH (37 5-39 5)	4,400
GROUNDWATER SAMPLE	
TPH (51 0-61 0)	ND

SOIL BORING LOCATION / MONITORING WELL LOCATION

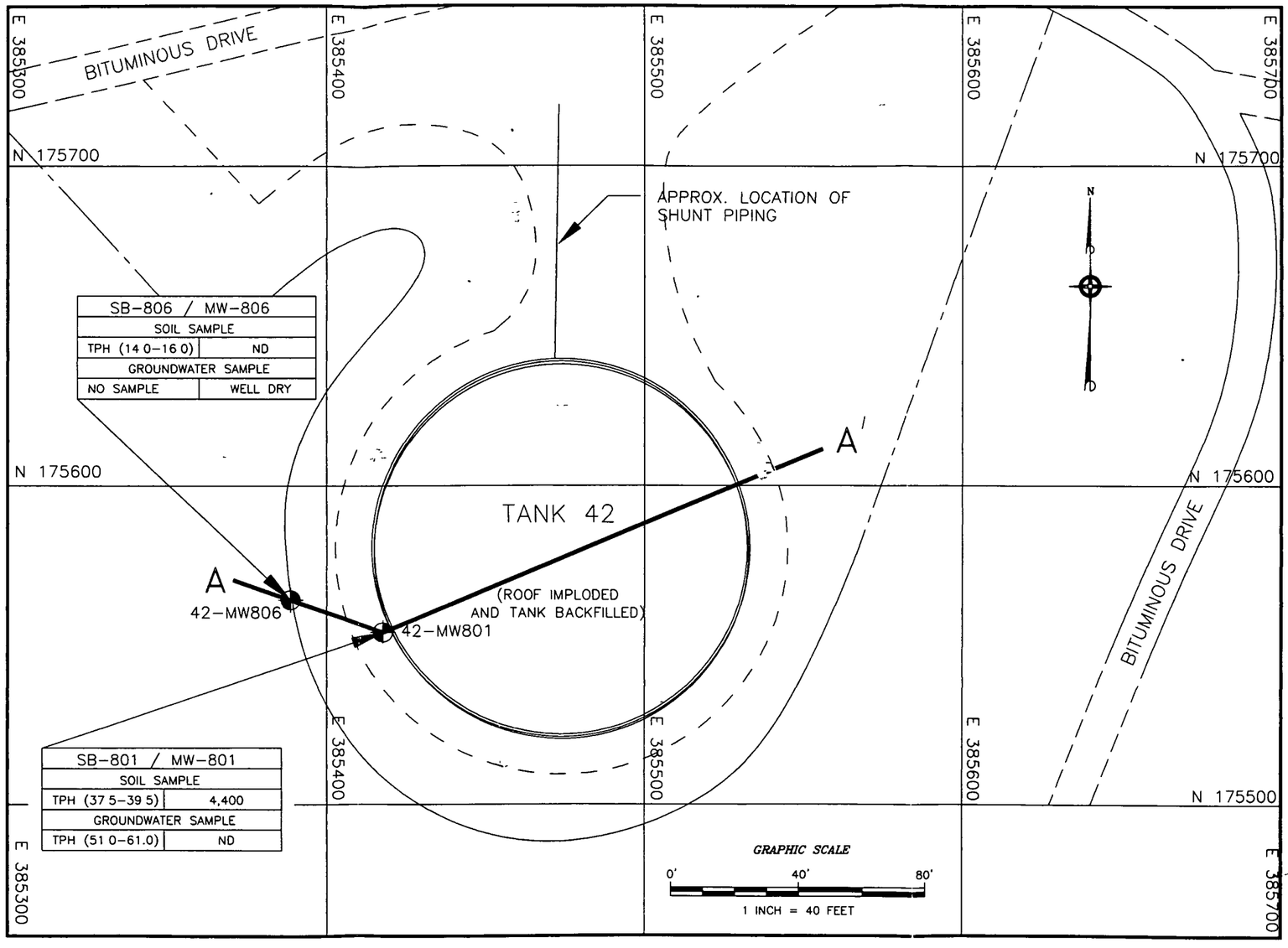
CONTAMINANT (DEPTH INTERVAL)

TYPE OF SAMPLE

CONTAMINANT CONCENTRATION

TYPE OF SAMPLE

CONTAMINANT CONCENTRATION



NOTES:

1) THE DATA DEPICTED INCLUDES TPH CONCENTRATIONS FOR SOIL AND GROUNDWATER, AND GROUNDWATER CONTAMINANTS AND CONCENTRATIONS EXCEEDING THE RIDEM GA GROUNDWATER QUALITY STANDARDS (GWQS) AND / OR PREVENTATIVE ACTION LIMITS (PAL).
2) SOIL SAMPLE TPH CONCENTRATION UNITS IN mg / Kg; GROUNDWATER SAMPLE TPH CONCENTRATION UNITS IN mg / L AND ALL OTHER GROUNDWATER CONTAMINANT CONCENTRATION UNITS IN Ug/L.
3) SOIL SAMPLING DEPTH INTERVAL IN FEET BELOW GROUND SURFACE; GROUNDWATER MONITORING WELL SCREENED INTERVAL IN MEAN LOW WATER ELEVATIONS (FEET).
4) PLAN NOT TO BE USED FOR DESIGN.
5) LOCATIONS FROM BASE MAP BY LOUIS FEDERICI & ASSOCIATES, 235 PROMENADE STREET, PROVIDENCE, RI.
6) GRID COORDINATES BASED ON THE STATE OF RHODE ISLAND GRID COORDINATE SYSTEM (NAD 1983)
7) ABANDONED MONITORING WELLS, FORMER SOIL BORING AND SURFACE SOIL SAMPLE LOCATIONS, AND TANK FEATURES SHOWN IN GRAY.

SOIL & GROUNDWATER CONTAMINANTS (JUNE - JULY, 1998); CROSS-SECTION LOCUS MAP - TANK 42

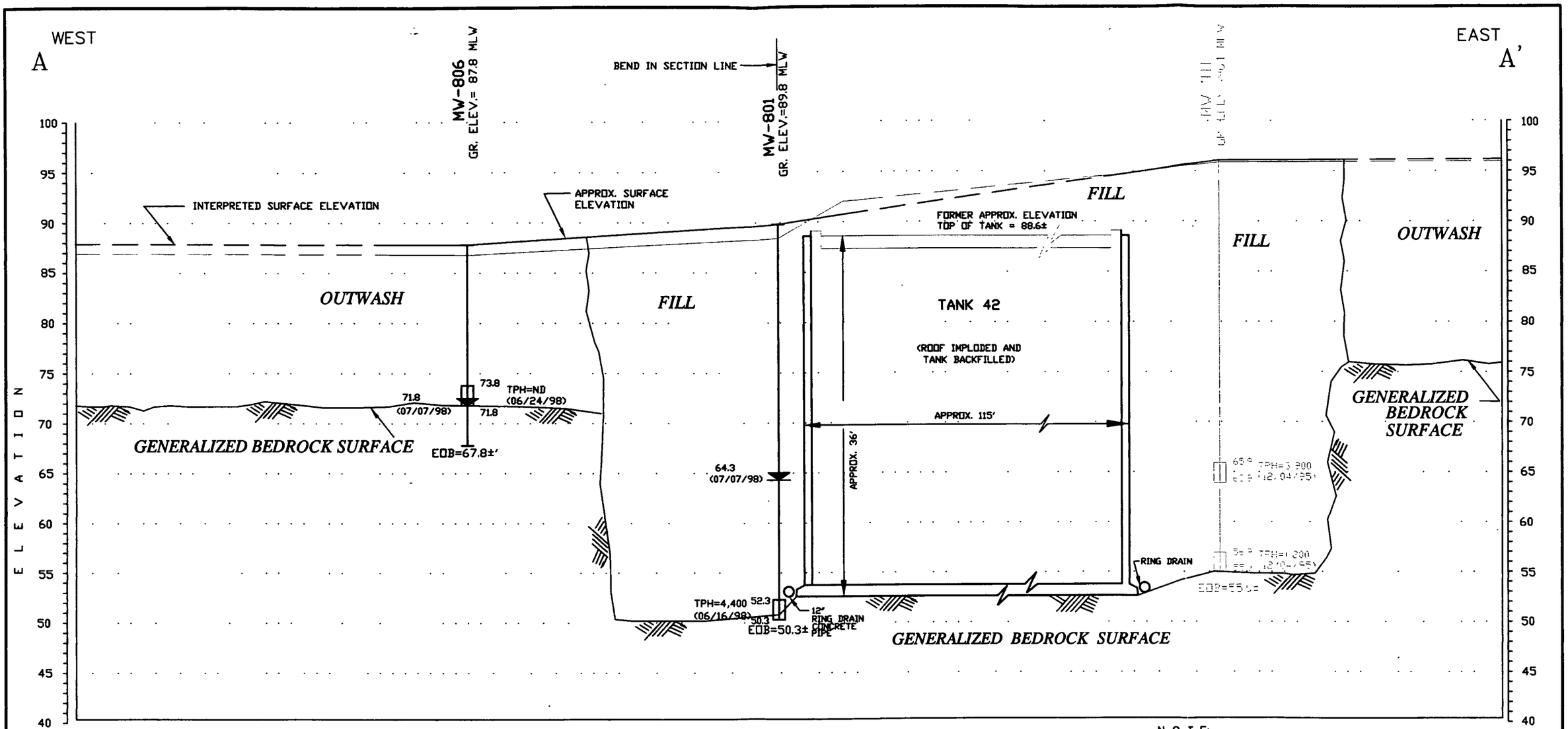
NETC-NEWPORT, RI

SUPPLEMENTAL SITE INVESTIGATION REPORT - TANK FARM 4

DRAWN BY	R.G DEWSNAP	REV	0
CHECKED BY	P SVETAKA	DATE	JANUARY 29, 1999
SCALE.	1" = 40'	FILE NO	DWG\NETC\SSI\T42_TPH DWG

FIGURE 4-1

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



LEGEND

46.9
TPH=5.0 (12/04/98)
44.9
SOIL SAMPLE INTERVAL ANALYZED BY LAB WITH ELEVATION AND TPH CONCENTRATION. (DATE SAMPLED)

63.3 (07/07/98) WATER TABLE ELEVATION IN FEET (MLW) (DATE MEASURED)

FORMER GROUND ELEVATION

TPH	TOTAL PETROLEUM HYDROCARBON (MG/KG)
MW 103	GROUNDWATER MONITORING WELL NUMBER
SB 205	SOIL BORING NUMBER
ND	NOT DETECTED
EOB	END OF BORING
GR. ELEV.	GROUND ELEVATION

GRAPHIC SCALE
10 0 10 20
H rizontal & V rtical Scale: 1IN. = 10 FT.

N O T E:

1) JULY 7, 1998, WATER LEVEL MEASUREMENTS REPORTED ON FIGURE.
2) ALL TPH UNITS IN MILLIGRAMS PER KILOGRAM (MG/KG).
3) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
4) PLAN NOT TO BE USED FOR DESIGN.
5) FORMER SAMPLE LOCATIONS AND TANK FEATURES SHOWN IN GRAY.

TPH IN SOIL

CROSS-SECTION A-A' - TANK 42
NETC-NEWPORT, RI
SUPPLEMENTAL SITE INVESTIGATION REPORT - TANK FARM 4

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	R. CLEAVER	DATE:	OCTOBER 21, 1998
SCALE:	1" = 10' (APPROX.)	FILE NO.:	DWG\NETC\SSI\XSECT42.DWG

FIGURE 4-2

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

Summary of Subsurface Soil Results

In summary, soils from SB-801, collected from a comparable depth to petroleum-impacted soils observed in nearby former well MW-123 (pre-interim action), still exhibited petroleum contamination, although the concentration detected (4,400 mg/kg) was somewhat lower than the proposed clean-up level of 5,000 mg/kg. Soils from SB-806, advanced downgradient of SB-801, did not exhibit petroleum contaminant migration in the unconsolidated overburden further downgradient of the tank.

Laboratory analytical results are presented in Appendix E.

4.2.2 Groundwater

As summarized in Section 4.1.2, groundwater samples were collected during the SSI field effort at Tank 42 from monitoring well MW-801 for analysis of VOCs, SVOCs, RCRA metals, and TPH. (MW-806 was nearly dry and samples could not be collected during this sampling event). A minor sheen was observed on purgewater from MW-801 during groundwater purging activities, however TPH was not detected (see discussion below). A brief discussion of groundwater analytical results is presented below. All positive groundwater detections are summarized in Table 4-3. Complete laboratory analytical results for the SSI samples are reported in Appendix E.

Volatile Organic Compounds (VOCs)

Only two VOCs, methyl tert-butyl ether (MTBE) and acetone, were reported in groundwater from MW-801 (replacement for MW-123), at trace levels of 1 J to 5 ug/L, respectively. No exceedances of the GA standards were detected. (The data reviewer noted that positive results for acetone may be biased high or be false positives attributable to blank contamination). Previous sampling at MW-123 (pre-interim action) resulted in no detectable concentrations of any VOCs; MTBE was not included in the list of VOCs analyzed.

TABLE 4-3
TANK 42 PCA/SI/SSI COMPARISON OF GROUNDWATER ANALYTICAL RESULTS
POSITIVE DETECTIONS[1]
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	GA Groundwater Quality Standard (GWQS)	GA Preventative Action Limit (PAL)	MW-123 and MW-801			Additional Well	
Investigation			PCA	SSI		SSI	
Well			MW-123	MW-801		MW-806	
Date Sampled			12/21/94	7/8/98		7/8/98	
			unfiltered	unfiltered	filtered	unfiltered	filtered
ANALYTE:							
Volatile Organic Compounds (µg/L)							
Acetone			ND	5	NA	NS	NS
Methyl tert-Butyl Ether	40	20	NA	1 J	NA	NS	NS
Semivolatile Organic Compounds (µg/L)							
bis(2-Ethylhexyl)phthalate			ND	2 J	NA	NS	NS
Metals (µg/L)							
Arsenic	50	25	*33.0*	2.5 B	9.9 B	NS	NS
Barium	2000	1000	37.9 B	17.6 B	41.3 B	NS	NS
Cadmium	5	2.5	ND	1.4 B	1.5 B	NS	NS
Chromium	100	50	25.8	2.4 B	19.1	NS	NS
Lead	15	7.5	**16.0**	ND	ND	NS	NS
Mercury	2	1	ND	ND	0.18 B	NS	NS
Silver			ND	43.5	18.3 B	NS	NS

Bold - exceeds GA GWQS
Italics - exceeds GA PAL
ND – not detected
J - quantitation approximate
* - from dilution analysis
B - blank contamination (organics), below CRDL (metals)
NA - not analyzed
NS - not sampled; well was dry
PCA - Preliminary Closure Assessment
SI - Site Investigation
SSI - Supplemental Site Investigation
[1] No groundwater samples were collected from the vicinity of the SSI samples during the SI phase.

Semi-Volatile Organic C mpounds (SVOCs)

Only one SVOC, bis(2-ethylhexyl)phthalate (BEHP), was detected in groundwater from MW-801, at a trace level of 2 J ug/L. No exceedances of the GA standards were detected. Previous sampling at MW-123 resulted in no detectable concentrations of any SVOCs.

RCRA 8 Metals

Low levels of arsenic, barium, cadmium, chromium, mercury, and silver were detected in one or both (unfiltered and filtered) of the groundwater samples collected from MW-801, as presented in Table 4-3. No exceedances of the GA standards were detected. During the data review effort, it was noted that metals results should be "used with caution", since these results may be biased high or may be false positives attributable to blank contamination.

Arsenic, chromium, and lead were detected in unfiltered groundwater previously collected from nearby former well MW-123. The arsenic level exceeded the RIDEM Preventive Action Limit (PAL) but not the GA Groundwater Quality Standard (GWQS), while the lead level exceeded both the GA GWQS and PAL. No GA standards were exceeded for chromium.

Total Petroleum Hydrocarbons (TPH)

Although TPH was detected in soil at SB-801 at 4,400 mg/kg, TPH was not detected in the groundwater sample collected from MW-801. (TPH was not analyzed in groundwater previously collected from nearby former well MW-123.) This indicates that a strong correlation does not exist between TPH concentrations in soil and TPH concentrations in groundwater. These groundwater results support previous investigation results that concluded that groundwater is not a significant migration pathway for petroleum compounds released from the tank.

5.0 TANK 45 - SUPPLEMENTAL SITE INVESTIGATION

As recommended in the SI Report (B&R Environmental, 1996a), the SSI was conducted to determine the effectiveness of ring-drain pumping to reduce petroleum mass in soils and groundwater at Tank 45 during tank closure activities ("interim action"). Following the interim action, additional soil and groundwater samples were collected from zones of petroleum-impacted soil identified during the SI as exceeding proposed clean-up standards. Sample results are compared to results of analyses conducted during the SI. The SI Report summarizes field investigation activities conducted previously at Tank 45, during the SI, and during the PCA. This section describes field investigation activities conducted at Tank 45 during the SSI, and summarizes the findings of this investigation.

5.1 FIELD INVESTIGATION ACTIVITIES

The SSI field activities at Tank 45 were conducted by TtNUS in June and July 1998. Objectives at Tank 45 were to: (1) collect soil samples from comparable zones where petroleum-impacted soils exceeding the action level had been sampled in former borings SB-122, SB-330, and SB-335 prior to completion of the interim action; (2) complete one new boring (SB-802) as a replacement groundwater monitoring well for destroyed well MW-122; and (3) install two additional borings/wells downgradient of SB-802, to investigate potential petroleum migration in the unconsolidated overburden. A description of each field investigation activity is presented in the sections that follow, including: overburden soil borings, soil sampling, and groundwater monitoring well installation; groundwater sampling and groundwater level measurements; and field screening and laboratory analysis. A summary of SSI soil borings and monitoring wells that were sampled at Tank 45 during the SSI is presented as Table 5-1.

5.1.1 Soil Borings, Soil Sampling, and Groundwater Monitoring Well Installation

Several wells installed at Tank 45 during previous investigations were damaged and/or buried during recent tank closure activities. During the SSI field effort at Tank 45, a Rhode Island-registered surveyor resurveyed the location of destroyed or buried monitoring wells and/or soil borings, established the present ground surface elevations, and set a stake at each location with the new ground elevations. The new ground surface elevations were then used to determine the sample depth intervals for the new SSI borings. Also as part of the SSI activities at Tank 45, one

TABLE 5-1
TANK 45 SSI SUMMARY
TANK 45 - SUMMARY OF SSI SOIL BORINGS AND MONITORING WELLS
TANK FARM 4
NSN, NEWPORT, RHODE ISLAND

Soil Borings	Ground Surface Elevation July 1998 (ft, MLW)	Depth of Boring (ft, bgs)	Sampled Interval Depth (ft, bgs)	Sampled Interval Elevation (ft, MLW)	Purpose	Notes
SB-802	111.01	39.5	36.0 - 38.0	73.0 - 75.0	Determine effectiveness of interim action by collecting soil sample from overburden petroleum-impacted zone observed in PCA SB-122	Advanced in tank socket; Located 4.8 ft from SB-122; Completed as MW-801
SB-803	110.86	39.0	38.0 - 40.0	70.9 - 72.9	Determine effectiveness of interim action by collecting soil sample from overburden petroleum-impacted zone observed in SI SB-330	Advanced in tank socket; Located 4.8 ft from SB-330
SB-804	110.62	18.0	14.0 - 16 0	94.6 - 96.6	Determine effectiveness of interim action by collecting soil sample from overburden petroleum-impacted zone observed in SI SB-335	Advanced in tank socket; Located 1.5 ft from SB-335
SB-807	109.73	26.0	14.0 - 16.0 24.0 - 25 0	93.7 - 95.7 84.7 - 85.7	Investigate potential petroleum migration in the unconsolidated overburden further downgradient of SB-802	Advanced in construction ramp Located 30.0 ft from SB-802; Completed as MW-807
SB-808	108.84	21 0	19.0 - 21.0	87 4 - 89.8	Investigate potential petroleum migration in the unconsolidated overburden further downgradient of SB-807	Advanced in construction ramp, Located 29 9 ft. from SB-807; Completed as MW-808

TABLE 5-1
TANK 45 SSI SUMMARY
TANK 45 - SUMMARY OF SSI SOIL BORINGS AND MONITORING WELLS
TANK FARM 4
NSN, NEWPORT, RHODE ISLAND

Monitoring Wells	Ground Surface Elevation July 1998 (ft, MLW)	Groundwater Elevation, July 7, 1998 (ft, MLW)	Screen Length (ft)	Screen Interval Elevation (ft, MLW)	Purpose	Notes
MW-330	110.69	92 26	10.0	72.8 - 82.8	Determine effectiveness of interim action on groundwater quality	Rehabilitated well; Sampled 7/8/98
MW-802	111 01	92 28	25.0	71.5 - 96.5	Determine effectiveness of interim action on groundwater quality	Replacement well for MW-122 (destroyed during tank demolition); Sampled 7/8/98
MW-807	109.73	91.40	15.0/10.0-25.0	84 7 - 99.7	Investigate potential petroleum migration in overburden groundwater downgradient of MW-802	Installed in construction ramp; Sampled 7/8/98
MW-808	108.84	89.95	10.0/10.5-20 5	88.3 - 98 3	Investigate potential petroleum migration in overburden groundwater downgradient of MW-807	Installed in construction ramp; Sampled 7/8/98

Notes:

bgs = below ground surface
ft = feet
MLW = mean low water

former monitoring well, MW-122, was properly abandoned in accordance with RIDEM regulations. A summary of groundwater monitoring well abandonment activities was presented in the Tank Farm 4 Groundwater Monitoring Well Abandonment Summary Report (B&R Environmental, 1998).

To meet the objectives of the SSI, five new overburden soil borings were advanced at Tank 45 using drive and wash drilling methods with 4-inch casing. Three of the five borings were completed as groundwater monitoring wells (MW-802, MW-807, and MW-808). Two soil borings, SB-803 and SB-804, were advanced to the required depth for soil sample collection and then backfilled. Wells were constructed of 2-inch inner diameter, flush joint, threaded Schedule 40 PVC, with factory-slotted well screens, and steel protective casings. All newly installed wells were developed according to standard protocols. Further details on well construction are presented in the Monitoring Well Construction Logs, attached as Appendix B. Drilling was conducted by a TtNUS subcontractor, Maher Environmental, with oversight by TtNUS.

MW-802 was installed to collect a soil sample from the interval coinciding with (or in closest proximity to) the highest TPH concentration as previously observed during the advancement of former adjacent well MW-122 (petroleum-impacted soils had been observed in MW-122 from approximately 34 to 36 feet bgs, see Table 5-2) and as a replacement well for previously destroyed well, MW-122. MW-802 was advanced to 39.5 feet bgs, and the well screen was installed from 14.5 to 39.5 feet bgs. (The well screen of former well MW-122 had been installed from 34 to 39 feet bgs.) One soil sample was collected for TPH analysis from MW-802, from 36 to 38 feet bgs, using a split-barrel sampler.

Soil borings SB-803 and SB-804 were advanced to collect soil samples from the interval coinciding with (or in closest proximity to) the highest TPH concentration as previously observed during the advancement of adjacent borings SB-330 and SB-335 (petroleum-impacted soils had been observed in SB-330 from approximately 38 to 40 feet bgs and in SB-335 from 15 to 17 feet bgs, see Table 5-2). SB-803 was advanced to 39 feet bgs prior to backfilling; one soil sample collected from 38 to 40 feet bgs using a split-barrel sampler was sent for laboratory analysis of TPH. SB-804 was advanced to 18 feet bgs prior to backfilling; one soil sample for TPH analysis was collected from 14 to 16 feet bgs.

TABLE 5-2
TANK 45 PCA/SI/SSI COMPARISON OF TPH IN SOILS
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	SB-122 and SB-802			SB-330 and SB-803			SB-335 and SB-804			Additional Borings		
Investigation	PCA		SSI	SI		SSI	SI		SSI	SSI		SSI
Boring	SB-122		SB-802[1]	SB-330		SB-803[2]	SB-335		SB-804[3]	SB-807[4]		SB-808[5]
Date Advanced	November 1994		June 1998	December 1995		June 1998	December 1995		June 1998	June 1998		June 1998
Ground Elevation (ft, MLW)	111.3[6]		111.0	110.8[6]		110.9	111.1[6]		110 6	109.7		108.8
Boring Depth (ft, bgs)	40.0		39 5	39.5		39.0	39 8		18.0	26.0		21 0
EOB (ft, MLW)	71 3		71 5	71.3		71.9	71.3		92 6	83.7		87.8
Sample Interval Depth (ft, bgs)												
Top	32.0	34 0	36.0	30.0	38.0	38.0	13.0	15.0	14.0	14.0	24.0	19.0
Bottom	34 0	36.0	38 0	32.0	39.5	40.0	15.0	17.0	16.0	16 0	25 0	21 0
Sample Interval Elevation (ft, MLW)												
Top	79.3	77.3	75.0	80.8	72.8	72.9	98.1	96.1	96.6	95.7	85.7	89.8
Bottom	77.3	75.3	73.0	78.8	71.3	70 9	96.1	94.1	94.6	93.7	84.7	87.8
TPH (mg/kg)	1,200	11,000	17,000	1,400	23,000	1,700	ND	7,100	5,700	17,000	21,000	3,700

Notes.

bgs = below ground surface
ft = feet
MLW = mean low water
EOB = end of boring
ND = not detected
PCA = Preliminary Closure Assessment
SI = Site Investigation
SSI = Supplemental Site Investigation
[1] SB-802 located 4.8 ft from SB-119.
[2] SB-803 located 4 8 ft from SB-330.
[3] SB-804 located 1.5 ft from SB-335.
[4] SB-807 located 30.0 ft downgradient of SB-802.
[5] SB-808 located 29 9 ft downgradient of SB-807.
[6] Ground elevation prior to tank demolition.

MW-807 and MW-808 were installed downgradient of MW-802 to investigate potential petroleum migration in the unconsolidated overburden further downgradient of the tank, outside the tank socket. MW-807 and MW-808 were advanced to 26 and 21 feet bgs, respectively, and soil samples were collected at 5-foot intervals, beginning at 4 feet bgs. The soil sample exhibiting the highest FID field screening reading or other evidence of petroleum impact was to be selected for laboratory analysis of TPH; if no evidence of petroleum impact was observed, the soil sample from the estimated water table was to be selected for analysis. In MW-807, laboratory analysis of TPH was performed on two soil samples collected from 14 to 16 feet bgs and from 24 to 25 feet bgs, where evidence of petroleum impact was observed during drilling and sampling activities (see Boring Logs, Appendix A). The well screen for MW-807 was installed from 10 to 25 feet bgs. In MW-808, laboratory analysis of TPH was performed on a soil sample collected from 19 to 21 feet bgs, where evidence of petroleum impact was observed (see Boring Logs, Appendix A). The well screen for MW-808 was installed from 10.5 to 20.5 feet bgs.

As noted previously, soil descriptions and any observed visual or olfactory evidence of the possible presence of petroleum (as well as FID screening results) were noted on boring logs for each boring/well (see Boring Logs, Appendix A).

5.1.2 Groundwater Sampling and Groundwater Level Measurements

Static groundwater level measurements were obtained from Tank Farm 4 wells, including wells at Tank 45, on July 7, 1998, prior to groundwater sampling activities. Measurements were conducted using an electronic water level indicator (M-scope) and were measured to the nearest 0.01 foot from the top of each PVC well riser. This information was collected to provide data on approximate groundwater flow direction(s) at the site. All newly installed soil borings and monitoring wells were surveyed for location and elevation by a surveyor registered in the State of Rhode Island. Depth to groundwater measurements were converted to elevations, as provided in Table 5-1.

Groundwater sampling of four wells at Tank 45 was conducted on July 8, 1998, including MW-330, and newly installed wells MW-802, MW-807, and MW-808. The static water level in the well was measured, the well volume calculated, and three to five well volumes of water were purged by bailing with a new, pre-cleaned disposable bailer. Field measurements of pH, temperature, and conductivity, collected after each well volume, were used to determine water

chemistry stabilization prior to sample collection. Field measurements of dissolved oxygen, turbidity, and salinity were also recorded for each well volume. Samples, poured directly from the bailer into the appropriate pre-preserved sample containers, were labeled, and stored on ice until delivery to the analytical laboratory. Groundwater samples were analyzed for VOCs, SVOCs, TPH, and RCRA metals (total/unfiltered and dissolved/field-filtered).

5.1.3 Field Screening and Laboratory Analysis

Soil samples, drilling wash water, groundwater samples, and purge water were visually inspected for the presence of petroleum during SSI activities (sheens, stains, odors, free product). These observations were recorded on sample log sheets and/or boring logs. In addition, soil samples were screened for volatile organics with a FID using the jar headspace technique (see Boring Logs, Appendix A).

Samples were collected and laboratory analyses performed in accordance with NFESC data quality Level C requirements, as described in the Final Work Plan (HNUS, 1994) and the Final Work Plan Addendum 4 (B&R Environmental, 1996b). EPA-approved analytical methods were used for all samples that were submitted for laboratory analysis. Soil and groundwater samples were analyzed for TPH by Method 418.1. Groundwater samples were also analyzed for VOCs by Method 8260; for SVOCs by Method 8270; and for RCRA metals (unfiltered/total and field-filtered/dissolved) by Method 6010. Laboratory analyses were conducted by Mitkem Corporation of Warwick, Rhode Island. Mitkem is a NFESC-approved laboratory. Laboratory analytical results are presented in Appendix E. Analytical results were not validated, but did undergo a minimum level data review by a TtNUS staff chemist.

All environmental samples collected as part of the SSI, including QC samples, were stored and shipped in accordance with chain-of-custody procedures outlined in the project-specific Quality Assurance/Quality Control Plan prepared as part of the Work Plan.

5.2 FINDINGS OF TANK 45 SUPPLEMENTAL SITE INVESTIGATION

A discussion of results for the soil and groundwater sampling conducted at Tank 45 during the SSI is presented below. As recommended in the SI Report and the Work Plan for this SSI, groundwater and soil sampling results are also compared to analytical results from corresponding

samples collected during the SI, as applicable. This discussion supplements additional, more comprehensive sampling and analytical data previously obtained during the PCA and the SI, which is summarized in the SI Report (B&R Environmental, 1996a).

5.2.1 Subsurface Soils

As summarized in Section 5.1.1, during the SSI field effort at Tank 45, six soil samples from five soil borings were collected and analyzed for TPH by Method 418.1. One soil TPH sample was collected from each of the borings SB-802 (soil boring for MW-802), SB-803, SB-804, and SB-808 (soil boring for MW-808), and two soil samples were collected for TPH analysis from SB-807 (soil boring for MW-807), as detailed below. Figures 5-1, 5-2, and 5-3 show a cross-section locus plan and cross-sections A-A' and B-B', respectively, to present a depiction of soil sampling in the vicinity of Tank 45.

SB-802 (replacement well for MW-122) was advanced approximately 3 feet downgradient of Tank 45, within the tank socket area, to a total depth of 39.5 feet bgs, where the possible top of ring-drain piping was encountered. A petroleum sheen was noted on the drilling washwater beginning at approximately 23 feet bgs. An oil layer was observed in washwater from 24 feet bgs to the end of the boring. The first attempt to collect a subsurface soil sample, from 34 to 36 feet bgs, resulted in insufficient recovery of soils, but did indicate evidence of petroleum impact. The soil sample collected from SB-802 for TPH analysis was collected from a depth interval (36 to 38 feet bgs) approximately corresponding to a previously collected TPH-contaminated soil sample from former adjacent well MW-122, as reported in the SI report, and summarized in Table 5-2. The sample consisted of ring-drain gravels in fine to coarse sand. The gravels were noted to be heavily impacted by petroleum, as exhibited by visual observations and elevated FID readings (see Boring Logs, Appendix A). The sands were noted as heavily stained with petroleum. As indicated in Table 5-2, laboratory analysis of duplicate soil samples collected from SB-802 (36 to 38 feet bgs) detected TPH at a maximum level of 17,000 mg/kg, significantly higher than the proposed clean-up level of 5,000 mg/kg for depths greater than 15 feet, and comparable to the level detected in the corresponding previous (pre-interim action) soil sample collected from nearby former well MW-122, where TPH was detected at 11,000 mg/kg from 34 to 36 feet bgs.

SB-803 was advanced approximately 2 feet from Tank 45 (within the tank socket) to a total depth of 39 feet bgs, in order to collect a soil sample from the interval coinciding with (or in closest

LEGEND

45-SB333 — SOIL BORING LOCATION WITH IDENTIFIER

45-MW330 — MONITORING WELL LOCATION WITH IDENTIFIER

45-SS02 — SURFACE SOIL SAMPLE LOCATION WITH IDENTIFIER

P1 — SOIL PROBING SAMPLE LOCATION WITH IDENTIFIER

— — — — LIMITS OF BEDROCK RAMP

——— - ——— LIMITS OF EXCAVATION

TPH — TOTAL PETROLEUM HYDROCARBONS

ND — NOT DETECTED

SB-801 / MW-801	
SOIL SAMPLE	
TPH (37 5-39 5)	4,400
GROUNDWATER SAMPLE	
TPH (51 0-61 0)	ND
LEAD (51 0-61 0) (Unfiltered)	18 7

SOIL BORING LOCATION / MONITORING WELL LOCATION

CONTAMINANT (DEPTH INTERVAL)

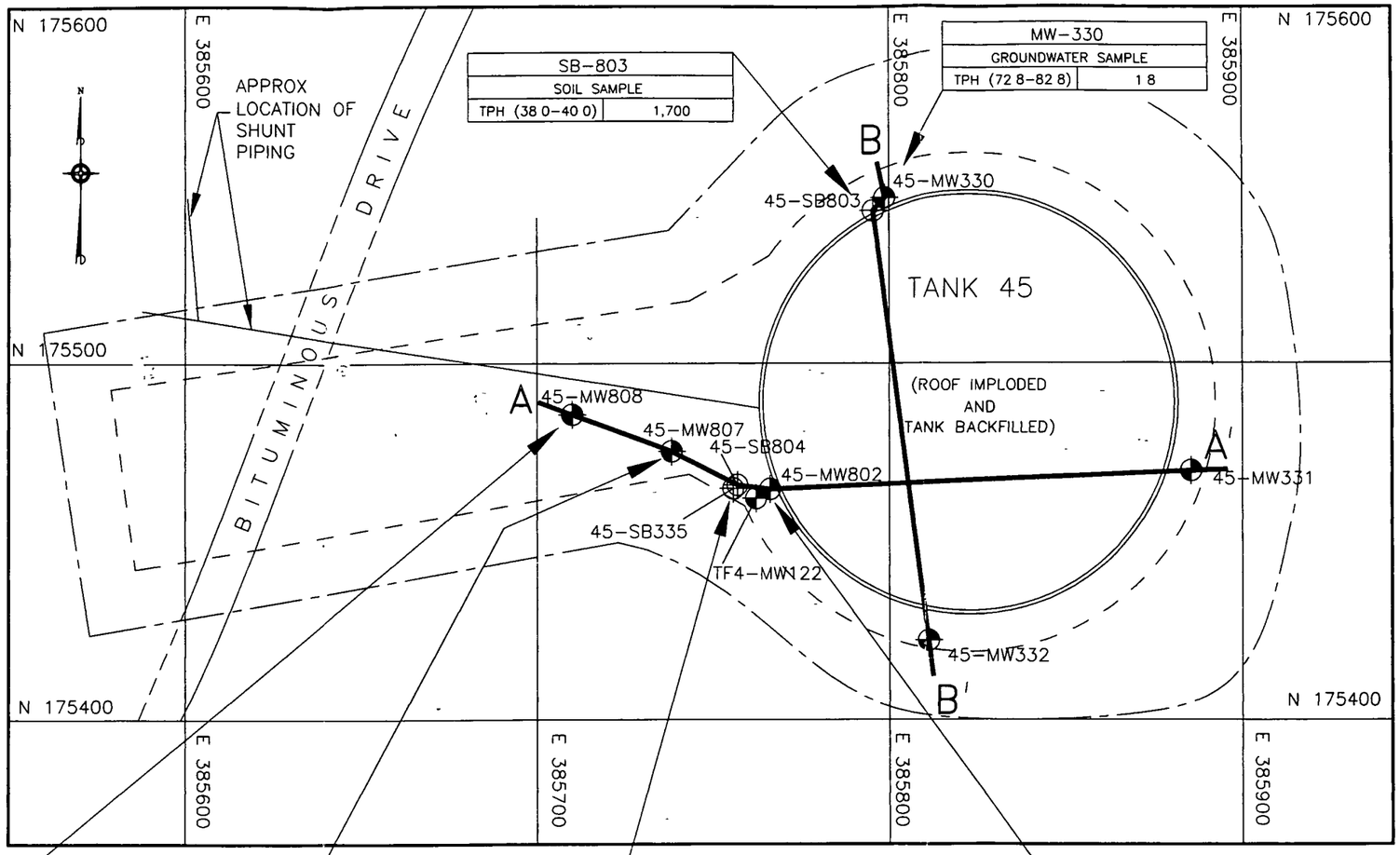
TYPE OF SAMPLE

CONTAMINANT CONCENTRATION

TYPE OF SAMPLE

CONTAMINANT CONCENTRATION

CONTAMINANT CONCENTRATION



SB-808 / MW-808	
SOIL SAMPLE	
TPH (19 0-21 0)	3,700
GROUNDWATER SAMPLE	
TPH (88 3-98.3)	ND

SB-807 / MW-807	
SOIL SAMPLE	
TPH (14 0-16 0)	17,000
TPH (24 0-25 0)	21,000
GROUNDWATER SAMPLE	
TPH (89.7-99 7)	ND

SB-804	
SOIL SAMPLE	
TPH (14 0-16 0)	5,700

SB-802 / MW-802	
SOIL SAMPLE	
TPH (36.0-38.0)	17,000
GROUNDWATER SAMPLE	
TPH (71 5-96 5)	3 6
LEAD (71.5-96 5) (Unfiltered)	18.7

GRAPHIC SCALE

0' 40' 80'

1 INCH = 40 FEET

NOTES:

1) THE DATA DEPICTED INCLUDES TPH CONCENTRATIONS FOR SOIL AND GROUNDWATER, AND GROUNDWATER CONTAMINANTS AND CONCENTRATIONS EXCEEDING THE RIDEM GA GROUNDWATER QUALITY STANDARDS (GWQS) AND / OR PREVENTATIVE ACTION LIMITS (PAL).
2) SOIL SAMPLE TPH CONCENTRATION UNITS IN mg / Kg; GROUNDWATER SAMPLE TPH CONCENTRATION UNITS IN mg / L AND ALL OTHER GROUNDWATER CONTAMINANT CONCENTRATION UNITS IN Ug/L.
3) SOIL SAMPLING DEPTH INTERVAL IN FEET BELOW GROUND SURFACE; GROUNDWATER MONITORING WELL SCREENED INTERVAL IN MEAN LOW WATER ELEVATIONS (FEET).
4) PLAN NOT TO BE USED FOR DESIGN.
5) LOCATIONS FROM BASE MAP BY LOUIS FEDERICI & ASSOCIATES, 235 PROMENADE STREET, PROVIDENCE, RI.
6) GRID COORDINATES BASED ON THE STATE OF RHODE ISLAND GRID COORDINATE SYSTEM (NAD 1983).
7) ABANDONED MONITORING WELLS, FORMER SOIL BORING AND SURFACE SOIL SAMPLE LOCATIONS, AND TANK FEATURES SHOWN IN GRAY.

SOIL & GROUNDWATER CONTAMINANTS (JUNE - JULY, 1998), CROSS-SECTION LOCUS PLAN - TANK 45

NETC-NEWPORT, RI

SUPPLEMENTAL SITE INVESTIGATION REPORT - TANK FARM 4

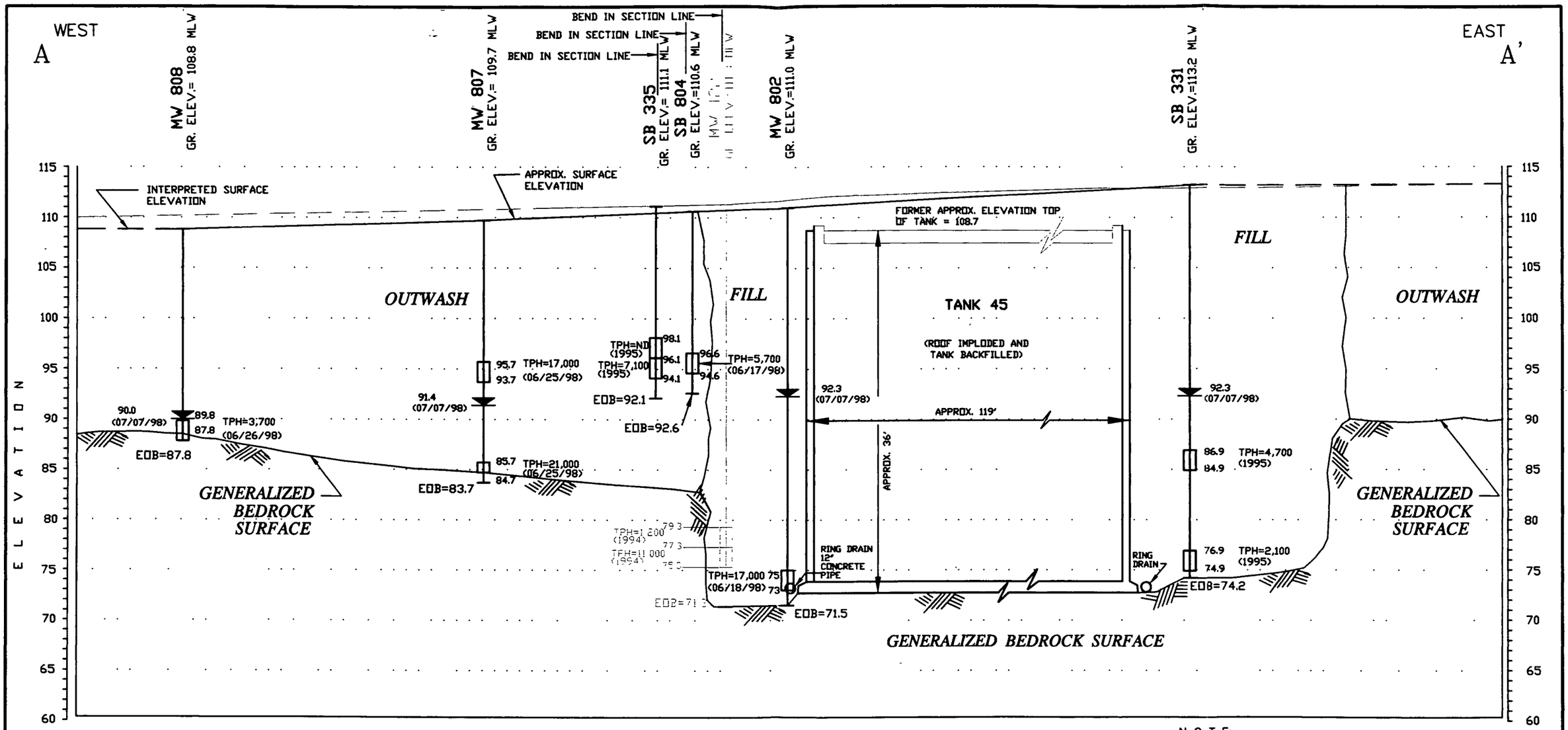
DRAWN BY	R G. DEWSNAP	REV	0
CHECKED BY	P SVETAKA	DATE	JANUARY 29, 1999
SCALE	1" = 40'	FILE NO	DWG\NETC\SSI\T45_TPH DWG

FIGURE 5-1

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887

(508)658-7899



LEGEND

86.9
TPH=4,700 (06/25/98) SOIL SAMPLE INTERVAL ANALYZED BY LAB WITH ELEVATION AND TPH CONCENTRATION. (DATE SAMPLED)
84.9

91.6 (07/07/98) WATER TABLE ELEVATION IN FEET (MLW) (DATE MEASURED)

FORMER GROUND ELEVATION

TPH	TOTAL PETROLEUM HYDROCARBON (MG/KG)
MW 103	GROUNDWATER MONITORING WELL NUMBER
SB 205	SOIL BORING NUMBER
ND	NOT DETECTED
EOB	END OF BORING

GRAPHIC SCALE

10 0 10 20

Horizontal & Vertical Scale: 1IN. = 10 FT.

TPH IN SOIL

NOTE:

1) JULY 7, 1998, WATER LEVEL MEASUREMENTS REPORTED ON FIGURE.
2) ALL TPH UNITS IN MILLIGRAMS PER KILOGRAM (MG/KG).
3) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
4) PLAN NOT TO BE USED FOR DESIGN.
5) FORMER SMAPLE LOCATIONS AND TANK FEATURES SHOWN IN GRAY.

CROSS-SECTION A-A' - TANK 45

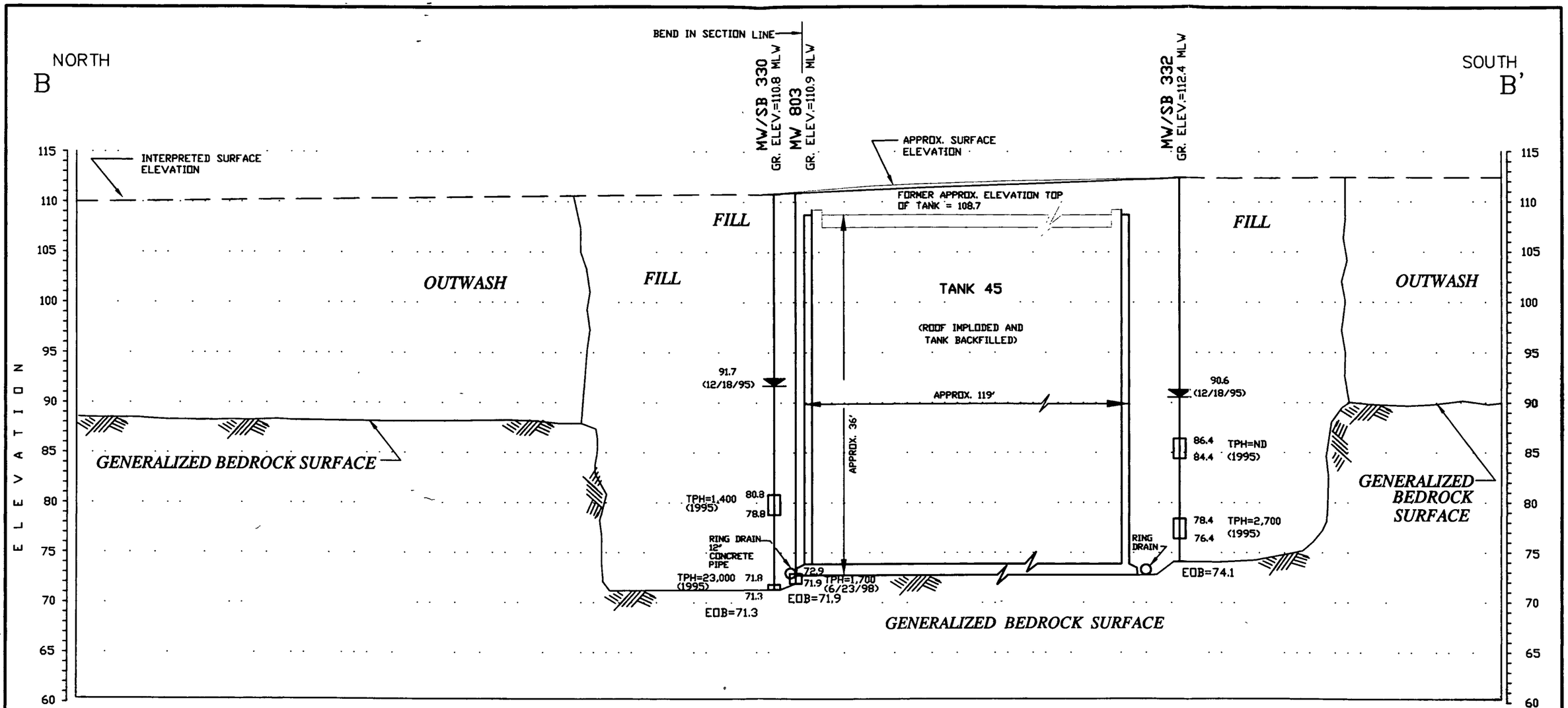
NETC-NEWPORT, RI

SUPPLEMENTAL SITE INVESTIGATION REPORT - TANK FARM 4

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	R. CLEAVER	DATE:	OCTOBER 20, 1998
SCALE:	1" = 10' (APPROX.)	FILE NO.:	DWG\NETC\SSI\XSECT45A.DWG

FIGURE 5-2

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



LEGEND

80.8 / TPH=1,400 (1995) / 78.8 — SOIL SAMPLE INTERVAL ANALYZED BY LAB WITH ELEVATION AND TPH CONCENTRATION. (DATE SAMPLED)

91.7 (12/18/95) — WATER TABLE ELEVATION IN FEET (MLW) (DATE MEASURED)

——— FORMER GROUND ELEVATION

TPH	TOTAL PETROLEUM HYDROCARBON (MG/KG)
MW 103	GROUNDWATER MONITORING WELL NUMBER
SB 205	SOIL BORING NUMBER
ND	NOT DETECTED
EOB	END OF BORING

GRAPHIC SCALE

10 0 10 20

Horizontal & Vertical Scale: 1 IN. = 10 FT.

N O T E:

1) DEC. 1995, WATER LEVEL MEASUREMENTS REPORTED ON FIGURE.
2) ALL TPH UNITS IN MILLIGRAMS PER KILOGRAM (MG/KG).
3) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
4) PLAN NOT TO BE USED FOR DESIGN.

TPH IN SOIL

CROSS-SECTION B-B' - TANK 45

NETC-NEWPORT, RI

SUPPLEMENTAL SITE INVESTIGATION REPORT - TANK FARM 4

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	R. DEWSNAP	DATE:	OCTOBER 21, 1998
SCALE:	1" = 10' (APPROX.)	FILE NO.:	DWG\NETC\SSI\XSECT45B.DWG

FIGURE 5-3

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

proximity to) the highest TPH concentration previously observed during the advancement of adjacent boring SB-330. A moderate to heavy petroleum sheen was noted in washwater beginning at 22 to 24 feet bgs. A heavy sheen and free product were observed in washwater from 32 feet bgs to the end of the boring. One soil sample was collected for TPH analysis from a depth interval of 38 to 40 feet bgs, which corresponds to a previously collected TPH-contaminated soil sample from former adjacent boring SB-330, as reported in the SI report, and summarized in Table 5-2. The sample consisted of rounded gravels in fine to coarse sand. Petroleum was observed to be saturating the sample and coating the associated drilling tools. As indicated in Table 5-2, laboratory analysis of this sample indicated TPH at a level of 1,700 mg/kg, which is below the proposed clean-up level of 5,000 mg/kg for depths greater than 15 feet, and is an order of magnitude lower than the previous sample collected from SB-330 (pre-interim action), where TPH was detected at 23,000 mg/kg, exceeding the proposed clean-up level.

SB-804 was advanced approximately 10 feet from Tank 45, to a total depth of 18 feet bgs, in order to collect a soil sample from the interval coinciding with (or in closest proximity to) the highest TPH concentration as previously observed during the advancement of adjacent boring SB-335. A light petroleum sheen was noted in washwater beginning at 14 feet bgs. The first soil sample was collected from 14 to 16 feet bgs for TPH analysis, corresponding to a previously collected TPH-contaminated soil sample from former adjacent boring SB-335, as reported in the SI report, and summarized in Table 5-2. The sample consisted of fine to coarse sand and angular fine to coarse phyllite gravel. Petroleum was observed to be saturating the bottom 3 inches of the sample, and the remaining portion of the sample was petroleum-stained. As indicated in Table 5-2, laboratory analysis of this sample indicated TPH at a level of 5,700 mg/kg, exceeding the proposed clean-up level of 5,000 mg/kg for depths greater than 15 feet. In the sample previously collected from corresponding boring SB-335 (pre-interim action), TPH was detected at 7,100 mg/kg, also exceeding the proposed clean-up level.

MW-807 was advanced approximately 26 feet downgradient of Tank 45, (outside the tank socket area, and downgradient of SB-802), to a total depth of 26 feet bgs, to investigate potential migration of petroleum observed in upgradient boring SB-802. The top of altered bedrock was encountered at approximately 25 feet bgs. A petroleum sheen and a small quantity of oil were noted on washwater beginning at 13.5 to 14.0 feet bgs. One of two soil samples collected from MW-807 for TPH analysis was from a depth interval of 14 to 16 feet bgs, and consisted of silty, sandy gravel. Petroleum was observed coating the gravels and was noted along fracture planes of

the phyllite gravel. Petroleum staining was noted in the top 8 inches of the sample. A second soil sample was collected from MW-807 for TPH analysis from a depth of 24 to 25 feet bgs. (The sample had been advanced to 26 feet bgs, however, the lower portion of the soil sample was interpreted to be the top of altered bedrock and was not sent for laboratory analysis. Petroleum was also observed inside fracture and bedding planes of the phyllite bedrock.) As indicated in Table 5-2, analytical results indicated TPH was detected in this downgradient location in both samples (14 to 16 feet bgs and 24 to 25 feet bgs) at elevated levels (17,000 mg/kg and 21,000 mg/kg, respectively), both exceeding the proposed clean-up level.

MW-808 was advanced approximately 48 feet downgradient of Tank 45, (outside the tank socket area, and downgradient of SB-802), to a total depth of 21 feet bgs, to investigate potential migration of petroleum observed in upgradient borings SB-802 and SB-807. The top of altered bedrock was encountered at approximately 20.6 feet bgs. A light petroleum sheen was noted on washwater beginning at 18.5 to 19.0 feet bgs. The soil sample collected for TPH analysis was from a depth interval of 19 to 21 feet bgs, and consisted of silty, sandy gravel above altered degraded phyllite bedrock. Petroleum was observed coating the soils and was noted along fracture planes of the phyllite bedrock. Petroleum staining was noted in the bottom 0.75 feet of the sample. As indicated in Table 5-2, analytical results indicated TPH was detected in this downgradient location at a level of 3,700 mg/kg (at 19 to 21 feet bgs), which is lower than the proposed clean-up level of 5,000 mg/kg for depths greater than 15 feet.

Summary of Subsurface Soil Results

In summary, soils from MW-802 and SB-804, which were collected from a comparable depth to petroleum-contaminated soils observed in nearby former (pre-interim action) well/boring MW-122 and SB-335, respectively, still exhibited indications of petroleum contamination. TPH concentrations exceeded the proposed clean-up level of 5,000 mg/kg, indicating no significant decrease in TPH levels in these areas following implementation of the interim action pumping.

Soil from MW-807, located downgradient of MW-802, also exhibited petroleum contamination at elevated levels (17,000 mg/kg and 21,000 mg/kg), higher than levels detected at MW-802 and well above the proposed clean-up level of 5,000 mg/kg. However, at MW-808 (located downgradient of MW-802 and MW-807, the furthest downgradient boring at Tank 45) the level of

TPH contamination detected (3,700 mg/kg) in the unconsolidated overburden is lower than the proposed clean-up level for this depth.

Also, soil from SB-803 exhibited a significant decrease in TPH contamination (1,700 mg/kg, below the proposed clean-up level) from the level of TPH detected in the corresponding pre-interim action boring SB-330, where TPH had been detected in this zone at 23,000 mg/kg.

Laboratory analytical results are presented in Appendix E.

5.2.2 Groundwater

As summarized in Section 5.1.2, groundwater samples were collected from three newly installed monitoring wells, MW-802, MW-807, and MW-808, and from one previously existing well, MW-330. All samples were analyzed for VOCs, SVOCs, RCRA metals, and TPH. During groundwater purging activities, varying degrees of evidence of petroleum impact (sheen and/or oil droplets) were observed on purgewater from three of the four wells; groundwater from MW-808 had no visible evidence of petroleum. However, only very low levels of TPH were detected in only two wells, MW-330 and MW-802, as discussed below. A brief discussion of groundwater analytical results is presented below. All positive groundwater detections are summarized in Table 5-3. Complete laboratory analytical results are reported in Appendix E.

Volatile Organic Compounds (VOCs)

Only trace levels (from 1J to 8 ug/L) of from two to five VOCs were reported in the groundwater samples collected from all four monitoring wells sampled at Tank 45. The VOCs reported in unvalidated laboratory results include: 1,3,5-trimethylbenzene; acetone; carbon disulfide; methyl tert-butyl ether; n-butylbenzene; and naphthalene. No exceedances of the GA standards were detected. (The data reviewer noted that positive results for acetone, carbon disulfide, and naphthalene may be biased high or be false positives attributable to blank contamination.)

Previous sampling at MW-122 (pre-interim action; replaced by MW-802) resulted in no detectable concentrations of any VOCs. Two VOCs, 1,3,5-trimethylbenzene and MTBE, were not included in the list of VOCs analyzed. Furthermore, samples previously collected from MW-330 during the SI, (pre-interim action) were not analyzed for VOCs.

TABLE 5-3
TANK 45 PCA/SI/SSI COMPARISON OF GROUNDWATER ANALYTICAL RESULTS POSITIVE DETECTIONS
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	GA Groundwater Quality Standard (GWQS)	GA Preventative Action Limit (PAL)	MW-803 and MW-330			MW-122 and MW-802			Additional Wells			
Investigation			SI	SSI		PCA	SSI		SSI		SSI	
Well			MW-803	MW-330		MW-122	MW-802		MW-807		MW-808	
Date Sampled			10/5/95	7/8/98		12/1/94	7/8/98		7/8/98		7/8/98	
			Unfiltered	Unfiltered	Filtered	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
ANALYTE:												
Volatile Organic Compounds (ug/L)												
1,3,5-Trimethylbenzene				ND	NA	ND	1 J	NA	ND	NA	ND	NA
Acetone			NA	4 J	NA	ND	6	NA	4 J	NA	5	NA
Carbon Disulfide			NA	ND	NA	ND	ND	NA	1 J	NA	1 J	NA
Methyl tert-Butyl Ether	40	20	NA	2 J	NA	NA	2 J	NA	2 J	NA	3 J	NA
n-Butylbenzene			NA	ND	NA	ND	2 J	NA	ND	NA	ND	NA
Naphthalene	20	10	NA	ND	NA	ND	8	NA	ND	NA	ND	NA
Semivolatile Organic Compounds (ug/L)			NA									
2-Methylnaphthalene				ND	NA	ND	9 J	NA	ND	NA	ND	NA
Acenaphthene			NA	ND	NA	ND	1 J	NA	ND	NA	ND	NA
Anthracene			NA	ND	NA	ND	1 J	NA	ND	NA	ND	NA
bis(2-Ethylhexyl)phthalate			NA	ND	NA	ND	ND	NA	2 J	NA	ND	NA
Dibenzofuran			NA	ND	NA	ND	1 J	NA	ND	NA	ND	NA
Fluorene			NA	ND	NA	16 J	3 J	NA	ND	NA	1 J	NA
Naphthalene	20	10	NA	ND	NA	ND	7 J	NA	ND	NA	ND	NA
Phenanthrene			NA	ND	NA	15 J	7 J	NA	ND	NA	ND	NA
Pyrene			NA	ND	NA	15 J	1 J	NA	ND	NA	ND	NA
Metals (ug/L)												
Arsenic	50	25	NA	ND	ND	**656**	10.6	ND	ND	ND	2 8 B	ND
Barium	2000	1000	NA	10 8 B	B	*1530*	98.6 B	16.4 B	13.3 B	7.8 B	16 B	9.4 B
Cadmium	5	2.5	NA	1 9 B	2 2 B	ND	2.4 B	2.5 B	1.8 B	1.1 B	2 4 B	ND
Chromium	100	50	NA	0.75 B	1 3 ND	**406**	32.3	ND	1.7 B	ND	1 8 B	ND
Lead	15	7.5	NA	ND	ND	**722**	***18.7*** *	ND	ND	ND	ND	ND
Mercury	2	1	NA	0.36	ND	0.52	ND	0.11 B	0 1 B	0.11 B	0 1 B	ND
Silver			NA	7.7 B	7.0 B	29 0	8.9 B	7.7 B	10 3 B	7.5 B	17.1 B	9.7 B

TABLE 5-3
TANK 45 PCA/SI/SSI COMPARISON OF GROUNDWATER ANALYTICAL RESULTS POSITIVE DETECTIONS
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	GA Groundwater Quality Standard (GWQS)	GA Preventative Action Limit (PAL)	MW-803 and MW-330			MW-122 and MW-802			Additional Wells			
Investigation			SI	**SSI**		PCA	SSI		SSI		SSI	
Well			MW-803	MW-330		MW-122	MW-802		MW-807		MW-808	
Date Sampled			10/5/95	7/8/98		12/1/94	7/8/98		7/8/98		7/8/98	
			Unfiltered	Unfiltered	Filtered	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
Total Petroleum Hydrocarbons (TPH) (mg/L)												
TPH			6.3	1 8	NA	NA	3.6	NA	ND	NA	ND	NA

Bold - exceeds GA GWQS
Italics - exceeds GA PAL
ND - not detected
J - quantitation approximate
* - from dilution analysis
B - blank contamination (organics), below CRDL (metals)
NA - not analyzed
PCA - Preliminary Closure Assessment
SI - Site Investigation
SSI - Supplemental Site Investigation

Semi-Volatile Organic Compounds (SVOCs)

Only trace levels (1J to 9J ug/L) of from one to eight SVOCs were detected in the groundwater sample from three of the four monitoring wells sampled at Tank Farm 45. The SVOCs detected included naphthalene (also reported in the VOC fraction), 2-methylnaphthalene, acenaphthene, anthracene, dibenzofuran, fluorene, phenanthrene, and pyrene. No exceedances of the GA standards were detected. No SVOCs were detected in the sample from MW-330.

Previous sampling at MW-122 (pre-interim action; replaced by MW-802) resulted in slightly higher levels of three of these SVOCs. No SVOCs were reported at concentrations exceeding the GA standards. Furthermore, groundwater samples collected previously from MW-330 (pre-interim action) were not analyzed for SVOCs.

RCRA 8 Metals

Metals were reported in filtered and unfiltered groundwater samples collected from the four wells at Tank 45 as listed in Table 5-3. All metals were reported at levels below the GA standards, except for lead in the unfiltered sample from MW-802 (18.7 ug/L). The sample log sheet for this well (Appendix D) indicates high turbidity was observed in the groundwater prior to sampling. Therefore, the elevated lead concentration observed in this unfiltered sample (total metals analysis) can be attributed to lead associated with the high turbidity observation in this sample. The high turbidity level observed in this sample is not considered representative of groundwater quality in this location.

During the data review effort, it was noted that results for the metals barium, cadmium, silver, mercury, arsenic, and chromium should be "used with caution" since these results may be biased high or may be false positives attributable to blank contamination.

The unfiltered groundwater sample previously collected from former well MW-122 (replaced by MW-802) contained arsenic, chromium, and lead at levels exceeding the GA standards. Barium, mercury, and silver were also previously reported in MW-122, at levels below the GA standards. Barium concentrations were detected below the GA GWQS but above the GA PAL.

Groundwater samples previously collected from MW-330 during the SI (pre-interim action) were not analyzed for metals.

Total Petroleum Hydrocarbons (TPH)

Trace levels of TPH were reported in groundwater from two wells at Tank 45: existing well MW-330 (1.8 mg/L) and replacement well MW-802 (3.6 mg/L). TPH had been detected at a somewhat higher levels (6.3 mg/L) and 9.3 mg/L) in the previous samples collected from MW-330 and MW-331 during the SI (pre-interim action). TPH was not analyzed in groundwater previously collected from former well MW-122 (replaced by MW-802). TPH was not detected in wells downgradient from MW-802 (in MW-807 and MW-808).

Tables 5-2 and 5-3 include soil and groundwater positive detections, respectively, including TPH analyses during these investigations. As evidenced by this data, a strong correlation does not exist between TPH concentrations in soil and TPH concentrations in groundwater. These groundwater results support previous investigation results, which concluded that groundwater is not a significant migration pathway for petroleum compounds released from the tank.

6.0 TANK 48 - SUPPLEMENTAL SITE INVESTIGATION

As recommended in the SI Report (B&R Environmental, 1996a), the SSI was conducted to determine the effectiveness of ring-drain pumping to reduce petroleum mass in soils and groundwater at Tank 48 during tank closure activities ("interim action"). Following the interim action, additional soil and groundwater samples were collected from zones of petroleum-impacted soil identified during the SI as exceeding proposed clean-up standards. Sample results are compared to results of analyses conducted during the SI. The SI Report summarizes field investigation activities conducted previously at Tank 48, during the SI, and during the PCA. This section describes field investigation activities conducted at Tank 48 during the SSI, and summarizes the findings of this investigation.

6.1 FIELD INVESTIGATION ACTIVITIES

The SSI field activities at Tank 48 were conducted by TtNUS in June and July 1998. Objectives at Tank 48 were to: (1) collect a soil sample from a comparable zone where petroleum-impacted soils exceeding the action level had been sampled in former boring SB-119, prior to completion of the interim action; (2) complete this new boring (SB-805) as a replacement groundwater monitoring well for destroyed well MW-119; and (3) install an additional boring/well downgradient of SB-805, to investigate potential petroleum migration in the unconsolidated overburden. A description of each field investigation activity is presented in the sections that follow, including: overburden soil borings, soil sampling, and groundwater monitoring well installation; groundwater sampling and groundwater level measurements; and field screening and laboratory analysis. A summary of SSI soil borings and monitoring wells that were sampled at Tank 48 during the SSI is presented as Table 6-1.

6.1.1 Soil Borings, Soil Sampling, and Groundwater Monitoring Well Installation

Several wells installed at Tank 48 during previous investigations were damaged and/or buried during recent tank closure activities. During the SSI field effort at Tank 48, a Rhode Island-registered surveyor resurveyed the location of destroyed or buried monitoring wells and/or soil borings, established the present ground surface elevations, and set a stake at each location with the new ground elevations. The new ground surface elevations were used to determine the sample depth intervals for the new SSI borings. Also as part of the SSI activities at Tank 48, four

TABLE 6-1
TANK 48 SSI SUMMARY
TANK 48 - SUMMARY OF SSI SOIL BORINGS AND MONITORING WELLS
TANK FARM 4
NSN, NEWPORT, RHODE ISLAND

Soil Borings	Ground Surface Elevation July 1998 (ft, MLW)	Depth of Boring (ft, bgs)	Sampled Interval Depth (ft, bgs)	Sampled Interval Elevation (ft, MLW)	Purpose	Notes
SB-805	64.20	39.0	33.0-35.0	29.2 - 31.2	Collect soil sample from overburden petroleum-impacted zone observed in SI SB-119	Advanced in tank socket; Located 5.2 ft from SB-119, Completed as MW-805
SB-809	59.02	21.3	15.0-17.0	42.0 - 44.0	Investigate potential petroleum migration in the unconsolidated overburden further downgradient of SB-805	Advanced in tank socket; Located 72.2 ft from SB-809; Completed as MW-809

Monitoring Wells	Ground Surface Elevation July 1998 (ft, MLW)	Groundwater Elevation, July 7, 1998 (ft, MLW)	Screen Length (ft)	Screen Interval Elevation (ft, MLW)	Purpose	Notes
MW-805	64.20	50.33	30.0	25.4 - 55.4	Determine effectiveness of interim action on groundwater quality	Replacement well for MW-122 (destroyed during tank demolition); Sampled 7/9/98
MW-809	59.02	49.52	10.0	39.0 - 49.0	Investigate potential petroleum migration in overburden groundwater downgradient of MW-805	Overburden well; Sampled 7/9/98
MW-424	59.54	50.10	15.0	18.4 - 33.4	Determine effectiveness of interim action on groundwater quality	SI Bedrock well; Rehabilitated well; Sampled 7/9/98
MW-425	59.93	49.88	15.0	18.2 - 33.2	Determine effectiveness of interim action on groundwater quality	SI Bedrock well; Rehabilitated well; Sampled 7/9/98

Notes:
bgs = below ground surface
ft = feet
MLW = mean low water

former monitoring wells were properly abandoned in accordance with RIDEM regulations, including wells MW-119, MW-401, MW-404, and MW-412; two damaged monitoring wells were repaired (MW-408 and MW-422). A summary of groundwater monitoring well abandonment activities was presented in the Tank Farm 4 Groundwater Monitoring Well Abandonment Summary Report (B&R Environmental, 1998).

To meet the objectives of the SSI, two new overburden soil borings were advanced at Tank 48 using drive and wash drilling methods with 4-inch casing. Both borings were completed as groundwater monitoring wells (MW-805 and MW-809). Wells were constructed of 2-inch inner diameter, flush joint, threaded Schedule 40 PVC, with factory-slotted well screens, and steel protective casings. All newly installed wells were developed according to standard protocols. Further details on well construction are presented in the Monitoring Well Construction Logs, attached as Appendix B. Drilling was conducted by a TtNUS subcontractor, Maher Environmental, with oversight by TtNUS.

MW-805 was installed to collect a soil sample from the interval coinciding with (or in closest proximity to) the highest TPH concentration as previously observed during the advancement of former adjacent well MW-119 (the highest TPH concentration observed in soils at MW-119 were from 27 to 29 feet bgs, see Table 6-2), and as a replacement well for previously destroyed well MW-119. MW-805 was advanced to 39 feet bgs, and the well screen was installed from 8.8 to 38.8 feet bgs and as a replacement well for a previously destroyed well, MW-119. (The well screen of former well MW-119 had been installed from 33.5 to 38.5.) One soil sample collected from MW-805 (from 33 to 35 feet bgs) was sent for laboratory analysis of TPH.

MW-809 was installed downgradient of MW-805 to investigate potential petroleum migration in the unconsolidated overburden further downgradient of the tank, outside the tank socket MW-809 was advanced to 21.3 feet bgs, and soil samples were collected at 5-foot intervals, beginning at 5 feet bgs. The soil sample exhibiting the highest FID field screening reading or other evidence of petroleum impact was to be selected for laboratory analysis of TPH; if no evidence of petroleum impact was to be observed, the soil sample from the estimated water table was to be selected for analysis. Laboratory analysis of TPH was performed on one soil sample collected from 15 to 17 feet bgs (the deepest sample of overburden material collected from this boring). No evidence of petroleum was observed while drilling this boring. The well screen for MW-809 was installed from 10 to 20 feet bgs.

TABLE 6-2
TANK 48 PCA/SI/SSI COMPARISON OF TPH IN SOILS[1]
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	SB-119 and SB-805			Additional Boring
Investigation	PCA		SSI	SSI
Boring	SB-119		SB-805[2]	SB-809[3]
Date Advanced	November 1998		June 1998	June 1998
Ground Elevation (ft, MLW)	62.9[4]		64.2	59.0
Boring Depth (ft, bgs)	39.7		39.0	21.3
EOB (ft, MLW)	23.2		25.2	37.7
Sample Interval Depth (ft, bgs)				
Top	27.0	39.0	33.0	15.0
Bottom	29.0	39.7	35.0	17.0
Sample Interval Elevation (ft, MLW)				
Top	35.9	23.9	31.2	44.0
Bottom	33.9	23.2	29.2	42.0
TPH (mg/kg)	5,300	3,000	2,300	18

Notes:

bgs = below ground surface
ft = feet
MLW = mean low water
EOB = End of boring
PCA = Preliminary Closure Assessment
SI = Site Investigation
SSI = Supplemental Site Investigation
[1] No soil samples were collected from the vicinity of the SSI samples during the SI phase.
[2] SB-805 located 5.2 ft from SB-119.
[3] SB-809 located 72.2 ft downgradient of SB-805.
[4] Ground elevation prior to tank demolition

Soil descriptions and any observed visual or olfactory evidence of the possible presence of petroleum as well as FID screening results were noted on boring logs for each boring/well (boring logs are attached as Appendix A).

6.1.2 Groundwater Sampling and Groundwater Level Measurements

Static groundwater level measurements were obtained from Tank Farm 4 wells, including wells at Tank 48, on July 7, 1998, prior to groundwater sampling activities. Measurements were conducted using an electronic water level indicator (M-scope) and were measured to the nearest 0.01 foot from the top of each PVC well riser. This information was collected to provide data on approximate groundwater flow direction(s) at the site. All newly installed soil borings and monitoring wells were surveyed for location and elevation by a surveyor registered in the State of Rhode Island. Depths to groundwater measurements were then converted to elevations, as provided in Table 6-1.

Groundwater sampling of four wells at Tank 48 was conducted on July 9, 1998, including pre-existing bedrock wells MW-424 and MW-425, and newly installed wells MW-805 and MW-809. The static water level in the well was measured, the well volume calculated, and three to five well volumes of water were purged by bailing with a new, pre-cleaned disposable bailer. Field measurements of pH, temperature, and conductivity, collected after each well volume, were used to determine water chemistry stabilization prior to sample collection. Field measurements of dissolved oxygen, turbidity, and salinity were also recorded for each well volume. Samples, poured directly from the bailer into the appropriate pre-preserved sample containers, were labeled, and stored on ice until delivery to the analytical laboratory. All groundwater samples were analyzed for VOCs, SVOCs, TPH, and RCRA metals (total/unfiltered and dissolved/field-filtered). In addition, groundwater from bedrock wells MW-424 and MW-425 was also collected for Method 8015 analysis to obtain a petroleum fingerprint for these samples.

6.1.3 Field Screening and Laboratory Analysis

Soil samples, drilling wash water, groundwater samples, and purge water were visually inspected for the presence of petroleum during SSI activities (sheens, stains, odors, free product). These observations were recorded on sample log sheets and/or boring logs. In addition, soil samples

were screened for volatile organics with a FID using the jar headspace technique (see Boring Logs, Appendix A).

Samples were collected and laboratory analyses performed in accordance with NFESC data quality Level C requirements, as described in the Final Work Plan (HNUS, 1994) and the Final Work Plan Addendum 4 (B&R Environmental, 1996b). EPA-approved analytical methods were used for all samples that were submitted for laboratory analysis. Soil and groundwater samples were analyzed for TPH by Method 418.1. Groundwater samples were also analyzed for VOCs by Method 8260; for SVOCs by Method 8270; and for RCRA metals (unfiltered/total and field-filtered/dissolved) by Method 6010. Selected samples shipped for GRO analysis (Method 8015) were reported by the laboratory from the total ion chromatographs of the volatile organic analysis. Laboratory analyses were conducted by Mitkem Corporation of Warwick, Rhode Island. Mitkem is a NFESC-approved laboratory. Laboratory analytical results are presented in Appendix E. Analytical results were not validated, but did undergo a minimum level data review by a TtNUS staff chemist.

All environmental samples collected as part of the SSI, including QC samples, were stored and shipped in accordance with chain-of-custody procedures outlined in the project-specific Quality Assurance/Quality Control Plan prepared as part of the Work Plan.

6.2 FINDINGS OF TANK 48 SUPPLEMENTAL SITE INVESTIGATION

A discussion of results for the soil and groundwater sampling conducted at Tank 48 during the SSI is presented below. As recommended in the SI Report and the Work Plan for this SSI, groundwater and soil sampling results are also compared to analytical results from corresponding samples collected during the SI, as applicable. This discussion supplements additional, more comprehensive sampling and analytical data previously obtained during the PCA and the SI, which are summarized in the SI Report (B&R Environmental, 1996a).

6.2.1 Subsurface Soils

As summarized in Section 6.1.1, during the SSI field effort at Tank 48, two soil samples were collected from borings SB-805 (soil boring for MW-805) and SB-809 (soil boring for MW-809), and were analyzed for TPH by Method 418.1. Figures 6-1 and 6-2 show a cross-section locus plan

LEGEND

48–SB419 ⊕ SOIL BORING LOCATION WITH IDENTIFIER

48–MW425 ⊕ MONITORING WELL LOCATION WITH IDENTIFIER

48–SS02 ○ SURFACE SOIL SAMPLE LOCATION WITH IDENTIFIER

P1 ▪ SOIL PROBING SAMPLE LOCATION WITH IDENTIFIER

— — — — LIMITS OF BEDROCK RAMP

——— - ——— LIMITS OF EXCAVATION

TPH TOTAL PETROLEUM HYDROCARBONS

ND NOT DETECTED

SB–801 / MW–801	
SOIL SAMPLE	
TPH (37 5–39 5)	4,400
GROUNDWATER SAMPLE	
TPH (51 0–61 0)	ND
LEAD (25 4–55 4) (Unfiltered)	30 6

CONTAMINANT (DEPTH INTERVAL)

SOIL BORING LOCATION / MONITORING WELL LOCATION

TYPE OF SAMPLE

CONTAMINANT CONCENTRATION

TYPE OF SAMPLE

CONTAMINANT CONCENTRATION

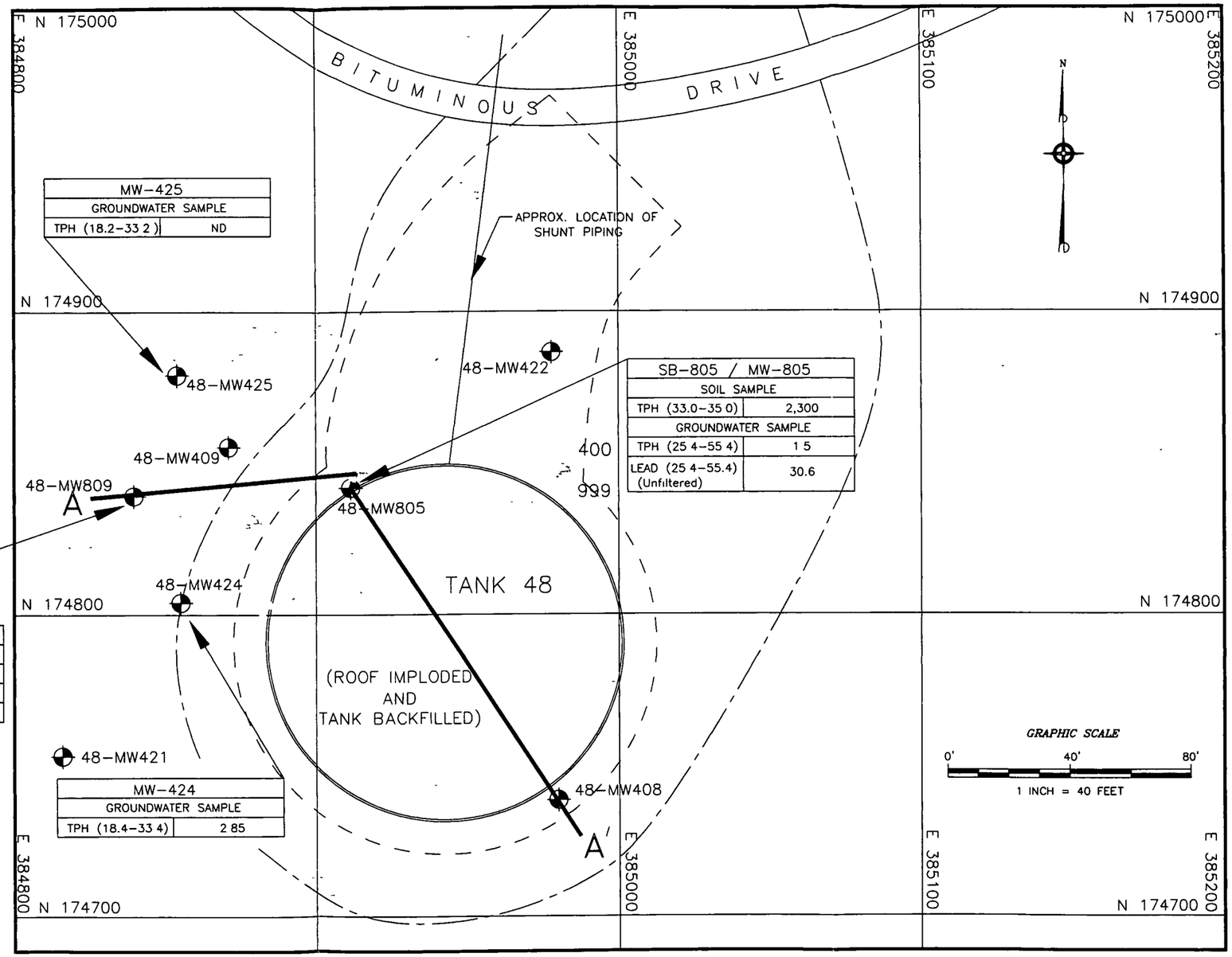
CONTAMINANT CONCENTRATION

SB–809 / MW–809	
SOIL SAMPLE	
TPH (15 0–17 0)	18
GROUNDWATER SAMPLE	
TPH (39 0–49 0)	ND

MW–425	
GROUNDWATER SAMPLE	
TPH (18.2–33 2)	ND

MW–424	
GROUNDWATER SAMPLE	
TPH (18.4–33 4)	2 85

SB–805 / MW–805	
SOIL SAMPLE	
TPH (33.0–35 0)	2,300
GROUNDWATER SAMPLE	
TPH (25 4–55 4)	1 5
LEAD (25 4–55.4) (Unfiltered)	30.6



NOTES:

1) THE DATA DEPICTED INCLUDES TPH CONCENTRATIONS FOR SOIL AND GROUNDWATER, AND GROUNDWATER CONTAMINANTS AND CONCENTRATIONS EXCEEDING THE RIDEM GA GROUNDWATER QUALITY STANDARDS (GWQS) AND/OR PREVENTATIVE ACTION LIMITS (PAL).
2) SOIL SAMPLE TPH CONCENTRATION UNITS IN mg / Kg; GROUNDWATER SAMPLE TPH CONCENTRATION UNITS IN mg / L AND ALL OTHER GROUNDWATER CONTAMINANT CONCENTRATION UNITS IN Ug/L.
3) SOIL SAMPLING DEPTH INTERVAL IN FEET BELOW GROUND SURFACE; GROUNDWATER MONITORING WELL SCREENED INTERVAL IN MEAN LOW WATER ELEVATIONS (FEET).
4) PLAN NOT TO BE USED FOR DESIGN.
5) LOCATIONS FROM BASE MAP BY LOUIS FEDERICI & ASSOCIATES, 235 PROMENADE STREET, PROVIDENCE, RI
6) GRID COORDINATES BASED ON THE STATE OF RHODE ISLAND GRID COORDINATE SYSTEM (NAD 1983).
7) ABANDONED MONITORING WELLS, FORMER SOIL BORING AND SURFACE SOIL SAMPLE LOCATIONS, AND TANK FEATURES SHOWN IN GRAY.

SOIL & GROUNDWATER CONTAMINANTS (JUNE – JULY, 1998), CROSS–SECTION LOCUS PLAN – TANK 48

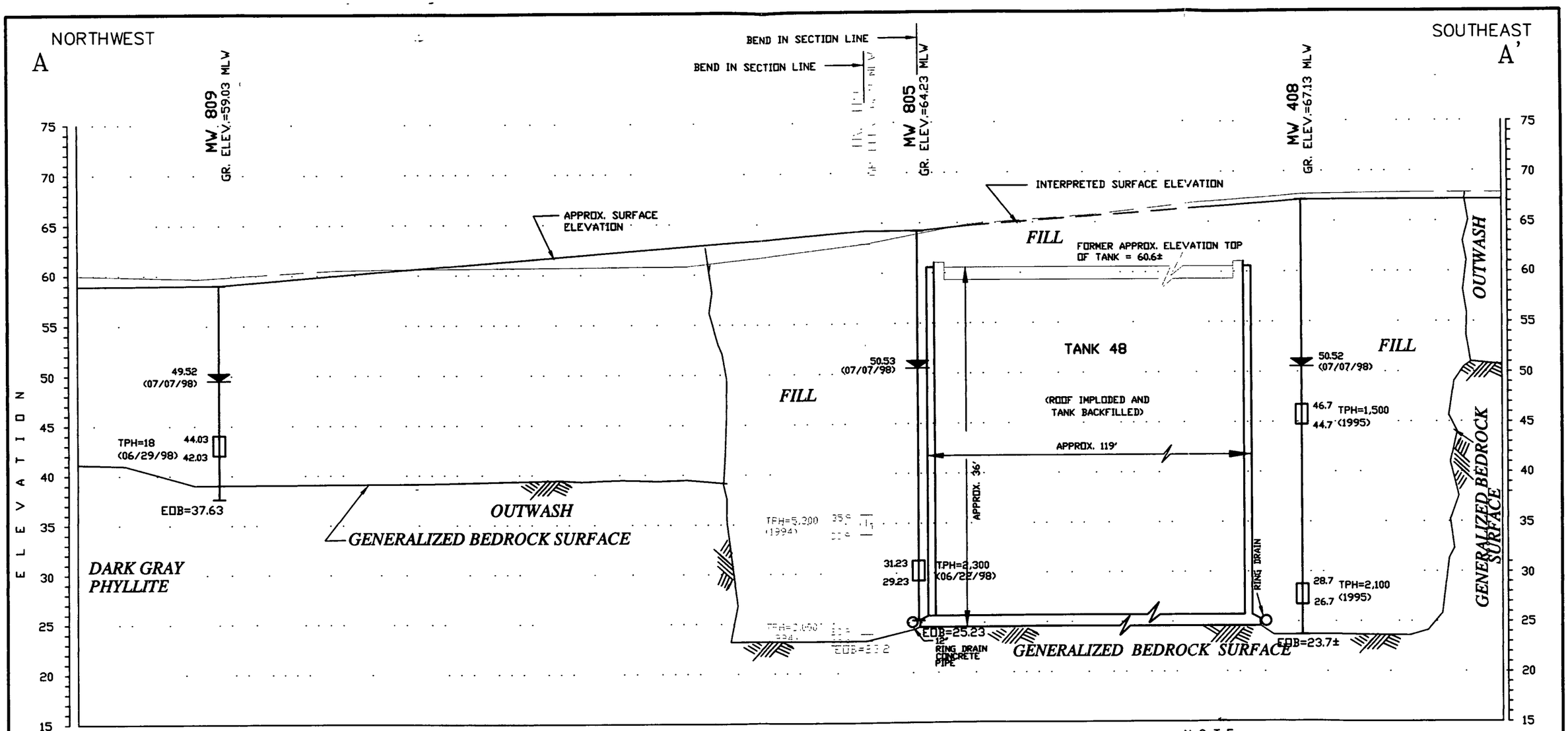
NETC–NEWPORT, RI

SUPPLEMENTAL SITE INVESTIGATION REPORT – TANK FARM 4

DRAWN BY	R G DEWSNAP	REV	0
CHECKED BY.	P SVETAKA	DATE	JANUARY 29, 1998
SCALE	1" = 40'	FILE NO	DWG\NETC\SSI\T48_TPH DWG

FIGURE 6–1

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658–7899



LEGEND

61.2
TPH=18 (06/29/98)
59.2
SOIL SAMPLE INTERVAL ANALYZED BY LAB WITH ELEVATION AND TPH CONCENTRATION. (DATE SAMPLED)

67.7 (07/07/98)
WATER TABLE ELEVATION IN FEET (MLW) (DATE MEASURED)

FORMER GROUND ELEVATION

TPH	TOTAL PETROLEUM HYDROCARBON (MG/KG)
MW 103	GROUNDWATER MONITORING WELL NUMBER
SB 205	SOIL BORING NUMBER
ND	NOT DETECTED
EOB	END OF BORING
GR. ELEV.	GROUND ELEVATION

GRAPHIC SCALE

10 0 10 20

Horizontal & Vertical Scale: 1IN. = 10 FT.

TPH IN SOIL

N O T E:

1) JULY 7, 1998, WATER LEVEL MEASUREMENTS REPORTED ON FIGURE.
2) ALL TPH UNITS IN MILLIGRAMS PER KILOGRAM (MG/KG).
3) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
4) PLAN NOT TO BE USED FOR DESIGN.
5) FORMER SMAPLE LOCATIONS AND TANK FEATURES SHOWN IN GRAY.

CROSS-SECTION A-A' - TANK 48
NETC-NEWPORT, RI
SUPPLEMENTAL SITE INVESTIGATION REPORT - TANK FARM 4

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	R. CLEAVER	DATE:	OCTOBER 21, 1998
SCALE:	1" = 10' (APPROX.)	FILE NO.:	DWG\NETC\SSI\XSECT48.DWG

FIGURE 6-2

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

and cross-section A-A', respectively, to present a depiction of soil sampling in the vicinity of Tank 48.

SB-805 (replacement well for MW-119) was advanced approximately 2 feet from Tank 48, within the tank socket area, to a total depth of 39 feet bgs. A light petroleum sheen was noted on the drilling washwater beginning at approximately 20 feet bgs, increasing with depth. A light oil layer and a strong petroleum odor were observed in drilling washwater beginning at approximately 30 feet bgs. The soil sample collected from SB-805 for TPH analysis was collected from a depth interval (33 to 35 feet bgs) corresponding to a previously collected TPH-contaminated soil sample from former adjacent well MW-119, as reported in the SI report, and summarized in Table 6-2. The sample consisted of angular phyllite gravel, with petroleum observed to be filling the void spaces and noted inside fracture planes of the phyllite gravel. FID readings are presented on the boring logs (Appendix A). As indicated in Table 6-2, laboratory analysis of the SSI soil sample from SB-805 (33 to 35 feet bgs) detected TPH at a level of 2,300 mg/kg, which is below the proposed clean-up level of 5,000 mg/kg for depths greater than 15 feet, and is less than half the value detected in the corresponding previous (pre-interim action) soil sample collected from nearby former well MW-119, where TPH was detected at 5,300 mg/kg.

SB-809 was advanced approximately 70 feet downgradient of Tank 48 (outside the tank socket area) to a total depth of 21.3 feet bgs. This boring was advanced to investigate potential migration of petroleum observed in upgradient boring SB-805 through the unconsolidated overburden. The top of altered bedrock was encountered at approximately 20 feet bgs. No indications of petroleum impact were observed, based on visual inspection of subsurface soil samples and drilling washwater. (One elevated FID jar headspace reading, observed from 5 to 7 feet bgs, is thought to have been the result of methane, due to the organic debris noted in the sample.) One soil sample was collected (in duplicate) from SB-809 for TPH analysis, from a depth interval of 15 to 17 feet bgs, the deepest sample of overburden material collected from this boring. As indicated in Table 6-2, the maximum duplicate sample results indicated TPH at a trace level of 18 mg/kg.

Summary of Subsurface Soil Results

In summary, soils from SB-805 that were collected from a comparable depth to petroleum-contaminated soils observed in nearby former well MW-119 (pre-interim action) still exhibited

some indications of petroleum contamination. However, the TPH concentration detected (2,300 mg/kg) was below the proposed clean-up level of 5,000 mg/kg, indicating a decrease in TPH levels in this area following the implementation of the interim action pumping. Soils from SB-809, advanced downgradient of SB-805, exhibited very low levels (18 mg/kg) of petroleum contaminant migration in the unconsolidated overburden further downgradient of the tank.

Laboratory analytical results are presented in Appendix E.

6.2.2 Groundwater

As summarized in Section 6.1.2, groundwater samples were collected from the two newly installed monitoring wells, MW-805 and MW-809, and from two previously existing bedrock wells, MW-424 and MW-425. All samples were analyzed for VOCs, SVOCs, RCRA metals, and TPH. (Samples were also collected for Method 8015 analysis (petroleum fingerprint) from the two bedrock wells MW-424 and MW-425, however, due to laboratory error, the petroleum fingerprint analysis was not conducted). During groundwater purging activities, varying degrees of evidence of petroleum impact (odor, sheen, or oil droplets) were observed on purgewater from all four wells, however only very low levels of TPH were detected in only two wells, MW-805 and MW-424, as discussed below. A brief discussion of groundwater analytical results is presented below. All positive groundwater detections are summarized in Table 6-3. Complete laboratory analytical results are reported in Appendix E.

Volatile Organic Compounds (VOCs)

Groundwater samples collected from the two previously existing bedrock wells, MW-424 (duplicate samples) and MW-425, revealed comparable trace levels of five to eight VOCs in one or both wells. VOCs in these wells ranged from 1J to 9 ug/L and included acetone, MTBE, ethylbenzene, isopropylbenzene, n-propylbenzene, sec-butylbenzene, n-butylbenzene, and naphthalene. No exceedances of the GA standard were detected. Groundwater samples previously collected from MW-424 and MW-425 during the SI (pre-interim action) were not analyzed for VOCs.

Groundwater samples collected from newly installed replacement well MW-805 and downgradient well MW-809 detected trace levels (from 1J to 2J ug/L) of one to two VOCs. The VOCs reported

in these wells were MTBE and sec-butylbenzene. No exceedances of the GA standards were detected. Previous sampling at MW-119 (pre-interim action; replaced by MW-805) resulted in no detectable concentrations of any VOCs. Two VOCs, MTBE and sec-butylbenzene, were not included in the list of VOCs analyzed.

Semi-Volatile Organic Compounds (SVOCs)

Only trace levels (2 to 6J ug/L) of four to six SVOCs were detected in groundwater samples from bedrock wells MW-424 (duplicate samples) and MW-425. The SVOCs detected in one or both wells included naphthalene, 2-methylnaphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, and/or pyrene. No exceedances of the GA standards were detected. Groundwater samples previously collected from MW-424 and MW-425 during the SI (pre-interim action) were not analyzed for SVOCs.

In the groundwater samples collected from MW-805 and MW-809, trace levels of from three to five SVOCs were detected in each well, ranging from 1J to 2J ug/L. The SVOCs detected in one or both wells included 2-methylnaphthalene, acenaphthene, dibenzofuran, fluorene, and/or phenanthrene. (These compounds also reported in the bedrock wells, as summarized above.) No exceedances of the GA standards were detected. These compounds were also detected at comparable trace levels (1 to 7 ug/L) in the groundwater sample previously collected from former well MW-119 (pre-interim action; replaced by MW-805). Trace amounts (1J to 2J ug/L) of anthromene and pyrene were also detected in former well MW-119.

RCRA 8 Metals

Metals were reported in filtered and unfiltered groundwater samples collected from the four wells at Tank 48 as listed in Table 6-3. All metals were reported at levels below the GA standards, except for lead in the unfiltered sample from MW-805 (30.6 ug/L). The sample log sheet for this well (Appendix D) indicates high turbidity was observed in the groundwater prior to sampling.

TABLE 6-3
TANK 48 PCA/SI/SSI COMPARISON OF GROUNDWATER ANALYTICAL RESULTS POSITIVE DETECTIONS
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	GA Groundwater Quality Standard (GWQS)	GA Preventative Action Limit (PAL)	MW-424						MW-425						MW-119 and MW-805						Additional Well			
Investigation			SI		SSI				SI		SSI				PCA		SSI				SSI			
Well			MW-424		MW-424				MW-425		MW-425				MW-119		MW-805				MW-809			
Date Sampled			12/1/95		7/8/98				12/1/95		7/8/98				12/1/94		7/8/98		7/9/98		7/9/98			
			Unfiltered		Unfiltered[1]		Filtered[1]		Unfiltered		Unfiltered		Filtered		Unfiltered		Unfiltered		Filtered		Unfiltered		Filtered	
ANALTYE:																								
Volatile Organic Compounds (ug/L)																								
Acetone				NA	8			NA		NA	4	JB		NA		ND	4	JB		NA	4	JB		NA
Ethylbenzene	700	350		NA		ND		NA		NA	1	J		NA		ND		ND		NA		ND		NA
Isopropylbenzene				NA	1			NA		NA	3	J		NA		ND		ND		NA		ND		NA
Methyl tert-Butyl Ether	40	20		NA	1.5			NA		NA	2	J		NA		NA	1	J		NA	2	J		NA
n-Butylbenzene				NA		ND		NA		NA	6			NA		ND		ND		NA		ND		NA
n-Propylbenzene				NA		ND		NA		NA	3	J		NA		ND		ND		NA		ND		NA
Naphthalene	20	10		NA	9			NA		NA	7			NA		ND		ND		NA		ND		NA
sec-Butylbenzene				NA	1			NA		NA	1	J		NA		NA		ND		NA	1	J		NA
Semivolatile Organic Compounds (ug/L)																								
2-Methylnaphthalene				NA		ND		NA		NA	6	J		NA	7	J	1	J		NA		ND		NA
Acenaphthene				NA	2			NA		NA	2	J		NA	1	J	1	J		NA	2	J		NA
Dibenzofuran				NA	2			NA		NA	2	J		NA	1	J	1	J		NA	2	J		NA
Fluorene				NA	2			NA		NA	3	J		NA	2	J	2	J		NA	2	J		NA
Naphthalene	20	10		NA		ND		NA		NA	6	J		NA	1	J		ND		NA		ND		NA
Phenanthrene				NA		ND		NA		NA	4	J		NA	3	J	2	J		NA		ND		NA
Anthracene				NA		ND		NA		NA		ND		NA	1	J		ND		NA		ND		ND
Pyrene				NA	3			NA		NA		ND		NA	2	J		ND		NA		ND		NA
Metals (ug/L)																								
Arsenic	50	25		NA		ND		ND		NA		ND	3.7	B	7.5	B		ND		ND	13		5.6	B
Barium	2000	1000		NA	17.35		20.15			NA	24.6	B	22.2	B	20.8	B	5 4	B	13.5	B	42.6	B	28.6	B
Cadmium	5	2.5		NA	0.95		0.8			NA	1.4	B	*2 6*	B		ND		ND	1.3	B	1.7	B	*3.7*	B
Chromium	100	50		NA	0.5			ND		NA		ND		ND		ND	2.6	B		ND	7.5	B		ND

TABLE 6-3
TANK 48 PCA/SI/SSI COMPARISON OF GROUNDWATER ANALYTICAL RESULTS POSITIVE DETECTIONS
TANK FARM 4 SUPPLEMENTAL SITE INVESTIGATION
NSN, NEWPORT, RHODE ISLAND

	GA Groundwater Quality Standard (GWQS)	GA Preventative Action Limit (PAL)	MW-424						MW-425						MW-119 and MW-805						Additional Well			
Investigation			SI		SSI				SI		SSI				PCA		SSI				SSI			
Well			MW-424		MW-424				MW-425		MW-425				MW-119		MW-805				MW-809			
Date Sampled			12/1/95		7/8/98				12/1/95		7/8/98				12/1/94		7/8/98		7/9/98		7/9/98			
			Unfiltered		Unfiltered[1]		Filtered[1]		Unfiltered		Unfiltered		Filtered		Unfiltered		Unfiltered		Filtered		Unfiltered		Filtered	
Lead	15	7.5		NA		ND		ND		NA		ND		ND	5.2		***30.6***	*		ND		ND		ND
Mercury	2	1		NA	0.072 5		0 067 5			NA	0 11	B	0.96		0.42		0.1	B		ND	0:12	B	0.17	B
Silver				NA		ND	1 65			NA	8.6	B	3.1	B		ND	3.7	B	2 9	B	3.8	B	4.3	B
Total Petroleum Hydrocarbons (TPH) (mg/L)																								
TPH			440		2.85			NA		ND		ND		NA		NA	1.5			NA		ND		NA

Bold - exceeds GA GWQS
Italics - exceeds GA PAL
ND - not detected
J - quantitation approximate
* - from dilution analysis
B - blank contamination (organics), below CRDL (metals)
NA - not analyzed
PCA - Preliminary Closure Assessment
SI - Site Investigation
SSI - Supplemental Site Investigation
[1] Values listed are averages from analyses of duplicate samples.

Therefore, the elevated lead concentration observed in this unfiltered sample (total metals analysis) can be attributed to lead associated with the high turbidity observation in this sample. The high turbidity level observed in this sample is not considered representative of groundwater quality in this location.

Cadmium was reported in the filtered samples from MW-425 and MW-809 at levels exceeding the GA PAL, but less than the GA GWQS, as presented in Table 6-3. Cadmium results for the corresponding unfiltered samples from these wells were below the GA standards. During the data review effort, it was noted that cadmium results, as well as results for the metals barium, silver, mercury, arsenic, and chromium should be "used with caution", since these results may be biased high or may be false positives attributable to blank contamination.

Groundwater samples previously collected from MW-424 and MW-425 during the SI (pre-interim action) were not analyzed for metals. The groundwater sample previously collected from former well MW-119 (pre-interim action; replaced by MW-805), contained low levels of arsenic, barium, lead, and mercury. No concentrations exceeded the GA standards.

Total Petroleum Hydrocarbons (TPH)

Trace levels of TPH were reported in groundwater from two wells at Tank 48: bedrock well MW-424 (an average of 2.85 mg/l in duplicate samples from this well) and tank socket well MW-805 (1.5 mg/L). TPH had been detected at a significantly higher level (440 mg/L) in the previous sample collected from MW-424 during the SI (pre-interim action). TPH levels in groundwater samples collected from wells screened in the tank socket during the SI were reported at 18 mg/L for MW-401, 87 mg/L for MW-404, 3.9 mg/L for MW-408, and 13.5 mg/L for MW-412. TPH was not analyzed in groundwater previously collected from nearby former well MW-119 (replaced by MW-805). TPH was not detected in bedrock well MW-425 or in downgradient overburden well MW-809.

Tables 6-2 and 6-3 include soil and groundwater positive detections, respectively, including TPH analyses performed during these investigations. As evidenced by this data, a strong correlation does not exist between TPH concentrations in soil and TPH concentrations in groundwater. These groundwater results support previous investigation results that concluded that groundwater is not a significant migration pathway for petroleum compounds released from the tank.

7.0 SUMMARY AND CONCLUSIONS

In accordance with the Tanks 42, 45, and 48 SIs, additional subsurface soil and groundwater samples were collected from zones of petroleum-impacted soil exceeding the proposed clean-up levels following the source control (tank cleaning) and interim action (ring drain pumping). SSI sample results were compared with PCA and SI results to evaluate the effectiveness of the source control and interim action, and to determine if addition remedial action is necessary.

7.1 GENERAL

SSI soil TPH concentrations were compared to the PCA and SI soil TPH concentrations and the proposed clean-up levels of 2,500 mg/kg and 5,000 mg/kg for soils at depths of 1 to 15 feet and greater than 15 feet, respectively. SSI soil sample results did not indicate a systematic reduction in TPH concentrations in soils as a result of tank closure activities. This may be a result of variations in the amount of groundwater pumped from the ring drain of each tank during cleaning. Also, SSI groundwater sampling results indicate that the interim action has had a limited but positive impact on groundwater quality.

7.2 TANK 42

The following subsections summarize the Tank 42 SSI findings and conclusions.

7.2.1 Tank 42 SSI Summary

The Tank 42 PCA identified petroleum-impacted soils at SB-123, with a soil TPH concentration of 5,700 mg/kg at a sample interval 36.0 to 38.0 feet bgs (elevation 50.9 to 52.9 feet MLW). In addition, petroleum contamination was noted throughout the zone of impacted soils. During the SSI, an overburden boring (SB-801) was advanced 6.6 feet from the location of SB-123 and completed as a monitoring well (MW-801). Based on a field visual assessment of the SB-801 soil sample, a second overburden soil boring was advanced and a monitoring well was installed 31.1 feet downgradient of MW-801 (SB-806/MW-806) outside the tank bedrock socket in the natural outwash materials. The TPH level in the SB-801 soil sample from a sample interval 37.5 to 39.5 ft. bgs (elevations 50.3 to 52.3 feet MLW) was 4,400 mg/kg. The sample consisted of ring-drain gravels with the presence of petroleum noted. TPH was not detected in the SB-806 soil sample collected from a sample interval 14.0 to 16.0 feet bgs (elevations 71.8 to 73.8 feet

MLW). The SB-806 sample was collected from the interval exhibiting the highest FID field screening reading.

Comparison of the SB-123 and SB-801 results indicate a moderate decrease in the TPH level in this location. This reduction may be due partially to the tank ring drain pumping activities, as well as to continuing natural attenuation (dilution and biodegradation). The SSI results also indicate that petroleum-impacted soils, greater than 5,000 mg/kg TPH, do not extend to SB-806 where soil TPH contamination was not detected. SB-806 is located in a downgradient direction outside the tank socket in natural outwash materials. The data indicate that petroleum has not migrated beyond the tank socket fill materials, most likely due to two conditions: the viscosity of the oil and the lower hydraulic conductivity of the natural outwash materials. Heavier oils such as No. 6 fuel oil are relatively immobile due to high viscosity and low solubility (B&R Environmental, 1996a). Based on the sampling results, the petroleum-impacted soils seem to be limited to the fill materials placed during the construction of the tanks. The fill materials have a higher hydraulic conductivity than the natural outwash materials that surround the tanks. The lower hydraulic conductivity outwash materials appear to limit petroleum migration.

During the SI, groundwater samples collected from wells screened within the tank socket had a maximum TPH concentration of 10 mg/L. Immiscible oil droplets and a light oil layer were noted in the well development water. During the SSI, one groundwater sample was collected from MW-801, located in the tank socket (MW-806 was dry) and analyzed for VOCs, SVOCs, RCRA metals, and TPH. Unfiltered and filtered samples were collected for metals analysis. No detections above the GA groundwater quality standards or the preventative action limits were observed. In addition, TPH concentrations in MW-801 were below the detection limit of 1 mg/L; however, a minor sheen was observed on the surface of the purge water. No groundwater sample was collected from MW-806 during the SSI, since the well was nearly dry.

7.2.2 Tank 42 SSI Conclusions

The Tank 42 source control action has eliminated continued release to the environment, and the interim action has apparently helped remove contaminant mass from the fill material to lower TPH concentrations to a level below the proposed clean-up level of 5,000 mg/kg for soils below 15 feet below ground surface. However, results indicate that fill materials in the lower portion of the tank socket are still impacted and that petroleum contamination is still present in the coarse-grained

materials. Petroleum contamination above the proposed regulatory limits does not appear to have migrated beyond the Tank 42 fill materials.

The data indicate that the interim action has reduced TPH levels in groundwater by removing petroleum-impacted groundwater from the Tank 42 socket. Due to low groundwater levels, no sample was collected from MW-806 located outside the tank bedrock socket in the natural outwash materials. However, previous SI results indicate that the unconsolidated overburden aquifer is not a significant migration pathway for heavy fuel oil compounds released from the tanks (B&R Environmental 1996a). Also, the lower hydraulic conductivity of the bedrock and natural outwash materials surrounding the fill materials limit the migration of petroleum and petroleum-impacted groundwater from the unconsolidated aquifer.

Several options are available to address petroleum-impacted soil at Tank 42; however, because soil TPH concentrations do not exceed the proposed risk-based clean-up levels, and source control (removal of tank contents), and interim action (ring-drain pumping) have been completed, the most appropriate action is implementation of institutional controls.

Institutional controls include options such as Land Use Controls, access restrictions, posting signs, and monitoring. Land Use Controls, or other policies or rules can prevent the exposure of workers and nearby residents to the residual subsurface contaminants. These controls could also limit future placement of drinking water wells, construction or demolition activities, and excavation within the tanks areas.

7.3 TANK 45

The following subsections summarize the Tank 45 SSI findings and conclusions.

7.3.1 Tank 45 SSI Summary

During the Tank 45 PCA and SI, petroleum-impacted soils were identified at three locations:

1) SB-122, with a soil TPH concentration of 11,000 mg/kg at a sample interval 34 to 36 feet bgs (elevation 75.3 to 77.3 feet MLW),
2) SB-330, with a soil TPH concentration of 23,000 mg/kg at a sample interval 38 to 39.5 feet bgs (elevation 71.3 to 72.8 feet MLW), and

3) SB-335, with a soil TPH concentration of 7,100 mg/kg at a sample interval 15 to 17 feet bgs (elevation 94.1 to 96.1 feet MLW).

During the SSI, overburden borings SB-802, SB-803, and SB-805 were advanced at the locations of SB-122, SB-330, and SB-335 respectively, with one boring (SB-802) completed as a monitoring well (MW-802). Based on a visual assessment of the soil samples, two additional soil borings were advanced and monitoring wells were installed 30 feet downgradient from MW-802 (SB-807/MW-807) and 30 feet downgradient from MW-807 (SB-808/MW-808). These additional downgradient borings/monitoring wells were located in the tank construction ramp area. Six soil samples (one from each boring and two from MW-807) were analyzed for TPH (Method 418.1).

The TPH level in the SB-802 soil sample from a sample interval 36.0 to 38.0 feet bgs (elevations 73.0 to 75.0 feet MLW) was 17,000 mg/kg. An oil layer was observed in wash water at this boring. The sample consisted of ring-drain gravel and the presence of petroleum was noted. Comparison of the SB-122 and SB-802 results indicate a significant increase in the TPH level at this interval.

The TPH level in the SB-803 soil sample from a sample interval 38.0 to 40.0 feet bgs (elevations 70.9 to 72.9 feet MLW) was 1,700 mg/kg. An oil layer was observed in wash water at this boring and petroleum was observed to be saturating the sample. Comparison of the SB-330 and SB-803 results indicates a significant decrease in the TPH level at this interval.

The TPH level in the SB-804 soil sample from a sample interval 14.0 to 16.0 feet bgs (elevations 94.6 to 96.6 feet MLW) was 5,700 mg/kg. A light sheen was observed in wash water at this boring and petroleum was observed in the sample. Comparison of the SB-335 and SB-804 results indicates a slight decrease in the TPH level at this interval.

In the downgradient sample locations, moderate to high TPH levels were observed in the fill material within the tank construction ramp area. The SB-807 and SB-808 samples were collected from the intervals exhibiting the highest FID field screening reading. Located approximately 30 feet from Tank 45, SB-807 yielded TPH concentrations of 17,000 mg/kg at a sample interval 14.0 to 16.0 feet bgs (elevations 93.7 to 95.7 feet MLW) and 21,000 mg/kg at a sample interval 24.0 to 25.0 feet bgs (elevations 84.7 to 85.7 feet MLW). A sheen and oil layer were observed in wash water at this boring and petroleum was observed in the samples.

The boring furthest away (60 feet) from Tank 45, SB-808, yielded a TPH concentration of 3,700 mg/kg at a sample interval 19.0 to 21.0 feet bgs (elevations 87.8 to 89.8 feet MLW). A light sheen was observed in wash water at this boring and petroleum was observed in the sample.

During the PCA, an unfiltered groundwater sample was collected from one well (MW-122) screened within the tank socket, and the sample was analyzed for VOCs, SVOCs, and RCRA metals. No VOCs were detected; and low levels of SVOCs were detected at concentrations below the GA groundwater quality standards and the preventative action levels. Levels of arsenic, barium, chromium, and lead were detected above the GA groundwater quality standards or preventative action levels; these were attributed to the high turbidity of the unfiltered sample. During the SI, groundwater samples from two wells screened within the tank socket had a TPH concentrations of 6.3 and 9.3 mg/L. Immiscible oil droplets and a light oil layer were noted in well the development water.

SSI groundwater samples were collected from four overburden monitoring wells at Tank 45, and analyzed for VOCs, SVOCs, RCRA metals, and TPH. Unfiltered and filtered samples were collected for metals analysis from each monitoring well. Groundwater TPH levels ranged from 1.8 to 3.6 mg/L at MW-330 and MW-802 both screened within the tank socket. These results indicate a decrease in groundwater TPH within the tank socket when compared to SI TPH results discussed above. TPH was not detected at the downgradient wells MW-807 and MW-808. Analytical results for these samples indicate the presence of VOCs and SVOCs at low levels, below the GA groundwater quality standards and the preventative action limits. All metals concentrations were low below the groundwater standards with the exception of lead detected in the unfiltered sample from MW-802 at 18.7 µg/L, exceeding the GA groundwater quality standard of 15 µg/L. However, lead was not detected in the MW-802 filtered sample. Field observations recorded during the groundwater sampling indicated a high turbidity in the samples. The elevated lead concentration observed in the unfiltered sample (total metals analysis) could be attributed to lead that is associated with the high turbidity observation in this sample. The high turbidity level observed in this sample is not considered representative of groundwater quality at this location.

Metal levels in the MW-802 groundwater sample (unfiltered) were much lower than the levels reported in the MW-122 groundwater sample (unfiltered) collected during the PCA in 1994.

7.3.2 Tank 45 SSI Conclusions

The interim action does not appear to have reduced Tank 45 soil TPH levels consistently below the proposed clean-up level of 5,000 mg/kg for soils below 15 feet below ground surface. In addition, soil TPH exceeds the clean-up level at MW-807, located approximately 30 feet from Tank 45 within the ramp fill, a potential contaminant migration pathway in a downgradient direction from the tank. Petroleum-impacted soils extend to SB-808, located approximately 60 feet downgradient from Tank 45 but do not exceed the soil clean-up level. Further remedial action may be required to address exceedances of the proposed clean-up levels.

The data indicate that the interim action may have helped reduce TPH levels in groundwater by removing petroleum-impacted groundwater from the Tank 45 socket. Comparison of SI and SSI groundwater sample results for wells located in the tank socket show a decrease in TPH levels. TPH was detected at very low levels in the groundwater samples; and the samples did not exceed the GA groundwater quality standards or preventative action limits for the additional analytes. The lower hydraulic conductivity of the bedrock and natural outwash materials surrounding the fill materials limit the migration of petroleum and petroleum-impacted groundwater from the unconsolidated aquifer. The presence of only low concentrations of TPH in groundwater samples, collected from monitoring wells installed in fill materials downgradient of the tank sockets, indicates that the unconsolidated overburden aquifer is not a significant migration pathway for heavy fuel oil compounds released from the tank.

Several options are available to address soils exceeding the clean-up level at Tank 45. Potential technologies screened in the Tank 50 evaluation included: 1) Institutional Controls, 2) Excavation with Off-site Disposal or Treatment, 3) Thermally Enhanced Air Sparging, and 4) In-situ Bioremediation. As noted previously, bioremediation treatability studies conducted at Tank 50 concluded that in-situ bioventing/biosparging will not reduce the hydrocarbon concentrations in all areas below 5,000 mg/kg within a reasonable period of time due to the high concentrations of heavy fuel fractions (FWENC 1997). An evaluation of the other technologies, namely 1) Institutional Controls, 2) Excavation with Off-site Disposal or Treatment, and 3) Thermally Enhanced Air Sparging could be considered as the basis of a Tank 45 CAP.

7.4 TANK 48

The following subsections summarize the Tank 48 SSI findings and conclusions.

7.4.1 Tank 48 SSI Summary

The Tank 48 PCA identified petroleum-impacted soils at SB-119 with soil TPH concentrations of 5,300 mg/kg at a sample interval 27.0 to 29.0 feet bgs (elevations 33.9 to 35.9 feet MLW), and 3,000 mg/kg at a sample interval 39.0 to 41.0 feet bgs (elevations 23.2 to 23.9 feet MLW). In addition, petroleum was noted to be present throughout the coarse-grained fill materials. During the SSI an overburden boring (SB-805) was advanced 5.2 feet from the location of SB-119 and completed as a monitoring well (MW-805). Based on a field visual assessment of the soil sample from SB-805, a second overburden soil boring was advanced and a monitoring well was installed 72.2 feet downgradient from MW-805 (SB-809/MW-809) outside the tank bedrock socket and fill in the natural outwash materials. The TPH level in the SB-805 soil sample from an interval 33.0 to 35.0 feet bgs (elevation of 29.2 to 31.2 feet MLW) was 2,300 mg/kg. The presence of petroleum was noted in the sample. The TPH level in the SB-809 soil sample from a depth 15.0 to 17.0 feet bgs (elevations of 42.0-44.0 feet MLW) was 18 mg/kg. No indications of petroleum impacts were observed. The SB-809 sample was collected from the deepest overburden sample interval.

Comparison of the SB-119 and SB-805 results indicates a significant decrease in TPH levels since the previous sampling effort. This reduction may be due partially to the tank ring drain pumping activities as well as to continuing natural attenuation (dilution and biodegradation). The SSI results indicate that petroleum-impacted soils greater than 5,000 mg/kg TPH do not exist at SB-805 or extend to MW-809, where low level TPH contamination was detected. SB-809 is located in a downgradient direction outside the tank socket in natural outwash materials. The data indicate that petroleum has not migrated beyond the tank socket fill materials, most likely due to two conditions: the viscosity of the oil and the lower hydraulic conductivity of the natural outwash materials. Heavier oils such as No. 6 fuel oil are relatively immobile due to high viscosity and low solubility (B&R Environmental 1996a). Based on the sampling results, the significantly petroleum-impacted soils seem to be limited to the fill materials placed during the construction of the tanks. The fill materials have a higher hydraulic conductivity than the natural outwash materials that surround the tanks. The lower hydraulic conductivity outwash materials appear to limit petroleum migration.

During the PCA, an unfiltered groundwater sample was collected from one well (MW-119) screened within the tank socket and analyzed for VOCs, SVOCs, and RCRA metals. No VOCs were detected; and low levels of SVOCs and metals were detected at concentrations below the GA groundwater quality standards and preventive action levels. During the SI, tank socket groundwater TPH levels were 18 mg/L in MW-401, 87 mg/L in MW-404, 3.9 mg/L in MW-408, and 13.5 mg/L in MW-412. Outside of the tank socket overburden SI groundwater TPH levels were 4.7 mg/L in MW-409, non-detect in MW-421, and 3.3 mg/L in MW-422, while bedrock groundwater TPH levels in MW-424 and MW-425 were 440 mg/L and non-detected, respectively.

SSI groundwater samples were collected from two overburden monitoring wells (one screened in the tank socket (MW-805) and the other screened outside the tank socket (MW-809)) and the two bedrock monitoring wells and analyzed for VOCs, SVOCs, RCRA metals, and TPH. Unfiltered and filtered samples were collected for metals analysis from each monitoring well. Analysis of these samples indicates the presence of VOCs and SVOCs at low levels, below the GA groundwater quality standards and the preventative action limits. All metals concentrations were also below the groundwater standards with the exception of lead detected in the unfiltered sample from MW-805 at 30.6 µg/L, exceeding the GA groundwater quality standard of 15 µg/L. However, lead was not detected in the MW-805 filtered sample. Field observations recorded during groundwater sampling indicated a high turbidity in the samples. The elevated lead concentration observed in the unfiltered sample (total metals analysis) could be attributed to lead that is associated with the high turbidity observation in this sample. The high turbidity level observed in this sample is not considered representative of groundwater quality at this location.

A comparison of MW-119 SI groundwater sample results and MW-805 SSI groundwater sample results shows that the VOCs, SVOCs, and metals results were comparable with exception of the elevated lead level detected in the SSI sample as noted above. However, a comparison of SI and SSI groundwater analytical results shows a general decrease in TPH levels in wells screened in the tank socket, in overburden outside of the tank socket, and in bedrock. Tank socket well groundwater TPH levels recorded in the SI ranged from 3.9 to 87 mg/L, while a TPH level of 1.5 mg/L was recorded for the SSI well screened in the tank socket. During the SI TPH levels in wells screened in overburden outside of the tank socket ranged from non-detect to 3.3 mg/L while a level of non-detect was recorded for the overburden groundwater sample during the SSI. For bedrock wells, the SI and SSI TPH levels in MW-424 were 440 mg/L and 2.85 mg/L and TPH was recorded as non-detect in MW-425 during both investigations.

7.4.2 Tank 48 SSI Conclusions

Tank 48 source control measures have eliminated continued release to the environment, and the interim action has apparently helped to remove enough contaminant mass from the fill material to lower TPH concentrations below the proposed clean-up level of 5,000 mg/kg for soils below 15 feet below ground surface. However, results indicate that fill materials in the lower portion of the tank socket are still impacted and that petroleum is still present in the gravel materials. While the SI data indicate petroleum contamination above the proposed regulatory limits does not appear to have migrated beyond the Tank 48 fill materials, petroleum was observed in the bedrock in downgradient previous SI borings SB-424 and SB-425.

The data indicate that the interim action has reduced TPH levels in groundwater by removing petroleum-impacted groundwater from the Tank 48 socket. TPH was detected at very low levels in the groundwater samples; and, the samples did not exceed the GA groundwater quality standards or preventative action limits for the additional analytes with the exception of lead in the unfiltered sample from MW-805. Previous SI results indicate that the unconsolidated overburden aquifer is not a significant migration pathway for heavy fuel oil compounds released from the tanks (B&R Environmental 1996a). Also, the lower hydraulic conductivity of the natural outwash materials and bedrock surrounding the fill materials limit the migration of petroleum and petroleum-impacted groundwater from the unconsolidated aquifer. However, impacted groundwater was detected in the bedrock aquifer during the SI at a TPH concentration of 440 mg/L, in association with the occurrence of petroleum in bedrock fractures; this TPH level in bedrock groundwater was not repeated in the SSI.

Several options are available to address petroleum-impacted soil at Tank 48. However, because soil TPH concentrations do not exceed the proposed risk-based clean-up levels, and since the source control (removal of tank contents) and interim actions (ring drain pumping) have been completed, the most appropriate action is implementation of institutional controls.

Institutional controls include options such as Land Use Controls, access restrictions, posting signs, and monitoring. Land Use Controls, or other policies or rules can prevent the exposure of workers and nearby residents to the residual subsurface contaminants. These controls could also limit future placement of drinking water wells, construction or demolition activities, and excavation within the areas of the tanks.

8.0 RECOMMENDATIONS

Recommendations for additional remedial actions at Tanks 42, 45, and 48 are provided below, based on the results of the SSI, and on results of the bioremediation pilot test at Tank 50. Source control measures consisting of removing tank contents and cleaning have been completed, and an interim action consisting of ring drain pumping has been completed. In addition, the in-place demolition of the tanks and backfilling with clean fill has been completed. The next phase includes identifying and developing the alternative required to protect potential human and ecological receptors, and meeting the proposed soil clean-up levels of 2,500 mg/kg TPH in soils at depths of 3 to 15 feet and 5,000 mg/kg TPH in soils at depths of 15 feet or more.

8.1 TANK 42 AND 48

The following section recommends further actions at Tanks 42 and 48.

8.1.1 Development of Tank 42 and 48 Remedial Alternatives

The alternative will consist of institutional controls and groundwater monitoring. Since tank demolition has been completed, site access restrictions are not required.

Institutional controls are activities that do not involve engineering actions or treatment to reduce potential health threats or mitigate contaminant migration. These activities will protect human and ecological receptors by limiting future use of the site to prevent human contact with petroleum-impacted groundwater and soil at Tanks 42 and 48. Controls that should be considered for future use, occupancy, and activity of and at Tanks 42 and 48 include prohibiting residential use, prohibiting intrusive work without proper health and safety precautions, and prohibiting installation of water supply wells. The controls should be documented in an environmental land usage agreement between RIDEM and the Navy, which will be incorporated into the CAP.

Groundwater monitoring should consist of sampling groundwater monitoring well(s) screened in the unconsolidated overburden downgradient of the tank socket. Based on the use of the tank as storage for virgin petroleum, sample analyses should be conducted for VOCs, SVOCs, TPH using EPA Method 8100M, and RCRA metals. SSI results indicate product has not migrated out of the

tank socket. Three rounds of sampling on a semi-annual basis will be conducted to confirm that conditions have not changed.

Any activities requiring intrusive work (such as excavation or drilling) will be permitted only by implementation of proper health and safety precautions, as detailed in a health and safety plan. The health and safety plan, which will be developed only when intrusive activities are planned, will define procedures to monitor air quality and other site safety issues, such as the use of appropriate personal protection equipment (PPE).

8.1.2 Additional Investigation

The need for additional site characterization should be assessed throughout the development of the remedial alternative phase.

8.1.3 Preparation of the Corrective Action Plan

RIDEM regulation DEM-DWM-UST05-93 Sec. 14.11 establishes the requirements for preparing a Corrective Action Plan (CAP) to formalize the approved alternative. Upon RIDEM approval of this report, CAPs will be prepared for Tanks 42 and 48 that include specific actions to be implemented under institutional controls.

8.2 TANK 45

The following section recommends further actions at Tank 45.

8.2.1 Development of Tank 45 Remedial Alternatives

Further remedial action may be considered at Tank 45 to address residual petroleum-impacted soil and exceedances of the proposed clean-up levels. Bioremediation treatability studies conducted at Tank 50 concluded that in-situ bioventing/biosparging will not reduce the hydrocarbon concentrations in all areas below 5,000 mg/kg within a reasonable period of time due to the high concentrations of heavy fuel fractions (FWENC 1997). Further evaluation is recommended of the other technologies identified in the Tank 50 Technology Screening Evaluation Report with regard to Tank 45. These technologies include: 1) Institutional Controls, 2) Excavation with Off-site

Disposal or Treatment, and 3) Thermally Enhanced Air Sparging. These three technologies should be evaluated relative to one another, and a preferred technology selected. The preferred technology may be a combination of technologies, incorporating elements of the institutional controls outlined for Tanks 42 and 48.

Groundwater monitoring, consisting of sampling unconsolidated overburden and bedrock groundwater downgradient of the tank socket, should be an additional component of the remedial alternative. Based on the use of the tank as storage for virgin petroleum, sample analyses should be conducted for VOCs, SVOCs, TPH using EPA Method 8100M, and RCRA metals.

8.2.2 Additional Investigation

The need for additional site characterization should be assessed throughout the development of the remedial alternative phase.

8.2.3 Preparation of the Corrective Action Plan

RIDEM regulation DEM-DWM-UST05-93 Sec. 14.11 establishes the requirements for preparing a CAP to formalize the approved alternative. Upon RIDEM approval of this report, a CAP will be prepared for Tank 45 that includes further evaluation of remedial alternatives and presentation of the preferred alternative.

REFERENCES

REFERENCES

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APPENDIX A

SOIL BORING LOGS

BORING LOG FOR CTO 143 - Tank Farm 4 - Tank 42 - Supplemental Site Investigation
PROJECT NO 0288
LOGGED BY: Tracy Dorgan TRANSCRIBED BY. LAC
DRILLED BY (Company/Driller). Maher Env./Denis Duchnowski
GRD SURFACE ELEVATION 89.84 ELEVATION FROM

BORING NO. : SB-801
START DATE: 6-15-98
COMPLETION DATE: 6-16-98
MON. WELL NO.: MW-801
CHECKED BY . Mike Healey

DEPTH (FEET) 0	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID Jar HS]
2							No samples were taken from 0-37 5' bgs			
4										
6										
8										
10										
12										
14										
16										
18									Petroleum sheen noted on wash water @ ~17' bgs	0 ppm in b z near casing
20									Casing advancing very easy from 17 5'-24'	
22										
24									Lost water in casing @ 24' w/ roller-bit =~15 5 gal	
26										
28									Lost ~19 gal water from casing w/ roller-bit @ 29' bgs	
30										
32							(see P 2)			

TYPE OF DRILLING RIG Mobile Drill B-53 ATV
METHOD OF ADVANCING BORING 4" drive & wash casing
METHOD OF SOI L SAMPLING 3" split-barrel driven with a 300 lb hammer
METHOD OF ROCK CORING N/A

GROUNDWATER LEVELS
OTHER OBSERVATIONS

Tetra Tech NUS, Inc

BORING NO SB-801

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 42 - Supplemental Site Investigation
PROJECT NO: 0288
LOGGED BY: Tracy Dorgan TRANSCRIBED BY. LAC
DRILLED BY (Company/Driller): Maher Env /Denis Duchnowski
GRD SURFACE ELEVATION: 89 84 ELEVATION FROM

BORING NO : SB-801
START DATE: 6-15-98
COMPLETION DATE: 6-16-98
MON. WELL NO : MW-801
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID HS]
34							No samples taken from 0-37 5'			
36									Igneous & gneiss fragments noted in wash	
									Roller-bit hopping & chattering @ 36' ↓	
							▼37 5' S-1A=0 5'		Lost ~24 5 gal inside casing	
38	4	1 0	S-1 - 37 5-39 5' bgs			dk gray	Gravelly SAND Mostly medium-coarse sand, some fine		w/ roller-bit @ 39 5' Heavy	
	7		@1115		loose		angular gravel trace fill - 2 nails in sample		pet sheen & oil drops noted	
	17			39 0'					on wash tub	
	45	2 0		top of	soft	light	S-1B=0 5' - saprolitic schist Very soft with pastle-like		Free-product collecting in	
40				bedrock		gray	consistancy		wash tub from 37 5-39'	
									D&W casing to 39'	104 5 ppm
							End of boring @ 39 5'			
							Lost approx 60 gallons of water during drilling			

TYPE OF DRILLING RIG
METHOD OF ADVANCING BORING
METHOD OF SOI L SAMPLING
METHOD OF ROCK CORING

Refer to P 1 of 1

Tetra Tech NUS, Inc

GROUNDWATER LEVELS
OTHER OBSERVATIONS

BORING NO SB-801

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BORING LOG FOR CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigation
PROJECT NO 0288
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env /Denis Duchnowski
GRD. SURFACE ELEVATION: 111 01 ELEVATION FROM.

BORING NO. : SB-802
START DATE: 6-17-98
COMPLETION DATE: 6-18-98
MON. WELL NO : MW-802
CHECKED BY : Mike Healey

DEPTH (FEET) 0	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification; rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
2							No samples were taken from 0-34' bgs			
4										
6									Poss boulder from 6-9'	
8										
10										
12										
14									Dk gray phyllite fragments in wash	
16										
18										
20										
22										
24									Trace oil in wash @ 23' Heavy free-product in wash	
26									from 24' bgs down	
28										
30										
32										

TYPE OF DRILLING RIG Mobile Drill B-53 ATV
METHOD OF ADVANCING BORING 4 in drive & wash casing
METHOD OF SOIL SAMPLING 3 in split-barrel driven with a 300 lb hammer
METHOD OF ROCK CORING N/A

GROUNDWATER LEVELS
OTHER OBSERVATIONS.

Tetra Tech NUS, Inc

BORING NO.. SB-802

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 111.01 ELEVATION FROM:

BORING NO. . SB-802
START DATE. 6-17-98
COMPLETION DATE: 6-18-98
MON. WELL NO.: MW-802
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
32							No sample taken from 0-34'			
34							↓			
	5	0 3	S-1=34-36' @ 0930		loose	dk gray	Gravelly, SAND Mostly F-C sand, some F-C angular gravel 1 piece 2 5" diam sub-rounded gravel	sw	Poor recov petroleum odor & heavy staining	136 ppm
	3				↓					
	4					blk	Poss ring-drain fill			
36	5	2 0				↓				
	5	1 7	S-2=36-38' @ 1000				GRAVEL Some F-C sand mostly coarse rounded	gw	Free-product filling void spaces in gravel	240 ppm
	5									
	9						& fine cobbles		Very heavy pet staining	
38	32	2 0			↓	↓				
39									D&W to 39 5' Casing bouncing Roller-bit is	
39 5									brining up small concrete frags @ 39 5'	
				poss ring-drain pipe			End of boring @ 39 5', Poss top of ring drain pipe			
							Construct well with screen from 39 5-14 5'			

TYPE OF DRILLING RIG — Refer to P 1 of 2 for detail
METHOD OF ADVANCING BORING
METHOD OF SOI L SAMPLING
METHOD OF ROCK CORING

GROUNDWATER LEVELS.
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc

BORING NO.. SB-802

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigaiton
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 110.86 ELEVATION FROM:

BORING NO. : SB-803
START DATE: 6-22-98
COMPLETION DATE: 6-23-98
MON WELL NO.: N/A
CHECKED BY : Mike Healey

DEPTH (FEET) 0	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification; rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
2							No samples taken from 0-38' bgs			
4									Grinding & hopping from 4-6' bgs, quartzite fragments	
6									(white) in wash	
8										
10										
12										
14										
16										
18										
20										
22									Moderate-heavy pet sheen	
24									on wash water @ ~22-24'	
26										
28									Lost all water in casing @ 29'	
30									w/ roller-bit =~19 gal	
32									Harder driving @ 32'	

TYPE OF DRILLING RIG Mobile Drill B-53 ATV
METHOD OF ADVANCING BORING 4 in drive & wash casing
METHOD OF SOIL SAMPLING 3 in split-barrel driven by 300 lb hammer
METHOD OF ROCK CORING N/A

GROUNDWATER LEVELS
OTHER OBSERVATIONS.

Tetra Tech NUS, Inc.

BORING NO.. SB-803

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BORING LOG FOR. CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigaiton
PROJECT NO. 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY. LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 110.86 ELEVATION FROM:

BORING NO. . SB-803
START DATE: 6-22-98
COMPLETION DATE: 6-23-98
MON. WELL NO : N/A
CHECKED BY : Mike Healey

DEPTH (FEET) 32	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification; rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
							No samples taken from 0-38' bgs		Heavy petroleum sheen & free-product on wash	
34									water from approx 32' to EOB	
36									Hard, driving to ~35-36', lost water in casing @	
									~35-36' Pumping in fresh water No return up casing	
38									from 36-38'	
	9	0 6	S-1=38-39' bgs @		med	black	Sandy, GRAVEL - mostly rounded - subrounded coarse	gm	Total water loss = ~50 gal	75 2 ppm
	21	1 0	0945		dense		gravel Trace - some F-C sand			
40							Phyllite in nose of spoon Free-product saturating sample		Hammer bouncing @ 39' driving S-1 Stop	
									to avoid poss ring-drain	
							End of boring @ 39' bgs Casing to 38'		Free-product coating & drill rods & casing	
							Backfill with bent chips to 26' then volclay grout			

TYPE OF DRILLING RIG — Refer to P 1 of 2 for detail
METHOD OF ADVANCING BORING
METHOD OF SOI L SAMPLING
METHOD OF ROCK CORING

GROUNDWATER LEVELS
OTHER OBSERVATIONS

Tetra Tech NUS, Inc

BORING NO . SB-803

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigation
PROJECT NO 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 110 62 ELEVATION FROM:

BORING NO. : SB-804
START DATE: 6-17-98
COMPLETION DATE: 6-17-98
MON. WELL NO.: N/A
CHECKED BY : Mike Healey

DEPTH (FEET) 0	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering, etc) start @ 0920	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
							No samples taken from 0-14' bgs.			
2									Grinding & hopping from	
									2-3'	
4										
6										
									Grinding & hopping from 7-8'	
8										
10										
12										
14									Lt pet sheen on wash @ 14'	
	7	0 6	S-1 @ 14-16' bgs @ 1030		med	dk gray	Sand & gravel Sand is F-C grained, gravel is F-C angular phyllite Trace silt	gm	Heavy pet odor & staining Free-product in	127 4 ppm
	5									
	7				dense	to black			bottom 3 in	
16	15	2 0								

TYPE OF DRILLING RIG Mobile drill B-53 ATV
METHOD OF ADVANCING BORING 4 in drive & wash casing
METHOD OF SOI L SAMPLING. 3 in split-barrel driven with a 300 lb hammer
METHOD OF ROCK CORING. N/A

GROUNDWATER LEVELS
OTHER OBSERVATIONS

Tetra Tech NUS, Inc

BORING NO. SB-804

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 110.62 ELEVATION FROM:

BORING NO. : SB-804
START DATE: 6-17-98
COMPLETION DATE: 6-17-98
MON. WELL NO.: N/A
CHECKED BY : Mike Healey

DEPTH (FEET) 16	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification; rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
	8	1 2	S-2 @ 16-18' bgs				Silty, gravelly, SAND - mostly F-C sand, some fine -	sp	Small qty of free-product	87 ppm
	12		@		med	dark	coarse angular phyllite gravel, some silt		on wash water	
	15				dense	gray			Top 3" =pet stained and	
18	19	2 0							odor	
							End of boring @ 18' bgs			

TYPE OF DRILLING RIG
METHOD OF ADVANCING BORING
METHOD OF SOI L SAMPLING
METHOD OF ROCK CORING:

Refer to P 1 of 2

Tetra Tech NUS, Inc

GROUNDWATER LEVELS
OTHER OBSERVATIONS:

BORING NO.. SB-804

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 48 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 81 37 ELEVATION FROM:

BORING NO. : SB-805
START DATE: 6-19-98
COMPLETION DATE: 6-22-98
MON. WELL NO.: MW-805
CHECKED BY : Mike Healey

DEPTH (FEET) 0	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
2							No samples taken from 0-33' bgs			
4										
6										
8										
10										
12										
14										
16										
18										
20									Lt -mod petroleum sheen on wash @ 20'	
22									Increasing pet sheen with	
24									depth	
26										
28										
30									Strong pet odor while drilling	0 0 ppm in
32									Oil drops & heavy sheen on wash water	breathing zone

TYPE OF DRILLING RIG Mobile drill B-53 ATV
METHOD OF ADVANCING BORING 4 in drive & wash casing
METHOD OF SOI L SAMPLING 3 in split-barrel driven with a 300 lb hammer
METHOD OF ROCK CORING

GROUNDWATER LEVELS
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc

BORING NO. SB-805

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 48 - Supplemenetal Site Investigation
PROJECT NO: 0288-0552
LOGGED BY. Tracy Dorgan TRANSCRIBED BY. LAC
DRILLED BY (Company/Driller): Maher Env /Denis Duchnowski
GRD. SURFACE ELEVATION 81.37 ELEVATION FROM.

BORING NO. : SB-805
START DATE: 6-19-98
COMPLETION DATE: 6-22-98
MON. WELL NO.: MW-805
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering; etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
32										
33										
34	8 5	1 0	S-1=33-35' bgs @ 0940		med dense	dark gray	GRAVEL Mostly angular phyllite gravel, trace silt, trace sand	gm	Saturated Abundant free-product	186 ppm
35	5 7	2 0			↓	to black	Free-product along fracture planes & in void spaces		↓	
36	7 8	0 5	S-2=35-37' bgs @ 1000		↓	↓	S-2A=0 2' - similar to above S-2B=0 3' - subrounded granite coarse gravel - ring-drain		Ring-drain grvl has	
37	8 5	2 0			↓	↓	gravel		↓ free-product coating exterior	
38									Drive & wash to 39' Lost all water in casing	
39									once bit reached 39' =25 5 gal	
							End of boring at 39' bgs		Note heavy sheen & some free-product stuck	
									to drill tools	

TYPE OF DRILLING RIG — Refer to P 1 of 2 for detail
METHOD OF ADVANCING BORING
METHOD OF SOI L SAMPLING
METHOD OF ROCK CORING

GROUNDWATER LEVELS
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc

BORING NO.: SB-805

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 42 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION. 87.79 ELEVATION FROM.

BORING NO. : SB-806
START DATE: 6-23-98
COMPLETION DATE: 6-24-98
MON. WELL NO.: MW-806
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification, rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
0										
2										
4										
	8	1 0	S-1=4-6' bgs @ 1624		dense	dark gray	Gravelly, SAND Mostly F-C well graded sand, some fine subrounded gravel, trace silt	sw	dry	0 0 ppm
	31				↓					
	25					dark				
6	22	2 0			↓	brown	↓			
									D&W to 9'	
8										
	25	0 7	S-2=9-11' @ 0820		dense	dark gray	Gravelly, SAND Mostly F-M poorly graded sand, fine subround gravel, trace silt	sp	Damp - wet, poss from wash water	0 0 ppm
10	28				↓	↓	↓			
	27								D&W to 11 5', casing	
	31	2 0			↓	↓	↓		regusal Roller-bit through	
12									Boulder from 11 5-13 5' cutting=D&W to 14'	
				boulder						
14										
	27	0 6	S-3=14-16' @ 1115		dense	dark gray	S-3A=0 4' - gravelly, SAND Mostly F-C well graded fine subangular gravel	sw		0 0 ppm
	36				↓	↓				
	34						S-3B=0 2' - soft, saprolitic? phyllite Poss boulder			
16	47	2 0		poss top of bedrock	↓	↓	or cobble Minor oxidation			

TYPE OF DRILLING RIG Mobile drill B-53 ATV
METHOD OF ADVANCING BORING 4" drive & wash casing
METHOD OF SOI L SAMPLING 2 in split-barrel driven with a 140 lb down-hole hammer
METHOD OF ROCK CORING N/A

GROUNDWATER LEVELS
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc

BORING NO. SB-806

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 42 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY: LAC
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION:87.79 ELEVATION FROM:

BORING NO. : SB-806
START DATE: 6-23-98
COMPLETION DATE: 6-24-98
MON. WELL NO.: MW-806
CHECKED BY : Mike Healey

DEPTH (FEET) 16	BLOWS PER 6"	SAMPR EC. / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering, etc)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
									Cuttings are both fresh & weathered phyllite	
18									fragments Trace silty, clay w/ orange-brn. color	
20	50 100/5"	5 0 9	S-4=19-20' @ 1200		soft	dk gray	Saprolitic phyllite Minor oxidation noted Very soft - many fractures perpendicular to boring 1-2" zone of	v. bkn	Lt sheen on wash water, probably from graphite in	0.5 ppm
				EOB			clay filled fractures in center of sample		phyllite	
							End of boring at 20' bgs			

TYPE OF DRILLING RIG METHOD OF ADVANCING BORING. METHOD OF SOI L SAMPLING. METHOD OF ROCK CORING:	Refer to P 1 of 2 for details
GROUNDWATER LEVELS: OTHER OBSERVATIONS:	BORING NO.: SB-806 PAGE 2 of 2

Tetra Tech NUS, Inc.

BORING LOG FOR: CTO 143 - Tank Farm 4 -Tank 45 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY:
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 109.73 ELEVATION FROM:

BORING NO. : SB-807
START DATE: 6-25-98
COMPLETION DATE: 6-25-98
MON. WELL NO.: MW-807
CHECKED BY : Mike Healey

DEPTH (FEET) 0	BLOWS PER 6"	SAMP REC. / SAMP LENG	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
							No samples taken from 0-4'		D&W to 4'	
2									Grey wash, including wt. qtz and mostly dk gray phyllite cuttings	
4										
	7		S-1 = 4-6' bgs @ 0830		med dense	dk gray	Silty, SAND and GRAVEL - sands are F-C, gravel is angular F-C phyllite and schist Trace	SM / GM	No structure noted. Fill. Wet exterior, damp interior of	0 0 ppm
	10	1 3								
	9								samp.	
6	13	2 0								
									D&W to 9'	
8									no change	
	7		S-2 = 9-11' bgs @ 0854		med dense	dk gray	Similar to S-1 above	SM / GM	Saturated on exterior damp - wet interior of	0.0 ppm
	10	1 0								
	9								sample	
	9	2 0								
12									D&W to 14'	
									Strong PET odor, sheen and	
14									small qty. of free-product on wash w/roller bit @ 13 5-	
	7		S-3 = 14-16' bgs @ 1030		med	dk gray	Silty, sandy, GRAVEL mostly F-C subangular phyllite gravel in F-M sand, trace silt matrix	GM	14' bgs	
	7	1 2								615 2 ppm
	10				dense		Heavy petroleum staining in top 8 in free-product coating gravels and in fractures inside gravel		Note. use 3" & 300lb hammer to sample Free product noted	
16	9	2 0								

TYPE OF DRILLING RIG Mobile Drill B-53 ATV
METHOD OF ADVANCING BORING 4 in drive & wash casing
METHOD OF SOI L SAMPLING 2 in split-barrel driven by 140 lb down-hole hammer (S-1 &S-2) 3" spoon and 300 lb hammer below S-2
METHOD OF ROCK CORING· N/A

GROUNDWATER LEVELS.
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: SB-807

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BORING LOG FOR: CTO 143 - Tank Farm 4 - Tank 45 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY:
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 109.73 ELEVATION FROM:

BORING NO. : SB-807
START DATE: 6-25-98
COMPLETION DATE: 6-25-98
MON. WELL NO.: MW-807
CHECKED BY : Mike Healey

DEPTH (FEET) 16	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
18										
20	5 5	0 5	S-4 = 19-21' bgs @ 1110		med dense	dk gray	Similar to S-3 above. Lt. pet. stains, no free-product.	GM	Wet exterior, moist wet interior of sample	33 0 ppm
	4 4	2 0								
22										
24									Casing harder to drive @ 23 2'	
	17 30	1 2	S-5 = 24-26' bgs @ 1150		dense	dk gray to	S-5A=1' GRAVEL, mostly coarse angular phillite gravel, trace silt, trace F-M sand.	GM	Saturated with free-product along bedding	126 0 ppm
26	35 47	2 0		poss top of bedrock		black	S-5B = graphitic, saprolitic phyllite Bedding planes perpendicular to boring, nearly horizontal		planes and fracture surfaces	
							Trace vertical fractures Free-product throughout S-5A and B Pet impact along all bedding planes and			
							fracture surfaces			
							End of Boring at 26' bgs			

TYPE OF DRILLING RIG
METHOD OF ADVANCING BORING
METHOD OF SOI L SAMPLING.
METHOD OF ROCK CORING·

See page 1 of 2 for details

GROUNDWATER LEVELS.
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc

BORING NO.: SB-807

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BORING LOG FOR: CTO 143 - Tank Farm 4 -Tank 45 - Supplemental Site Investigaiton
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY:
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 108.84 ELEVATION FROM:

BORING NO. : SB-808
START DATE: 6-26-98
COMPLETION DATE: 6-26-98
MON. WELL NO.: MW-808
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC / SAMP LENG	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG / WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition, odors, geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
0							No samples taken from 0-4'		Drive to 4', knocked out soils from casing no wash needed.	
2										
4										
	8		S-1 = 4-6' bgs @ 0835		med dense	dk gray	Sandy, GRAVEL - mostly graphitic phyllite F-C gravel (angular), some F-C sand, trace silt	GM	Dry no structure, possible fill	0.0 ppm
	7	1 4								
	9									
6	11	2 0								
									Woody stem fragments in wash.	
8										
	21		S-2 = 9-11' bgs @ 0850		dense	dk gray	Similar to S-1 above. Minor yellow-orange oxidation noted	GM	Saturated inside and out possible from wash	0 3 ppm
10	15	0 6								
	17								Probable fill	
	19	2 0								
12										
14										
	11		S-3 = 14-16' bgs @ 0920		dense	dk gray	Gravelly, SAND. Mostly F-C sand, some fine-coarse subrounded-angular gravel Trace silt	SM/ GM	Wet exterior, dry-damp interior of samp. Lost ~10 5 gallons	2.5 ppm
	21	1 0								
	33								water from casing when S-3 removed from boring	
16	47	2 0								

TYPE OF DRILLING RIG Mobile Drill B-53 ATV
METHOD OF ADVANCING BORING 4 in ID drive & wash casing
METHOD OF SOI L SAMPLING: 2 in split-barrel driven with a 140 lb down-hole hammer
METHOD OF ROCK CORING: N/A

GROUNDWATER LEVELS.
OTHER OBSERVATIONS: Lost ~10 5 gal (casing vol) @ 16' when S-3 removed from boring.

Tetra Tech NUS, Inc.

BORING NO.: SB-808

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BORING LOG FOR: CTO 143 - Tank Farm 4 -Tank 45 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY:
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 108.84 ELEVATION FROM:

BORING NO. : SB-808
START DATE: 6-26-98
COMPLETION DATE: 6-26-98
MON. WELL NO.: MW-808
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
16										
18										
									Lt. pet sheen on wash	
	17		S-4 = 19-21' bgs @			dk..	S-4A = 1.1' - similar to S-3 above.	SM/	water. Petroleum odor.	53 ppm
20	23	1 5	0945		dense	gray-	S-4B = 0 4' - graphitic, saprolitic, phyillite Oil in	GM	Pet. staining in bottom	
	35					blk.	bedding planes and both horizontal and vertical	VBR	0.75' of sample. Free-	
21	63	2 0		possible top of bedrock			fractures		product noted in soils	
									and on wash water.	
							End of Boring @ 21' bgs			

TYPE OF DRILLING RIG: See page 1 of 2 for details
METHOD OF ADVANCING BORING.
METHOD OF SOI L SAMPLING·
METHOD OF ROCK CORING.

GROUNDWATER LEVELS:
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: SB-808

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BORING LOG FOR: CTO 143 - Tank Farm 4 -Tank 48 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY:
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 76.19 ELEVATION FROM:

BORING NO. : SB-809
START DATE: 6-29-98
COMPLETION DATE: 6-29-98
MON. WELL NO.: MW-809
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
0							No samples taken from 0-5'		Drive to 5' no wash needed, knocked soils	
2									out of casing.	
4										
6	7 15	1 3	S-1 = 5-7' bgs @ 1020		med	gray	S-1A = 0 5' - sandy, GRAVEL. Mostly angular phyillite gravel fragments-graphitic.	GM	Dry, no odor or staining. S-1B = trace fine root	351 ppm*
8	15 13	2 0			dense	dark brown	S-1B = SILT. Trace fine sand, trace clay Trace fine roots & organic matter Fine layering noted.	OL/ SM	fibers. Fine layering noted	
10										
12	27 52 57 63	1 2 2 0	S-2 = 10-12' bgs @ 1100	possible top of till	very dense	yellow orange gray-brown	S-2A = 0.7' - SAND. Mostly poorly graded F-M sand, trace silt S-2B = 0 5 - silty, sandy, GRAVEL mix Mostly angular phyllite gravel, some F-C sand, trace silt	SP GM	Wet - satuarated. Poss. top of till.	0 0 ppm
14									Hard Driving Casing	
16	22 40	0.6 2 0	S-3 = 15-17' bgs @ 1135		Very dense	dark brown dark gray	Similar to S-2B above Includes trace clay.	GM	Damp - wet.	0.0 ppm

TYPE OF DRILLING RIG. Mobile Drill B-53 ATV
METHOD OF ADVANCING BORING 4 in. ID drive & wash casing
METHOD OF SOI L SAMPLING: 2 in split-barrel driven with a 140 lb down-hole hammer
METHOD OF ROCK CORING: N/A

GROUNDWATER LEVELS:
OTHER OBSERVATIONS: * = Poss. FID detect of methane no pet. odor noted from sample

Tetra Tech NUS, Inc.

BORING NO.: SB-809

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BORING LOG FOR: CTO 143 - Tank Farm 4 -Tank 48 - Supplemental Site Investigation
PROJECT NO: 0288-0552
LOGGED BY: Tracy Dorgan TRANSCRIBED BY:
DRILLED BY (Company/Driller): Maher Env./Denis Duchnowski
GRD. SURFACE ELEVATION: 76.19 ELEVATION FROM:

BORING NO. : SB-809
START DATE: 6-29-98
COMPLETION DATE: 6-29-98
MON. WELL NO.: MW-809
CHECKED BY : Mike Healey

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS or ROCK HARD	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, Jar HS]
16										
	46	0 6	S-3 cont from p 1							
	43	2 0	of 2							
									D&W to 20'. Phyllite	
18									fragments & trace clay	
									in wash Some frag's have	
									fresh faces most are	
20									slightly oxidized.	
	70	0 8	S-4 = 20-21.35'	possible	very fissile	gray	S-4A = 0.2' - similar to S-2B & S-3	GM	Dry - Damp.	0.0 ppm
	100		@ 1345	top of			S-4B = 0 6' - very fissile, graphitic phyllite Slightly	VBR		
	100/4"			bedrock			saprolitic, minor oxidation staining noted on both			
22		1 35					horizontal & vertical bedding planes & fractures			
									Water lost during drilling	
							End of Boring @ 21 35'		= ~10 gal max.	

TYPE OF DRILLING RIG.
See page 1 of 2 for details
METHOD OF ADVANCING BORING:
METHOD OF SOI L SAMPLING.
METHOD OF ROCK CORING:

GROUNDWATER LEVELS.
OTHER OBSERVATIONS:

Tetra Tech NUS, Inc.

BORING NO.: SB-809

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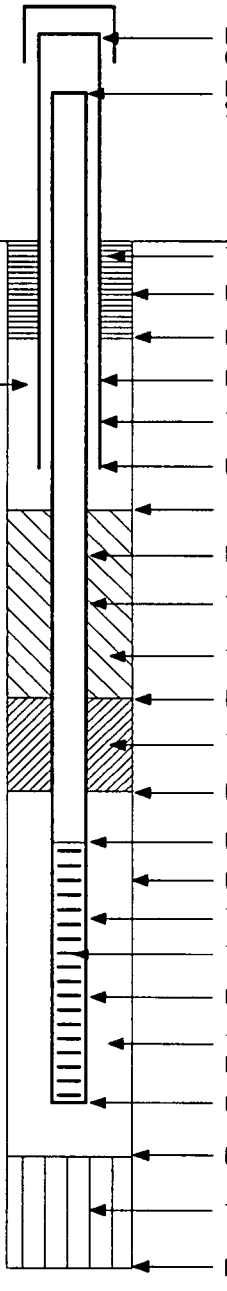
APPENDIX B

WELL CONSTRUCTION LOGS

OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

PROJECT NAME: CTO 143 - Tank Farm 4 - Supplemental Site Investigation
PROJECT NO: 0288-0552
PROJECT LOCATION: NETC Newport, RI - Tank Farm 4
WELL NO: MW-805
CLIENT: U.S. Navy
BORING NO: SB-805
CONTRACTOR: Maher Environmental
DRILLER: Denis Duchnowski
BORING LOCATION: Tank 48-Ring drain approx. 5' South of former MW-119
LOGGED BY: Tracy Dorgan
DATE: 6-22-98
CHECKED BY: Mike Healey
DATE:
PAGE 1 OF 1

ELEVATION TOP OF PROTECTIVE CASING: 83.21
ELEVATION TOP OF RISER PIPE: 82.87
GROUND ELEVATION: 81.37



LENGTH OF PROTECTIVE CASING ABOVE GROUND SURFACE (Ft)	1.84
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (Ft)	1.50
TYPE OF SURFACE SEAL	cement
DIA SURFACE SEAL BGS (In)	~5 in.
DEPTH TO BOTTOM OF SURFACE SEAL (Ft)	2.5
ID OF PROTECTIVE CASING (In)	4
TYPE OF PROTECTIVE CASING	steel casing
DEPTH BOTTOM OF PROTECTIVE CASING (Ft)	3.0'
DEPTH BOTTOM OF DRAIN LAYER (Ft)	5.0'
RISER PIPE (In) ID: 2 OD: 2 1/4	
TYPE OF RISER PIPE	schedule 40 PVC
TYPE OF BACKFILL AROUND RISER PIPE	N/A
DEPTH TOP OF SEAL (Ft)	5.0'
TYPE OF SEAL (hydrated)	bentonite chips
DEPTH BOTTOM OF SEAL (Ft)	7.0'
DEPTH TOP OF PERVIOUS SECTION (Ft)	8.8'
DIAMETER OF BOREHOLE (In)	4.5 in.
TYPE OF PERVIOUS SECTION	schedule 40 PVC
TYPE OF OPENINGS	.020" factory slotted
PERVIOUS SECTION (In) ID: 2 OD: 2 1/4	
TYPE OF FILTER PACK AROUND PERVIOUS SECTION	filtersil #1 silica sand
DEPTH BOTTOM OF PERVIOUS SECTION (Ft)	38.8'
DEPTH BOTTOM OF FILTER PACK (Ft)	38.8'
TYPE OF BACKFILL BELOW FILTER PACK (collapsed fill)	natural materials
END OF BORING(Ft)	39.0

-2 stainless steel centralizers placed on well screen.

-4 bags of #1 sand used for filter-pack (400 lbs).

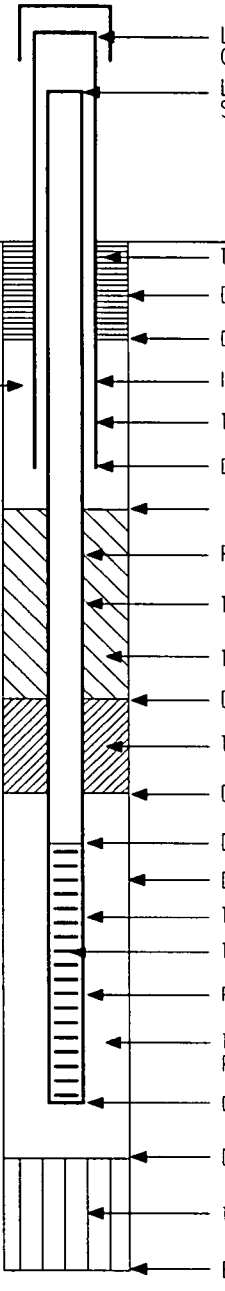
GENERAL NOTE

1 Entry of 0.00 for Ground Elevation, Elev Top of Riser Pipe & Elev Top of Protective Casing Indicates that Surveyed Ground Elevation Not Available

OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

PROJECT NAME: CTO 143 - Tank Farm 4 - Supplemental Site Investigation
PROJECT NO: 0288-0552
PROJECT LOCATION: NETC Newport, RI Tank Farm 4 Tank 42
WELL NO: MW-806
CLIENT: U.S. Navy
BORING NO: SB-806
CONTRACTOR: Maher Environmental
DRILLER: Denis Duchnowski
BORING LOCATION: Approx. 30' W (downgradient) of Tank 42.
LOGGED BY: Tracy Dorgan
DATE: 6-24-98
CHECKED BY: Mike Healey
DATE:
PAGE: 1 OF 1

ELEVATION TOP OF PROTECTIVE CASING: 89.70
ELEVATION TOP OF RISER PIPE: 89.45
GROUND ELEVATION: 87.79



LENGTH OF PROTECTIVE CASING ABOVE GROUND SURFACE (Ft)	1.91
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (Ft)	1.66
TYPE OF SURFACE SEAL	cement
DIA SURFACE SEAL BGS (In)	~5
DEPTH TO BOTTOM OF SURFACE SEAL (Ft)	2.5
I D OF PROTECTIVE CASING (In)	4
TYPE OF PROTECTIVE CASING	steel casing
DEPTH BOTTOM OF PROTECTIVE CASING (Ft)	3.0
DEPTH BOTTOM OF DRAIN LAYER (Ft)	4.0
RISER PIPE (In) ID 2 OD 2.25	
TYPE OF RISER PIPE	schedule 40 PVC
TYPE OF BACKFILL AROUND RISER PIPE	N/A
DEPTH TOP OF SEAL (Ft)	4.0
TYPE OF SEAL (hydrated)	bentonite chips
DEPTH BOTTOM OF SEAL (Ft)	5.0'
DEPTH TOP OF PERVIOUS SECTION (Ft)	6.0'
DIAMETER OF BOREHOLE (In)	4.5
TYPE OF PERVIOUS SECTION	schedule 40 PVC
TYPE OF OPENINGS	0.010 factory slotted
PERVIOUS SECTION (In) ID 2 OD 2.25	
TYPE OF FILTER PACK AROUND PERVIOUS SECTION	#0 filtersil silica sand
DEPTH BOTTOM OF PERVIOUS SECTION (Ft)	16.0'
DEPTH BOTTOM OF FILTER PACK (Ft)	16.0'
TYPE OF BACKFILL BELOW FILTER PACK	bentonite chips
END OF BORING(Ft)	20.0'

-2 stainless steel centralizers placed on well screen.

GENERAL NOTE

1 Entry of 0.00 for Ground Elevation, Elev Top of Riser Pipe & Elev Top of Protective Casing Indicates that Surveyed Ground Elevation Not Available

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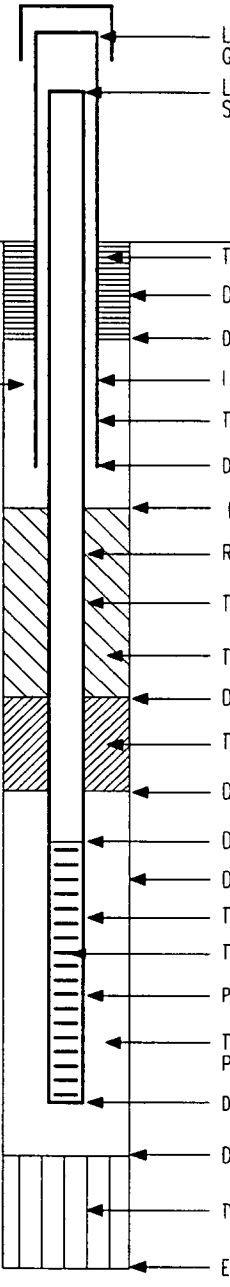
OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

PROJECT NAME:	CTO 143 - Tank Farm 4 - Supplemental Site Investigation	PROJECT NO	0288
PROJECT LOCATION	NETC Newport, RI Tank Farm 4	WELL NO:	MW-801
CLIENT	U.S. Navy	BORING NO	SB-801
CONTRACTOR	Maher Environmental	DRILLER	Denis Duchnowski
LOGGED BY	Tracy Dorgan	DATE:	6-15-98 - 6-18-98
CHECKED BY:	Mike Healey	DATE	
		BORING LOCATION	Tank 42-Ring Drain ~5' north former MW 123
		PAGE:	1 OF 1

ELEVATION TOP OF PROTECTIVE CASING	91.70
ELEVATION TOP OF RISER PIPE	91.25
GROUND ELEVATION	89.84
LENGTH OF PROTECTIVE CASING ABOVE GROUND SURFACE (Ft)	1.86
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (Ft)	1.41
TYPE OF SURFACE SEAL	concrete
DIA SURFACE SEAL BGS (In)	~5 in.
DEPTH TO BOTTOM OF SURFACE SEAL (Ft)	2.5'
SAND DRAIN LAYER	
I D OF PROTECTIVE CASING (In)	4 in.
TYPE OF PROTECTIVE CASING	steel pipe
DEPTH BOTTOM OF PROTECTIVE CASING (Ft)	3'
DEPTH BOTTOM OF DRAIN LAYER (Ft)	5'
RISER PIPE (In) ID 2 OD 2 1/4	
TYPE OF RISER PIPE	schedule 40 PVC
TYPE OF BACKFILL AROUND RISER PIPE	bent. chips & #3 sand
DEPTH TOP OF SEAL (Ft)	23.3'
TYPE OF SEAL (hydrated)	bentonite chips
DEPTH BOTTOM OF SEAL (Ft)	26.5'
DEPTH TOP OF PERVIOUS SECTION (Ft)	28.8'
DIAMETER OF BOREHOLE (In)	4.5
TYPE OF PERVIOUS SECTION	schedule 40 PVC
TYPE OF OPENINGS	0.020" factory slotted
PERVIOUS SECTION (In) ID 2 OD 2 1/4	
TYPE OF FILTER PACK AROUND PERVIOUS SECTION	#1 & #3 filtersil silica sand
DEPTH BOTTOM OF PERVIOUS SECTION (Ft)	38.8'
DEPTH BOTTOM OF FILTER PACK (Ft)	38.8'
TYPE OF BACKFILL BELOW FILTER PACK	bentonite chips
END OF BORING(Ft)	39.5'



Note:

-Used 2 bags/batches of volclay grout. Both ran into FM.

-Switched to bentonite chips & #3 sand for backfill (hydrated.) Use 3-50 lb. bags chips & 1-100 lb bag sand.,

-2 stainless steel cenralizers used at top & bottom of screen.

-7-100 lb. bags of silica sand used for filter-pack. 6-#1 sand & 1 #3 sand. Filling void spaces around well.

-Well developed prior to placement of seal on 6-18-98.

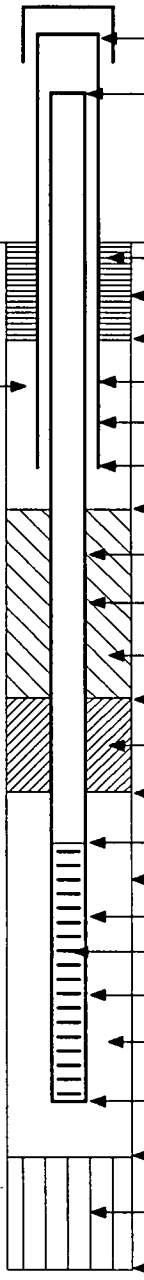
GENERAL NOTE

1 Entry of 0.00 for Ground Elevation, Elev. Top of Riser Pipe & Elev. Top of Protective Casing Indicates that Surveyed Ground Elevation Not Available

OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

PROJECT NAME: CTO 143 - Tank Farm 4 - Supplemental Site Investigation
PROJECT NO: 0288-0552
PROJECT LOCATION: NETC - Newport, RI - Tank Farm 4
WELL NO: MW-802
CLIENT: U.S. Navy
BORING NO: SB-802
CONTRACTOR: Maher Environmental
DRILLER: Denis Duchnowski
BORING LOCATION: Ring drain - Tank 45 ~5' N.E. former MW-122
LOGGED BY: Tracy Dorgan
DATE: 6-18-98
CHECKED BY: Mike Healey
DATE:
PAGE: 1 OF 1

ELEVATION TOP OF PROTECTIVE CASING: 113.03
ELEVATION TOP OF RISER PIPE: 112.80
GROUND ELEVATION: 111.01



LENGTH OF PROTECTIVE CASING ABOVE GROUND SURFACE (Ft)	2.03
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (Ft)	1.79
TYPE OF SURFACE SEAL	concrete
DIA SURFACE SEAL BGS (In)	~5"
DEPTH TO BOTTOM OF SURFACE SEAL (Ft)	2.5'
ID OF PROTECTIVE CASING (In)	4.0
TYPE OF PROTECTIVE CASING	steel pipe
DEPTH BOTTOM OF PROTECTIVE CASING (Ft)	3.0'
DEPTH BOTTOM OF DRAIN LAYER (Ft)	5.0'
RISER PIPE (In) ID	2 OD 2 1/4
TYPE OF RISER PIPE	schedule 40 PVC
TYPE OF BACKFILL AROUND RISER PIPE	bentonite chip
DEPTH TOP OF SEAL (Ft)	5.0'
TYPE OF SEAL	(hydrated) bentonite chip
DEPTH BOTTOM OF SEAL (Ft)	12.0'
DEPTH TOP OF PERVIOUS SECTION (Ft)	14.5'
DIAMETER OF BOREHOLE (In)	4.5"
TYPE OF PERVIOUS SECTION	schedule 40 PVC
TYPE OF OPENINGS	.020" factory slotted
PERVIOUS SECTION (In) ID	2 OD 2 1/4
TYPE OF FILTER PACK AROUND PERVIOUS SECTION	No. 1 silica sand filtersil
DEPTH BOTTOM OF PERVIOUS SECTION (Ft)	39.5'
DEPTH BOTTOM OF FILTER PACK (Ft)	39.5'
TYPE OF BACKFILL BELOW FILTER PACK	N/A
END OF BORING(Ft)	39.5'

-Used 3.5 100 lb. bags for filter-pack.

-Placed 2 stainless-steel centralizers on screen. 1 @ ~35' bgs & 2nd @ 20' bgs.

GENERAL NOTE

1 Entry of 0 00 for Ground Elevation, Elev Top of Riser Pipe & Elev Top of Protective Casing Indicates that Surveyed Ground Elevation Not Available

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OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

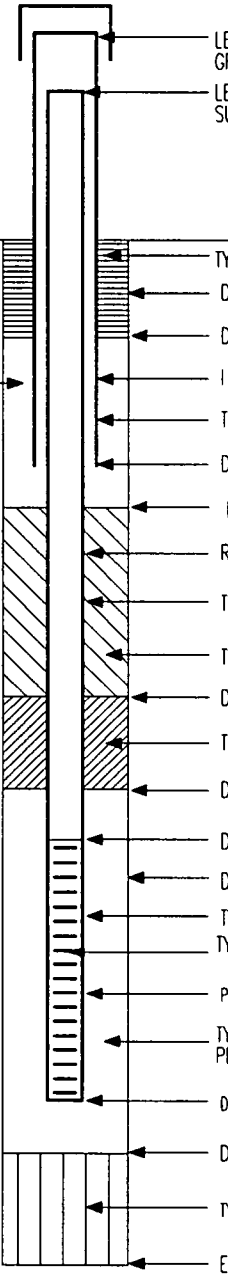
PROJECT	CTO 143 - Tank Farm 4 - Supplemental Site Investigation	PROJECT	0288-0552
PROJECT	NETC - Newport, RI Tank Farm 4	WELL NO	MW-807
CLIENT	U.S. Navy	BORING	SB-807
CONTRACTOR	Maher Environmental — DRILLER Denis Duchnowski	BORING	Approx. 30' W (downgradient) of
LOGGED	Tracy Dorgan — DATE. 6-25-98		MW-802 at Tank Farm 45. Possible
CHECKED	Mike Healey — DATE.		ramp location.

PAGE 1 OF- 1

ELEVATION TOP OF CASING 111.91

ELEVATION TOP RISER PIPE 116.62

GROUND ELEVATIO 109.73



SAND DRAIN

-2 stainless steel centralizers placed on top & bottom of screen.

LENGTH OF PROTECTIVE CASING GROUND SURFACE		2.18
LENGTH OF RISER PIPE ABOVE SURFACE		1.89
TYPE OF SURFACE		cement
DIA. SURFACE SEAL BGS		~5-6"
DEPTH TO BOTTOM OF SURFACE SEAL		~2.5'
I D OF PROTECTIVE CASING		4
TYPE OF PROTECTIVE		steel pipe
DEPTH BOTTOM OF PROTECTIVE CASING		3.0
DEPTH BOTTOM OF DRAIN LAYER		4.5
RISER PIPE (In)	I D 2 O D. 2.25	
TYPE OF RISER PIPE		schedule 40 PVC
TYPE OF BACKFILL AROUND RISER PIPE		N/A
DEPTH TOP OF SEAL (Ft)		4.5
TYPE OF SEAL	(hydrated)	bentonite chips
DEPTH BOTTOM OF SEAL		7.5
DEPTH TOP OF PERVIOUS SECTION (Ft)		10.0'
DIAMETER OF BOREHOLE (In)		4.5
TYPE OF PERVIOUS SECTION		schedule 40 PVC
TYPE OF OPENINGS		020" factory slotted
PERVIOUS SECTION	I D 2 O D 2.25	
TYPE OF FILTER PACK AROUND PERVIOUS SECTION		#1 filter sil silica sand
DEPTH BOTTOM OF PERVIOUS SECTION		25.0
DEPTH BOTTOM OF FILTER PACK		25.2
TYPE OF BACKFILL BELOW FILTER		bentonite chips
END OF BORING(Ft)		26'

GENERAL NOT

1 Entry of 0 00 for Ground Elevation, Elev Top of Riser Pipe & Elev Top of Indicates that Surveyed Ground Elevation Not

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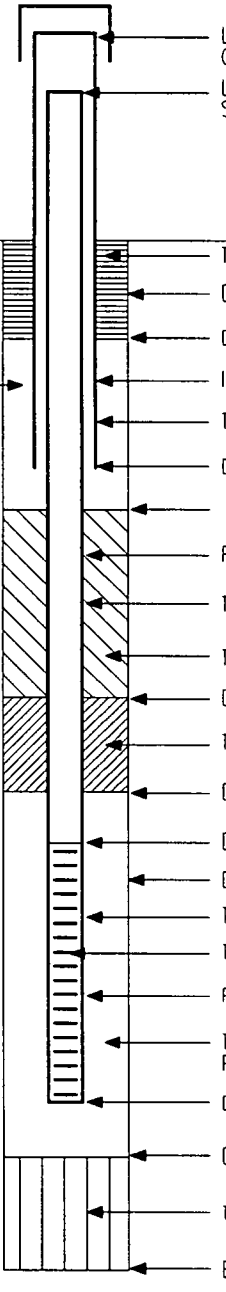
OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

PROJECT NAME: CTO 143 - Tank Farm 4 - Supplemental Site Investigation
PROJECT NO: 0288-0552
PROJECT LOCATION: NETC Newport, RI Tank Farm 4 - Tank 45
WELL NO: MW-808
CLIENT: U.S. Navy
BORING NO: SB-808
CONTRACTOR: Maher Environmental
DRILLER: Denis Duchnowski
BORING LOCATION: Approx. 60' W of MW-802 & 30' W of MW-807 at Tank Farm 45
LOGGED BY: Tracy Dorgan
DATE: 6-26-98
CHECKED BY: Mike Healey
DATE:

ELEVATION TOP OF PROTECTIVE CASING: 110.72
ELEVATION TOP OF RISER PIPE: 110.46
GROUND ELEVATION: 108.84



-2 stainless steel centralizers placed on well screen.

LENGTH OF PROTECTIVE CASING ABOVE GROUND SURFACE (Ft)	1.87
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (Ft)	1.60
TYPE OF SURFACE SEAL	cement
DIA SURFACE SEAL BGS (In)	~5 in.
DEPTH TO BOTTOM OF SURFACE SEAL (Ft)	2.5
I D OF PROTECTIVE CASING (In)	4
TYPE OF PROTECTIVE CASING	steel casing
DEPTH BOTTOM OF PROTECTIVE CASING (Ft)	3.0'
DEPTH BOTTOM OF DRAIN LAYER (Ft)	5.0'
RISER PIPE (In) ID 2 OD 2.25	
TYPE OF RISER PIPE	schedule 40 PVC
TYPE OF BACKFILL AROUND RISER PIPE	N/A
DEPTH TOP OF SEAL (Ft)	5.0'
TYPE OF SEAL (hydrated)	bentonite chips
DEPTH BOTTOM OF SEAL (Ft)	8.0'
DEPTH TOP OF PERVIOUS SECTION (Ft)	10.5
DIAMETER OF BOREHOLE (In)	4.5
TYPE OF PERVIOUS SECTION	schedule 40 PVC
TYPE OF OPENINGS	.020 factory slotted
PERVIOUS SECTION (In.) ID 2 OD 2.25	
TYPE OF FILTER PACK AROUND PERVIOUS SECTION	#1 filter sil silica sand
DEPTH BOTTOM OF PERVIOUS SECTION (Ft)	20.5
DEPTH BOTTOM OF FILTER PACK (Ft)	20.7
TYPE OF BACKFILL BELOW FILTER PACK	bentonite chips
END OF BORING(Ft)	21.0'

GENERAL NOTE

1 Entry of 0.00 for Ground Elevation, Elev. Top of Riser Pipe & Elev Top of Protective Casing Indicates that Surveyed Ground Elevation Not Available

OVERBURDEN MONITORING WELL CONSTRUCTION LOG — TETRA TECH NUS, INC.

PROJECT NAME:	CTO 143 - Tank Farm 4 - Supplemental Site Investigation	PROJECT NO	0288-0552
PROJECT LOCATION	NETC Newport, RI - Tank Farm 4 - Tank 48	WELL NO	MW-809
CLIENT	U.S. Navy	BORING NO	SB-809
CONTRACTOR:	Maher Environmental	DRILLER	Denis Duchnowski
LOGGED BY:	Tracy Dorgan	DATE	6-29-98
CHECKED BY:	Mike Healey	DATE	

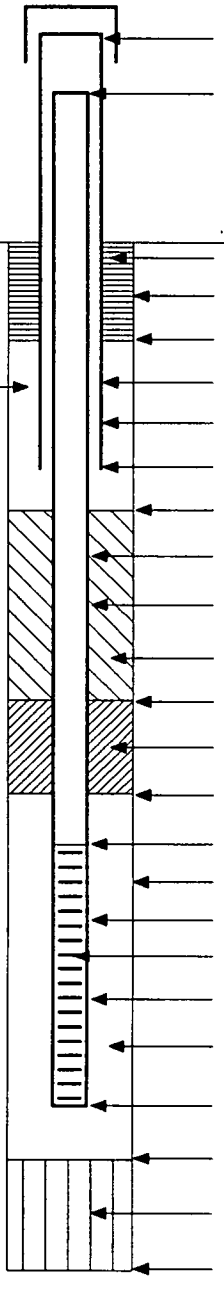
BORING LOCATION: Approx. 60' W (downgradient) of Tank 48.

PAGE: 1 OF 1

ELEVATION TOP OF PROTECTIVE CASING: 78.54

ELEVATION TOP OF RISER PIPE: 78.18

GROUND ELEVATION: 76.19



-2 stainless steel centralizers placed on screen.

LENGTH OF PROTECTIVE CASING ABOVE GROUND SURFACE (Ft)	2.35
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (Ft)	1.99
TYPE OF SURFACE SEAL	concrete
DIA SURFACE SEAL BGS (In)	5
DEPTH TO BOTTOM OF SURFACE SEAL (Ft)	2.5
I D OF PROTECTIVE CASING (In)	4
TYPE OF PROTECTIVE CASING	steel casing
DEPTH BOTTOM OF PROTECTIVE CASING (Ft)	3.0
DEPTH BOTTOM OF DRAIN LAYER (Ft)	5.0
RISER PIPE (In) ID: 2 OD: 2.25	schedule 40 PVC
TYPE OF RISER PIPE	N/A
TYPE OF BACKFILL AROUND RISER PIPE	5.0
DEPTH TOP OF SEAL (Ft)	(hydrated) bentonite chips
TYPE OF SEAL	8.0
DEPTH BOTTOM OF SEAL (Ft)	10.0
DEPTH TOP OF PERVIOUS SECTION (Ft)	4.5
DIAMETER OF BOREHOLE (In)	schedule 40 PVC
TYPE OF PERVIOUS SECTION	.010" factory slotted
TYPE OF OPENINGS	
PERVIOUS SECTION (In.) ID: 2 OD: 2.25	#0 filter sil silica sand
TYPE OF FILTER PACK AROUND PERVIOUS SECTION	20.0
DEPTH BOTTOM OF PERVIOUS SECTION (Ft)	20.2
DEPTH BOTTOM OF FILTER PACK (Ft)	bentonite chips
TYPE OF BACKFILL BELOW FILTER PACK	21.35'
END OF BORING(Ft)	

GENERAL NOTE

1 Entry of 0.00 for Ground Elevation, Elev Top of Riser Pipe & Elev Top of Protective Casing Indicates that Surveyed Ground Elevation Not Available

APPENDIX C

SURVEY DATA

LOUIS FEDERICI and ASSOCIATES

365 Smith Street, Providence, RI 02908 Tele: 401-331-1570 Fax: 401-331-1593

land surveyors biologists planners

Tabulation of field located wells for Tetra Tech NUS Inc.- at Tank Farm 4, Newport, RI

LFA PROJECT NUMBER = 941005

Date Surveyed: 6/10/98;

The values below are based on the following datums:

Horizontal = NAD 1983; Vertical = Local Mean Low Water

LFA PT. NO.	T. T. NUS I.D.	NORTHING	EASTING	EXISTING GRADE	TOP OF CASE	TOP OF PVC
430	**MW-422**	**174886.5656**	**384977.7830**	**66.03**	**68.22**	**68.00**
431	**MW-408**	**174738.2963**	**384979.8954**	**67.13**	**69.89**	**69.73**
432	**MW-805**	**174841.9933**	**384911.6514**	**64.20**	**66.04**	**65.70**
433	**MW-409**	**174855.4882**	**384870.9223**	**61.01**	**63.60**	**63.32**
434	**MW-425**	**174879.4265**	**384853.6962**	**59.93**	**61.90**	**61.78**
435	**MW-809**	**174839.3011**	**384839.4798**	**59.02**	**61.37**	**61.01**
436	**MW-424**	**174804.0450**	**384855.0149**	**59.54**	**61.95**	**61.80**
437	**MW-421**	**174753.0803**	**384815.9974**	**55.74**	**58.03**	**57.84**
438	MW-801	175554.0228	385417.9591	89.84	91.70	91.25
439	MW-806	175564.2284	385388.6168	87.79	89.70	89.45
440	MW-808	175485.7012	385709.9235	108.84	110.72	110.46
441	MW-807	175475.3647	385738.0198	109.73	111.91	111.62
442	SB-804	175465.9794	385756.6615	110.62		
443	MW-802	175464.8346	385766.0839	111.01	113.03	112.80
444	SB-803	175542.8778	385795.4660	110.86		
445	MW-330	175546.5288	385798.7502	110.69	112.87	112.79
446	MW-331	175469.8916	385885.5592	113.22	114.79	114.65
447	MW-332	175422.5083	385811.2934	112.70	114.00	113.84
448	MW--5D	175361.5299	385929.7505	115.26	118.43	118.13
449	MW-5S	175356.7993	385931.6799	115.41	118.60	118.37
450	MW-605	175872.8654	385124.3352	64.39	66.45	65.80
451	MW-418	175832.9219	385262.7563	69.90	72.37	72.23
452	MW-3S	175447.7299	385208.7553	72.53	75.66	75.36
453	MW-3D	175448.7882	385220.7880	73.54	76.73	76.45
454	MW-1D	175815.4290	384802.6251	51.17	53.92	53.55
455	MW-1S	175811.6709	384797.3819	50.88	53.69	53.69
456	MW-10	176361.0099	384315.0531	30.83	32.45	32.20
457	MW-4	175191.5840	383444.1375	34.11	36.99	36.73
77	BM #7	178487.4068	386160.1205	12.85		

NOTE:

1] THOSE VALUES IN BOLD SCRIPT ARE REVISED VALUES.

REVISIONS:

1] 10/7/98 RECALCULATED LFA POINTS 430-437.

2] 10/15/98 CHANGED ELEVATION LFA POINTS 430-437.

RI Rge. Number 1646

APPENDIX D

SAMPLE LOG SHEETS

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - OU#3 - SSI
Sample ID: TF4-MW-TB-01

Tetra Tech, NUS Job No./PMS 0288-0552
QC Information: TRIP BLANK #1 (if applicable)

Sample Method/Device: DIRECT POUR
Depth Sampled: ____ feet Total Depth ____ feet (SW Only)
Sample Date & Time: 7/8/98 1215 hours
Sampler(s): TRACY DORGAN
Date Recorded By: T. Dorgan
Signature

TYPE OF SAMPLE: (Check all that apply)

- ____ Groundwater
- ____ Surface Water
- ____ Residential Supply
- X Grab
- ____ Composite
- X Trip Blank*
- ____ Rinsate Blank*
- ____ Field Duplicate Collected
- ____ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	feet	Purge Start	hrs
Inside Diameter	inches	Purge Stop Time	hrs
Water Level	feet	Total Gallons Purged	
Well Volume	gal.	Purge Method	

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	Temp °C	pH	Spec. Cond.	DO
0				
1				
3				
4				

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
VOC's - 8260				DIRECT POUR LAB SUPPLIED VOC WATER INTO PRE-PRESERVED AMBER VOA VIALS.

Tt, NUS form #4

PAGE. 02

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - GT0143 - SSI
Sample ID: TF4-MW-RB-01

Tetra Tech, NUS Job No./PMS 0258-0552
QC Information: RINSATE BLANK - BRAND - WATER (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: N/A feet Total Depth N/A feet (SW Only)
Sample Date & Time: 7/8/98 1445 hours
Sampler(s): TRACY DORGAN

Date Recorded By: T. Dorgan
signature

TYPE OF SAMPLE: (Check all that apply)

- ___ Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- X Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	feet	Purge Start	hrs
Inside Diameter	inches	Purge Stop Time	hrs
Water Level	feet	Total Gallons Purged	
Well Volume	gal.	Purge Method	

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	Temp °C	pH	Spec. Cond.	DO
0				
1				
3				
4				

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
VOC'S-8260				1ST POURED LAB SUPPLIED VOC FREE H_2O
SVOC'S				(SAME AS USED FOR TF4-MW-TB-01) INTO BAILER
TOTAL RCRA METALS				(SINGLE SAMPLE DISP. BAILER) THEN COLLECT VOC
DISS. RCRA METALS				SAMPLES. FILL BAILER W/ DI VF WATER (LOT #
TPH-418.1				F182) & COLLECT TPH, SVOC & BOTH TOTAL
				& DISS. METALS.
				BAILER THEN USED TO PURGE/SAMPLE @
				MW-807.

Tt, NUS form #4

PAGE.02

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - C1014S - SSI
Sample ID: TF4-MW-RB-02

Tetra Tech, NUS Job No./PMS 0258-0552
QC Information: RINSATE BLANK FOR 4RO (if applicable)

Sample Method/Device: DISP. BAILER / DIRECT POUR
Depth Sampled: ____ feet Total Depth ____ feet (SW Only)
Sample Date & Time: 7/9/98 1700 hours
Sampler(s): T. DORGAN & S. HORDAN

Date Recorded By: _____ Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- X Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	feet	Purge Start	hrs
Inside Diameter	Inches	Purge Stop Time	hrs
Water Level	feet	Total Gallons Purged	
Well Volume	gal.	Purge Method	

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	Temp °C	pH	Spec. Cond.	DO
0				
1				
3				
4				

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
4RO				COLLECT TF4-MW-RB-02 RINSATE BLANK BY DIRECTLY POURING LAB SUPPLIED VOC FREE WATER INTO DISP. BAILER & THEN FILLING 2 PRE-PRESERVED 40 ML. VIALS

Tt, NUS form #4

PAGE.02

Steel 2.18
steel to PVC -0.08

JUL 09 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - SSI - CT0143
Sample ID: 45-MW-330-02

Tetra Tech, NUS Job No./PMS 0288-0552
QC Information: _____ (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: 7/8/98 1720 hours
Sampler(s): J Holder
Date Recorded By: J Holder
Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	39.88 feet	Purge Start	1630 hrs
Inside Diameter	2 inches	Purge Stop Time	1705 hrs
Water Level	20.53 feet	Total Gallons Purged	10
Well Volume	3.2 gal.	Purge Method	DISP. BAILER

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	turb	Temp °C	SAL	pH	Spec. Cond.	DO
0	231	12.7	0.01	6.72	0.266	2.17
1	789	12.3	0.01	6.60	0.268	2.28
2	512	12.0	0.01	6.18	0.270	0.97
3	582	12.2	0.01	6.20	0.272	2.64

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
				0.1 droplets
				0.1 sheen

Tt, NUS form #4

PAGE. 02

JUL 09 '96 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4-CT0143-SSI
Sample ID: 48-MW-424-02 (OLF = FILTERED METHYS)

Tetra Tech, NUS Job No./PMS: 0288-0552
QC Information: DUPLICATE ID = TF4-MW-DUP-01 (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: ____ feet Total Depth ____ feet (SW Only)
Sample Date & Time: 7 19 96 1520 hours DUP=1500
Sampler(s): T. DORGAN & J. HERDEN
Date Recorded By: T. Dorgan
Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- X Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	41.12 feet	Purge Start	1500 hrs
Inside Diameter	2 inches	Purge Stop Time	1510 hrs
Water Level	11.70 feet	Total Gallons Purged	15
Well Volume	4.8 gal.	Purge Method	WHALE PUMP

Color: ____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ____ ppm

Sampling/Purge Data:

Vol. #	Temp °C	SAL	pH	Spec. Cond.	turb	DO
0	14.0	0.01	6.94	0.292	694	5.38
1	11.9	0.01	6.53	0.298	694	3.90
2	12.0	0.01	6.41	0.300	460	0.74
3	12.2	0.01	6.36	0.302	473	0.25

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	INORGANIC	COMMENTS
GRO				Petroleum droplets, sheen, odor (strong)
VOC				
SVOC				APPROX. 0.05' LNAPL MEAS. USING
TPH				INTERFACE BAILER PRIOR TO PURGE.
tot met				
diss met				DK. BROWN - BLACK HEAVY PETROLEUM STAINING
				INT. OF WELL & BAILER. ▼ 18.62 @ 1509:30
				▼ 18.36 @ 1502 ▼ 18.57 @ 1507

Tt, NUS form #4

PAGE.02

1-96 - 0.12

JUL 09 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - CT0143 - SST
Sample ID: 48-MLJ-425-02

Tetra Tech, NUS Job No./PMS 0286-0552
QC Information: MS/MSD FOR GRO ANALYSIS (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: ~35-40 feet Total Depth ____ feet (SW Only)
Sample Date & Time: 7/9/98 1345 hours
Sampler(s): TRACY DORGAN

Date Recorded By: T. Dorgan
Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ____ Surface Water
- ____ Residential Supply
- X Grab
- ____ Composite
- ____ Trip Blank*
- ____ Rinsate Blank*
- ____ Field Duplicate Collected
- ____ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	43.04 feet	Purge Start	1115 hrs
Inside Diameter	2 inches	Purge Stop Time	1220 hrs
Water Level	11.90 feet	Total Gallons Purged	15-16
Well Volume	5.1 gal.	Purge Method	DISP. BAILER

Color: LT. BROWN Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	TURBIDITY (NTU)	Temp °C	pH	SALINITY (%)	Spec. Cond.	DO
0	84	17.0	6.24	0.01	.383	3.33
1	81	13.0	6.48	0.01	.344	3.35
2	177	14.1	6.55	0.01	.342	3.24
3	51	12.2	6.50	0.01	.350	3.27

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
				USED INTERFACE BAILER TO INSPECT AIR/WATER INTERFACE. NO VIS. FLOATING PRODUCT DROP PRODUCT BAILER TO BOTTOM, RECOVER WATER WITH OIL DROPS.
				VOL. 1 = CLEAR W/ OIL DROPS, SHEEN & PET. ODOR
				VOL. 2 = SAME AS VOL. 1.
				VOL. 3 = DECREASING OIL DROPS

Tt, NUS form #4

PAGE. 02

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - GO143 - SSI
Sample ID: 38-MW-605-01

Tetra Tech, NUS Job No./PMS 0284-0552
QC Information: _____ (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: _____ feet Total Depth 17.75 feet ~~(SW Only)~~
Sample Date & Time: ~~7/8/98~~ 0745 hours
Sampler(s): JOSH HAUSEN; TRACY DORGAN

Date Recorded By: T. Dorgan
Signature

Sampled on 7/9/98

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	~~17.75~~ 9.61 feet	Purge Start	1025 hrs
Inside Diameter	2 inches	Purge Stop Time	1035 hrs
Water Level	9.61 feet	Total Gallons Purged	2
Well Volume	1.3 gal.	Purge Method	DISP. BAILER

Color: BROWN Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: _____ ppm

Sampling/Purge Data:

Vol. #	TURB.	Temp °C	pH	Spec. Cond.	SALN.	DO
0	275	13.5	6.17	.421	0.01	2.27
1	925	12.1	6.55	.427	0.01	3.11
3						
4						

1237 ▼ 15.29
0736 ▼ 10.97 7/9/98

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
VOC's-8260				INIT. BAILER FROM AIR/H2O INTERFACE =
SVOC's				NO SHEEN NOTED.
TOTAL METALS (RCRA)				
DIS. METALS (")				WAS BAILED DRY IN 10 MIN. TOTAL PURGE =
TPH-418.1				2 GAL. WAIT FOR RECOVERY.

Tt, NUS form #4

used 6.1' of water for 75% Rec
knew 6.78'

PAGE: 02

steel stick up = 1.86 puc = steel − 0.45

JUL 09 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: IANC FARM 4 - CTO143 - SSI
Sample ID: 42-MW-801-01

Tetra Tech, NUS Job No./PMS 0288-0552
QC Information: MS/MSD - LAB QC (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: ____ feet Total Depth ____ feet (SW Only)
Sample Date & Time: 03718198 1200 hours
Sampler(s): JOSH HALDEN, TRACY DORGAN

Date Recorded By: _____ Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- X Other (Specify): MS/MSD

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	43.2' feet	Purge Start	1102 hrs
Inside Diameter	2 inches	Purge Stop Time	1155 hrs
Water Level	26.90 feet	Total Gallons Purged	9
Well Volume	2.7 gal.	Purge Method	DISP. BAILER

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	Turbidity (NTU's)	Temp °C	pH	SALIN (%)	Spec. Cond.	DO
0	05	12.7	7.11	0.01	.329	7.29
1	05	11.8	6.58	0.01	0.339	1.06
2	925	11.9	6.45	0.01	0.315	4.29
3	620	11.9	6.49	0.01	0.329	1.84

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	INORGANIC	COMMENTS
VOC's - 8260				INIT. PURGE = CLEAR, NO
SVOC's				minor sheen on purge water,
TOTAL RCRA METALS				NO oil droplets
DISS. RCRA METALS				
TPH - 418.1				

Tt, NUS form #4

PAGE: 02

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: JANK FARM 4 - CT0143 - SSI
Sample ID: 45-MN-802-01

Tetra Tech, NUS Job No./PMS 0288-0552
QC Information: _____ (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: 7-8-98 1700 hours
Sampler(s): TRACY DORGAN

Date Recorded By: _____ Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	41.25 feet ~~39.9~~ TD	Purge Start	1550 hrs
Inside Diameter	2 inches	Purge Stop Time	1650 hrs
Water Level	20.52 feet	Total Gallons Purged	11.5-12
Well Volume	~~3.4~~ gal.	Purge Method	DISP. BAILER

Color: DK. BROWN Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: _____ ppm

Sampling/Purge Data:

Vol. #	Turbidity (NTU's)	Temp °C	pH	Salinity (%)	Spec. Cond.	DO
0	530	13.6	5.94	0.01	.293	2.91
1	0.5.	11.7	5.92	0.01	.295	3.17
#2	0.5.	11.1	5.94	0.01	.296	4.06
#3	0.5.	10.8	5.92	0.01	.295	3.43

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	INORGANIC	COMMENTS
				OIL COATING BOTTOM 2 IN OF EXTERIOR OF
				BAILER, NO OIL OR SHEEN ON WATER FROM INSIDE
				BAILER. 2ND BAILER HAS WATER W/ HEAVY SHEEN
				& OIL DROPS.
				HEAVY PET. SHEEN & OIL DROPS.

Tt, NUS form #4

PAGE.02

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - OU143 - SSI
Sample ID: 48-MW-805-01

Tetra Tech, NUS Job No./PMS 0288-0552
QC Information: _____ (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: 7/9/98 1245 hours
Sampler(s): J Hilde

Date Recorded By: J Hilde
Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify): _____

*include sample source & lot No.

WELL PURGE DATA:

Micro Tip/OVA Monitor Reading: ppm

Well Depth	39.9 feet	Purge Start	1130 hrs
Inside Diameter	2 inches	Purge Stop Time	1205 hrs
Water Level	15.17 feet	Total Gallons Purged	12
Well Volume	4.0 gal.	Purge Method	DISP. BAILER

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Sampling/Purge Data:

Vol. #	Temp °C	SAL	pH	Spec. Cond.	turb	DO
0	13.1	0.01	6.58	0.261	927	1.50
1	12.1	0.01	6.31	0.266	05	4.01
2	12.1	0.01	6.23	0.270	05	2.78
3	12.0	0.01	6.33	0.268	05	2.68

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
VOC				sheen w/ product bailer, NO measurable
TPH				product found.
TOT Metal				oil drops, shown, odor from purge water
diss Metal				
SVOC				

Tt, NUS form #4

PAGE.02

NOT SAMPLED - DRY WELL

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - OT0143 - SST
Sample ID: 42-MW-806-01

Tetra Tech, NUS Job No./PMS 0288-0552
QC Information: _____ (if applicable)

Sample Method/Device: _____
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: __/__/__ _____ hours
Sampler(s): _____

Date Recorded By: _____
Signature

TYPE OF SAMPLE: (Check all that apply)

- ____ Groundwater
- ____ Surface Water
- ____ Residential Supply
- ____ Grab
- ____ Composite
- ____ Trip Blank*
- ____ Rinsate Blank*
- ____ Field Duplicate Collected
- ____ Other (Specify): _____

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	feet	Purge Start	hrs
Inside Diameter	inches	Purge Stop Time	hrs
Water Level	feet	Total Gallons Purged	
Well Volume	gal.	Purge Method	

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	Temp °C	pH	Spec. Cond.	DO
0				
1				
3				
4				

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO.		COMMENTS
		ORGANIC	INORGANIC	NOT SAMPLED!
				DRY WELL

Tt, NUS form #4

PAGE. 02

7 feet 2.18

steel to PVC 0.29

JUL 09 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4
Sample ID: 45-MW-807-01

Tetra Tech, NUS Job No./PMS 0288-055 2
QC Information: _____ (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: 7/8/98 1600 hours
Sampler(s): [signature]

Date Recorded By: [signature]
Signature

TYPE OF SAMPLE: (Check all that apply)

- X Groundwater
- ___ Surface Water
- ___ Residential Supply
- X Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Micro Tip/OVA Monitor Reading: ppm

Well Depth	27.0 feet	Purge Start	1515 hrs
Inside Diameter	2 inches	Purge Stop Time	1550 hrs
Water Level	20.22 feet	Total Gallons Purged	
Well Volume	1.1 gal.	Purge Method	DISP. BAILER

Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ

Sampling/Purge Data:

Vol. #	hrs	Temp °C	SAL	pH	Spec. Cond.	DO
0	147	12.4	0.01	6.50	0.273	1.46
1	05	11.5	0.01	6.38	0.272	3.27
2	05	11.4	0.01	6.20	0.295	1.57
3	05	11.4	0.01	6.20	0.293	1.74
4	05	11.6	0.01	6.17	0.294	1.61
5	05	11.9	0.01	6.30	0.272	1.59

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
				Oil on bailer, Oil Sheen, Oil Droplets

Tt, NUS form #4

PAGE.02

stnd b pic 0.27

JUL 09 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK FARM 4 - CT0143 - SSI
Sample ID: 45-MW-808-01

Tetra Tech, NUS Job No./PMS 0288-055 2
QC Information: _____ (if applicable)

Sample Method/Device: DISP. BAILER
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: 7 / 8 / 98 1450 hours
Sampler(s): _____

Date Recorded By: _____
Signature

TYPE OF SAMPLE: (Check all that apply)

- Y Groundwater
- ___ Surface Water
- ___ Residential Supply
- Y Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	22.40 feet ~~20.51 TD~~	Purge Start	1415 hrs
Inside Diameter	2 inches	Purge Stop Time	1440 hrs
Water Level	20.51 feet	Total Gallons Purged	2.5
Well Volume	0.3 gal.	Purge Method	DISP. BAILER

Color: GRAY Turbidity: CLR/SL CLDY/CLDY OPAQ

Micro Tip/OVA Monitor Reading: _____ ppm

Sampling/Purge Data:

Vol. #	turb	Temp °C	SAL	pH	Spec. Cond.	DO
0	05	12.8	0.01	6.43	0.280	9.39
1	05	11.9	0.01	6.26	0.279	2.40
2	05	11.8	0.01	6.22	0.279	2.70
3	05	11.8	0.01	6.28	0.277	3.97
4	05	11.6	0.01	6.15	0.274	4.08
5	861	11.5	0.01	6.16	0.276	3.59

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	INORGANIC	COMMENTS
				No oil or sheen observed

Tt, NUS form #4

PAGE.02

JUL 08 '98 08:34

TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: TANK Farm 4 - CTO 143 - SST
Sample ID: 4S-MW-809-01

Tetra Tech, NUS Job No./PMS 0728 - 0552
QC Information: _____ (if applicable)

Sample Method/Device: Disp Bailer
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: 7/9/98 1020 hours
Sampler(s): [signature]

Date Recorded By: [signature]
Signature

TYPE OF SAMPLE: (Check all that apply)

- ✓ Groundwater
- ___ Surface Water
- ___ Residential Supply
- ✓ Grab
- ___ Composite
- ___ Trip Blank*
- ___ Rinsate Blank*
- ___ Field Duplicate Collected
- ___ Other (Specify):

*include sample source & lot No.

WELL PURGE DATA:

Well Depth	21.75 feet	Purge Start	0945 hrs
Inside Diameter	2 Inches	Purge Stop Time	1015 hrs
Water Level	11.49 feet	Total Gallons Purged	8
Well Volume	1.7 gal.	Purge Method	Bailer

Color: GRAY Turbidity: CLR/SL CLDY/CLDY (OPAQ)

Micro Tip/OVA Monitor Reading: ppm

Sampling/Purge Data:

Vol. #	Temp °C	SAL	pH	Spec. Cond.	turb	DO
0	13.4	0.01	6.02	0.324	440	1.61
1	12.1	0.01	6.32	0.317	05	1.65
3	11.5	0.01	6.38	0.323	05	1.43
3	11.8	0.01	6.43	0.322	05	3.95
4	11.6	0.01	6.43	0.326	05	2.58
5						

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO. ORGANIC	TRAFFIC REPORT NO. INORGANIC	COMMENTS
TPH				Petroleum ODOR
VOC				
SVOC				
tot met				
diss met				

Tt, NUS form #4

PAGE.02

APPENDIX E

ANALYTICAL DATA

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(978) 658-7899 ▪ FAX (978) 658-7870 ▪ www.tetratech.com

C-NAVY-8-98-1220W

Date: August 11, 1998 cc: File 0288-A-4.9

To: James Forrelli

From: Linda Terzis LT

Subject: Data Review, Project No. 0288, SDG No. E0951
Mitkem Corporation
NETC Tank Farm 4 Site, Newport, RI

TPH:

8/Soils/ 42-SB-801-37.539.5, 45-SB-802-3638, 45-SB-803-3840, 45-SB-804-1416, 48-SB-805-3335, 48-SB-809-1517, TF4-SB-DUP-01, TF4-SB-DUP-02 (Field Duplicate Pairs 45-SB-802-3638/ TF4-SB-DUP-01 and 48-SB-809-1517/ TF4-SB-DUP-02)

1/Rinsate Blank/ TF4-SB-RB-01

A cursory data review was performed on the total petroleum hydrocarbon (TPH) data associated with soil samples collected at the NETC Tank Farm 4 site, on June 16 - 19, 22, 23, and 29, 1998. The samples and blanks were analyzed by US EPA Method 418.1.

The data package was checked for completeness. The TPH sample analysis dates are incorrectly noted as 98/12/23 on the sample plots. The raw data indicate that the samples were analyzed on June 24 and 25, 1998, and on July 11, 1998. The data are not affected.

The data package was checked for blank contamination and laboratory and field precision. The rinsate and most laboratory blanks were free of TPH contamination, however, TPH was detected at slightly below the quantitation limit in one laboratory blank. Positive TPH results near the quantitation limit may be biased high or false positive. The data user is cautioned in using positive results near the quantitation limit as they may be solely attributable to blank contamination. Laboratory precision was found to be acceptable for one of the soil matrix spike/matrix spike duplicate (MS/MSD) pairs, however the relative percent difference (RPD) of the MS/MSD analyses performed on soil sample 42-SB-801-37.539.5 was greater than 50%. The high RPD value was due to the relatively high concentration of TPH present in the unspiked sample obscuring the spiked amount of TPH. The data are not affected. Field precision was found to be acceptable for field duplicate pair 45-SB-802-3638/TF4-SB-DUP-01, however the RPD of the field duplicate pair 48-SB-

809-1517/TF4-SB-DUP-02 results was greater than 50%. The high RPD value may be a result of blank contamination since the sample results were non-detected and 18 ppm (near the quantitation limit). The data user is already cautioned in using data results near the quantitation limit, and further action is not required.

The review included a check for major non-compliances in the quality control summary forms and data summary forms. The sample plots were reviewed for agreement with the positive hits from the sample data.

The summary table results should be used with caution since the sample data have not been validated. TPH results near the quantitation limit should be used with caution since the results may be biased high or false positive due to blank contamination.

Soil Total Petroleum Hydrocarbon Analysis (mg/kg) UNVALIDATED DATA
Site Tank Farm 4
Case 0288, SDG E0951

EPA Sample Number	42-SB-801-37 539 5	45-SB-802-3638	45-SB-803-3840	45-SB-804-1416	48-SB-805-3335
Station Location	42-SB-801-37 539 5	45-SB-802-3638	45-SB-803-3840	45-SB-804-1416	48-SB-805-3335
Date Sampled	6/16/98	6/18/98	6/23/98	6/17/98	6/22/98
Date Extracted	6/24/98	6/24/98	6/25/98	6/24/98	6/25/98
Date Analyzed	6/24/98	6/24/98	6/25/98	6/24/98	6/25/98
Dilution Factor	1	10	1	10	1
Percent Solids	90 6	84 1	85 2	88 3	84 0
QC Identifier	None	Field Dup 45-SB-802-3638	None	None	None
Total Petroleum Hydrocarbons	4400	12000	1700	5700	2300

Soil Total Petroleum Hydrocarbon Analysis (mg/kg)
Site Tank Farm 4
Case 0288, SDG E0951

UNVALIDATED DATA

EPA Sample Number	48-SB-809-1517		TF4-SB-DUP-01		TF4-SB-DUP-02	
Station Location	48-SB-809-1517		TF4-SB-DUP-01		TF4-SB-DUP-02	
Date Sampled	6/29/98		6/18/98		6/29/98	
Date Extracted	7/11/98		6/24/98		7/11/98	
Date Analyzed	7/11/98		6/24/98		7/11/98	
Dilution Factor	1		10		1	
Percent Solids	82 5		90 0		81 9	
QC Identifier	Field Dup 48-SB-809-1517		Field Dup 45-SB-802-3638		Field Dup 48-SB-809-1517	
Total Petroleum Hydrocarbons	18		17000		12	U

U - Not detected, J - Estimated value below the CRQL,
B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Total Petroleum Hydrocarbon Analysis (mg/l)
Site: Tank Farm 4
Case 0288, SDG E0951

UNVALIDATED DATA

EPA Sample Number	TF4-SB-RB-01	
Station Location	TF4-SB-RB-01	
Date Sampled	6/19/98	
Date Extracted	6/24/98	
Date Analyzed	6/24/98	
Dilution Factor	1	
Percent Solids	0 0	
QC Identifier	Rinsate Blank	
Total Petroleum Hydrocarbons	0 95	U

cpy: M. Henley
R Cleary

TETRA TECH NUS, INC. **INTERNAL CORRESPONDENCE**

C-NAVY-8-98-1226W

Date: September 24, 1998 cc: File N0288A-4.10

To: James Forrelli

From: Linda Terzis

Subject: Data Review, Project No. 0288, SDG No. E1091
Mitkem Corporation
NETC Tank Farm 4 Site, Newport, RI

VOC/SVOC/Total Metals/TPH:

11/Groundwaters/ 42-MW-801-01, 45-MW-808-01, 45-MW-807-01, 45-MW-802-01, 45-MW-330-02, 38-MW-605-01, 48-MW-809-01, 48-MW-805-01, 48-MW-425-02, 48-MW-424-02, TF4-MW-DUP-01 (Field Duplicate Pair 48-MW-424-02/ TF4-MW-DUP-01)

1/Aqueous Rinsate Blank/ TF4-MW-RB-01

2/Aqueous Trip Blanks/ (VOCs only) TF4-MW-TB-01, TF4-MW-TB-02

Dissolved Metals:

11/Groundwaters/ 42-MW-801-01F, 45-MW-808-01F, 45-MW-807-01F, 45-MW-802-01F, 45-MW-330-02F, 38-MW-605-01F, 48-MW-809-01F, 48-MW-805-01F, 48-MW-425-02F, 48-MW-424-02F, TF4-MW-DUP-01F (Field Duplicate Pair 48-MW-424-02F/ TF4-MW-DUP-01F)

1/Aqueous Rinsate Blank/ TF4-MW-RB-01F

Gasoline Range Organics (GRO):

3/Groundwaters/ 48-MW-425-02, 48-MW-424-02, TF4-MW-DUP-01 (Field Duplicate Pair 48-MW-424-02/ TF4-MW-DUP-01)

1/Aqueous Rinsate Blank/ TF4-MW-RB-02

1/Aqueous Trip Blank/ TF4-MW-TB-02

A cursory data review was performed on the volatile, semivolatile, total metals, dissolved metals, gasoline range organics (GRO), and total petroleum hydrocarbons (TPH) data associated with groundwater samples collected at the NETC Tank Farm 4 site, on July 8 and 9, 1998. The volatile organic compounds were analyzed by USEPA SW-846 Method 8260A. The semivolatile organic compounds were analyzed by USEPA SW-846 Method 8270B. The total and dissolved metals were analyzed by USEPA SW-846 Methods 3005A/6010A/7471A. GRO results were reported from the total ion chromatographs of the volatile analysis, and total petroleum hydrocarbons were analyzed by USEPA Method 418.1.

The data package was checked for completeness. The laboratory was contacted on August 10, 1998 concerning missing GRO results, and for verification of TPH sample extraction dates. The laboratory responded on August 11, 1998 and verified that the TPH samples were extracted and analyzed on the same day as noted in the data package. Please note that the TPH sample analysis dates are incorrectly listed as 99/01/11 and 99/01/13 on the sample plots. The raw data indicate that the samples were analyzed on 7/13/98 and 7/15/98. GRO analysis was not performed on the samples due to a sample log-in error. Therefore, the laboratory reported estimated GRO results from the total ion chromatographs of the volatile analyses, which were performed within holding time. The results were received at TtNUS on August 18, 1998. The laboratory was contacted on August 11, 1998 concerning missing electronic deliverables for some samples. The laboratory was contacted again on August 21, 1998 concerning electronic deliverables for the GRO data, as well as the previously requested missing electronic deliverables. The missing information was received at TtNUS on August 21, 1998. The laboratory was contacted on September 1, 1998 concerning the TAL and dissolved metals results. Some sample results suggest that the samples may have been reversed (higher contaminant results in the filtered sample than in the unfiltered sample), or have been affected by laboratory or field contamination. TtNUS requested the reananlysis of selected samples. In addition, the laboratory was requested to investigate the possibility of laboratory contamination with lead. The laboratory responded on September 8, 1998. The laboratory verified that sample containers were not reversed during analysis, however, the lead results for reanalysis of selected samples were non-detected, including the field blanks. Therefore, the laboratory was requested to redigest and reanalyze (except for mercury) all of the groundwater samples. The data was received on September 21, 1998. Samples 48-MW-424-02F and 48-MW-805-01F could not be redigested and reanalyzed due to lack of sample volume, however, lead was not detected in the original analysis of these samples and they are not effected by the lead contamination. All other lead results are reported from the reanalyses. Most sample results in the reanalyses were higher than in the original analyses, due

possibly to the difference in homogeneity of the sample aliquot taken for reanalysis. Therefore, professional judgement was used to report all other analyte results from the original analyses.

The data package was checked for blank contamination and laboratory and field precision. Diethylphthalate was detected in the semivolatile rinsate blank. Acetone, methylene chloride, and carbon disulfide were detected in the volatile field blanks, and acetone, methylene chloride, and naphthalene were detected in the volatile laboratory blanks. The acetone and methylene chloride contamination was present at similar concentrations in the field and laboratory blanks. Barium, cadmium, silver, and mercury were present in both the laboratory and field blanks. Arsenic and chromium were present in the rinsate blank. Positive results for these compounds may be biased high or false positive. The data user is cautioned in using positive results near the quantitation limit for these compounds as they may be solely attributable to blank contamination. Lead results for all samples except 48-MW-424-02F and 48-MW-805-01F are reported from reanalyses since the original analyses were affected by a laboratory contamination problem with lead. The relative percent difference of the TPH field duplicate results was greater than 50%. The data user is cautioned in using positive results for TPH in the samples due to poor field duplicate precision. The GRO results should be considered estimated due to the analytical method employed.

The review included a check for major non-compliances in the quality control summary forms and data summary forms. The sample chromatographs and plots were reviewed for agreement with the positive hits from the sample data. The volatile compound 2-chloroethyl vinyl ether was recovered at 0% in both the matrix spike and matrix spike duplicate analyses. Styrene was recovered slightly below the QC limits. These compounds were recovered at acceptable levels in the laboratory control spike analyses. Styrene results may be biased low, and non-detected 2-chloroethyl vinyl ether results should not be used due to the possibility of false negative data.

The summary table results should be used with caution since the sample data have not been validated. Positive results for diethylphthalate, acetone, methylene chloride, carbon disulfide, naphthalene, barium, cadmium, silver, mercury, arsenic, and chromium may be biased high or false positive attributable to blank contamination. TPH results should be used with caution due to poor duplicate field precision. Styrene results may be biased low due to poor spike recoveries. The volatile compound 2-chloroethyl vinyl ether results should not be used due to the potential for false negative data. The GRO results should be considered estimated due to the analytical method employed.

Aqueous Volatile Organic Analysis (ug/l) UNVALIDATED DATA
Site Tank Farm 4
Case. 0288, SDG E1091

Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-02		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-02		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Date Sampled	7/8/98		7/9/98		7/9/98		7/9/98		7/8/98		7/8/98	
Date Extracted												
Date Analyzed	7/15/98		7/21/98		7/16/98		7/15/98		7/15/98		7/15/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		Field Dup 48-MW-424-02		None		None		None		None	
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U
Acetone	4	J	8	B	4	JB	6		5		6	
Iodomethane	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	5	U	5	U	5	U	5	U	5	U
Methyl tert-Butyl Ether	2	J	1	J	2	J	5	U	1	J	2	J
trans-1,2-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U
2-Butanone	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,2-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U
2,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U
Dibromomethane	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U
2-Chloroethylvinyl ether	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U
4-Methyl-2-Pentanone	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U

U - Not detected, J - Estimated value below the CRQL,
B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Volatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site: Tank Farm 4

Case 0288; SDG E1091

Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-02		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-02		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Date Sampled	7/8/98		7/9/98		7/9/98		7/9/98		7/8/98		7/8/98	
Date Extracted												
Date Analyzed	7/15/98		7/21/98		7/16/98		7/15/98		7/15/98		7/15/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		Field Dup 48-MW-424-02		None		None		None		None	
1,3-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U
2-Hexanone	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U
1,1,1,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	1	J	5	U	5	U	5	U
Total Xylenes	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	1	J	3	J	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichloropropane	5	U	5	U	5	U	5	U	5	U	5	U
Bromobenzene	5	U	5	U	5	U	5	U	5	U	5	U
n-Propylbenzene	5	U	5	U	3	J	5	U	5	U	5	U
2-Chlorotoluene	5	U	5	U	5	U	5	U	5	U	5	U
1,3,5-Trimethylbenzene	5	U	5	U	5	U	5	U	5	U	1	J
4-Chlorotoluene	5	U	5	U	5	U	5	U	5	U	5	U
tert-Butylbenzene	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trimethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U
sec-Butylbenzene	5	U	1	J	1	J	5	U	5	U	5	U
p-Isopropyltoluene	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U
n-Butylbenzene	5	U	5	U	6		5	U	5	U	2	J
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U
Hexachlorobutadiene	5	U	5	U	5	U	5	U	5	U	8	
Naphthalene	5	U	9	B	7		5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Volatile Organic Analysis (ug/l) UNVALIDATED DATA

Site Tank Farm 4

Case: 0288, SDG: E1091

Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01		TF4-MW-RB-02	
Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01		TF4-MW-RB-02	
Date Sampled	7/9/98		7/8/98		7/8/98		7/9/98		7/9/98		7/8/98		7/9/98	
Date Extracted														
Date Analyzed	7/16/98		7/15/98		7/15/98		7/16/98		7/21/98		7/15/98		7/17/98	
Dilution Factor	1		1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		Field Dup 48-MW-424-02		Rinsate Blank		Rinsate Blank	
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Acetone	4	JB	4	J	5		4	JB	8	B	5		5	B
Iodomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	1	J	1	J	5	U	5	U	6		5	U
Methylene Chloride	5	U	5	U	5	U	5	U	5	U	2	J	2	JB
Methyl tert-Butyl Ether	1	J	2	J	3	J	2	J	2	J	5	U	5	U
trans-1,2-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
2-Butanone	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,2-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
2,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
2-Chloroethylvinyl ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
4-Methyl-2-Pentanone	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Volatile Organic Analysis (ug/l) UNVALIDATED DATA
Site. Tank Farm 4
Case 0288; SDG: E1091

Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01		TF4-MW-RB-02	
Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01		TF4-MW-RB-02	
Date Sampled	7/9/98		7/8/98		7/8/98		7/9/98		7/9/98		7/8/98		7/9/98	
Date Extracted														
Date Analyzed	7/16/98		7/15/98		7/15/98		7/16/98		7/21/98		7/15/98		7/17/98	
Dilution Factor	1		1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		Field Dup 48-MW-424-02		Rinsate Blank		Rinsate Blank	
1,3-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
2-Hexanone	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,1,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Total Xylenes	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	1	J	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
n-Propylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
2-Chlorotoluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3,5-Trimethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
4-Chlorotoluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
tert-Butylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trimethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
sec-Butylbenzene	5	U	5	U	5	U	1	J	1	J	5	U	5	U
p-Isopropyltoluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
n-Butylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Hexachlorobutadiene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Naphthalene	5	U	5	U	5	U	5	U	9	B	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U

U - Not detected, J - Estimated value below the CRQL.

Aqueous Volatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site. Tank Farm 4

Case 0288; SDG E1091

Station Location	TF4-MW-TB-01		TF4-MW-TB-02	
Station Location	TF4-MW-TB-01		TF4-MW-TB-02	
Date Sampled	7/8/98		7/9/98	
Date Extracted				
Date Analyzed	7/15/98		7/16/98	
Dilution Factor	1		1	
Percent Solids	0 0		0 0	
QC Identifier	Trip Blank		Trip Blank	
Dichlorodifluoromethane	5	U	5	U
Chloromethane	5	U	5	U
Vinyl Chloride	5	U	5	U
Bromomethane	5	U	5	U
Chloroethane	5	U	5	U
Trichlorofluoromethane	5	U	5	U
1,1-Dichloroethene	5	U	5	U
Acetone	7		4	JB
Iodomethane	5	U	5	U
Carbon Disulfide	5	U	5	U
Methylene Chloride	2	J	1	JB
Methyl tert-Butyl Ether	5	U	5	U
trans-1,2-Dichloroethene	5	U	5	U
1,1-Dichloroethane	5	U	5	U
Vinyl Acetate	5	U	5	U
2-Butanone	5	U	5	U
cis-1,2-Dichloroethene	5	U	5	U
2,2-Dichloropropane	5	U	5	U
Bromochloromethane	5	U	5	U
Chloroform	5	U	5	U
1,1,1-Trichloroethane	5	U	5	U
1,1-Dichloropropene	5	U	5	U
Carbon Tetrachloride	5	U	5	U
1,2-Dichloroethane	5	U	5	U
Benzene	5	U	5	U
Trichloroethene	5	U	5	U
1,2-Dichloropropane	5	U	5	U
Dibromomethane	5	U	5	U
Bromodichloromethane	5	U	5	U
2-Chloroethylvinyl ether	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U
4-Methyl-2-Pentanone	5	U	5	U
Toluene	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Volatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site. Tank Farm 4

Case: 0288, SDG E1091

Station Location	TF4-MW-TB-01		TF4-MW-TB-02	
Station Location	TF4-MW-TB-01		TF4-MW-TB-02	
Date Sampled	7/8/98		7/9/98	
Date Extracted				
Date Analyzed	7/15/98		7/16/98	
Dilution Factor	1		1	
Percent Solids	0 0		0 0	
QC Identifier	Trip Blank		Trip Blank	
1,3-Dichloropropane	5	U	5	U
Tetrachloroethene	5	U	5	U
2-Hexanone	5	U	5	U
Dibromochloromethane	5	U	5	U
1,2-Dibromoethane	5	U	5	U
Chlorobenzene	5	U	5	U
1,1,1,2-Tetrachloroethane	5	U	5	U
Ethylbenzene	5	U	5	U
Total Xylenes	5	U	5	U
Styrene	5	U	5	U
Bromoform	5	U	5	U
Isopropylbenzene	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U
1,2,3-Trichloropropane	5	U	5	U
Bromobenzene	5	U	5	U
n-Propylbenzene	5	U	5	U
2-Chlorotoluene	5	U	5	U
1,3,5-Trimethylbenzene	5	U	5	U
4-Chlorotoluene	5	U	5	U
tert-Butylbenzene	5	U	5	U
1,2,4-Trimethylbenzene	5	U	5	U
sec-Butylbenzene	5	U	5	U
p-Isopropyltoluene	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U
n-Butylbenzene	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U
Hexachlorobutadiene	5	U	5	U
Naphthalene	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Semivolatile Organic Analysis (ug/l) UNVALIDATED DATA

Site. Tank Farm 4

Case 0288; SDG E1091

Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-01		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-01		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Date Sampled	7/8/98		7/9/98		7/9/98		7/9/98		7/8/98		7/8/98	
Date Extracted	7/10/98		7/13/98		7/13/98		7/10/98		7/10/98		7/10/98	
Date Analyzed	7/24/98		7/24/98		7/24/98		7/24/98		7/24/98		7/24/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		Field Dup 48-MW-424-02		None		None		None		None	
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
Phenol	10	U	10	U	10	U	10	U	10	U	10	U
Bis(2-Chloroethyl)ether	10	U	10	U	10	U	10	U	10	U	10	U
2-Chlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
2-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
2,2'-oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U	10	U	10	U
N-Nitroso-di-n-propylamine	10	U	10	U	10	U	10	U	10	U	10	U
Hexachloroethane	10	U	10	U	10	U	10	U	10	U	10	U
Nitrobenzene	10	U	10	U	10	U	10	U	10	U	10	U
Isophorone	10	U	10	U	10	U	10	U	10	U	10	U
2-Nitrophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dimethylphenol	10	U	10	U	10	U	10	U	10	U	10	U
Bis(2-Chloroethoxy)Methane	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	6	J	10	U	10	U	7	J
4-Chloroaniline	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorobutadiene	10	U	10	U	10	U	10	U	10	U	10	U
4-Chloro-3-methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
2-Methylnaphthalene	10	U	10	U	6	J	10	U	10	U	9	J
Hexachlorocyclopentadiene	10	U	10	U	10	U	10	U	10	U	10	U
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4,5-Trichlorophenol	25	U	25	U	25	U	25	U	25	U	25	U
2-Chloronaphthalene	10	U	10	U	10	U	10	U	10	U	10	U
2-Nitroaniline	25	U	25	U	25	U	25	U	25	U	25	U
Dimethylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
Acenaphthylene	10	U	10	U	10	U	10	U	10	U	10	U
2,6-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U	10	U
3-Nitroaniline	25	U	25	U	25	U	25	U	25	U	25	U
Acenaphthene	10	U	2	J	2	J	10	U	10	U	1	J
2,4-Dinitrophenol	25	U	25	U	25	U	25	U	25	U	25	U
4-Nitrophenol	25	U	25	U	25	U	25	U	25	U	25	U

U - Not detected, UJ - Detection limit approximate, J - Quantitation approximate,

* - From dilution analysis, R - Rejected, EB/TB - Equipment/Trip Blank contamination

Aqueous Semivolatile Organic Analysis (ug/l) UNVALIDATED DATA
Site. Tank Farm 4
Case· 0288, SDG· E1091

Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-01		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Station Location	45-MW-330-02		48-MW-424-02		48-MW-425-01		38-MW-605-01		42-MW-801-01		45-MW-802-01	
Date Sampled	7/8/98		7/9/98		7/9/98		7/9/98		7/8/98		7/8/98	
Date Extracted	7/10/98		7/13/98		7/13/98		7/10/98		7/10/98		7/10/98	
Date Analyzed	7/24/98		7/24/98		7/24/98		7/24/98		7/24/98		7/24/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		Field Dup 48-MW-424-02		None		None		None		None	
Dibenzofuran	10	U	2	J	2	J	10	U	10	U	1	J
2,4-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U	10	U
Diethylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U	10	U	10	U
Fluorene	10	U	2	J	3	J	10	U	10	U	3	J
4-Nitroaniline	25	U	25	U	25	U	25	U	25	U	25	U
4,6-Dinitro-2-methylphenol	25	U	25	U	25	U	25	U	25	U	25	U
N-Nitroso-diphenylamine	10	U	10	U	10	U	10	U	10	U	10	U
4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
Pentachlorophenol	25	U	25	U	25	U	25	U	25	U	25	U
Phenanthrene	10	U	10	U	4	J	10	U	10	U	7	J
Anthracene	10	U	10	U	10	U	10	U	10	U	1	J
Carbazole	10	U	10	U	10	U	10	U	10	U	10	U
Di-n-Butylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
Fluoranthene	10	U	10	U	10	U	10	U	10	U	10	U
Pyrene	10	U	1	J	10	U	10	U	10	U	1	J
Butylbenzylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
3,3'-Dichlorobenzidine	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(a)anthracene	10	U	10	U	10	U	10	U	10	U	10	U
Chrysene	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U	10	U	2	J	10	U
Di-n-octylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(b)fluoranthene	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(k)fluoranthene	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(a)pyrene	10	U	10	U	10	U	10	U	10	U	10	U
Indeno(1,2,3-cd)pyrene	10	U	10	U	10	U	10	U	10	U	10	U
Dibenzo(a,h)Anthracene	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(g,h,i)Perylene	10	U	10	U	10	U	10	U	10	U	10	U

Aqueous Semivolatile Organic Analysis (ug/l) UNVALIDATED DATA

Site. Tank Farm 4

Case 0288; SDG E1091

Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01	
Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01	
Date Sampled	7/9/98		7/8/98		7/8/98		7/9/98		7/9/98		7/8/98	
Date Extracted	7/13/98		7/10/98		7/10/98		7/13/98		7/13/98		7/10/98	
Date Analyzed	7/23/98		7/24/98		7/24/98		7/23/98		7/24/98		7/24/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		Field Dup 48-MW-424-02		Rinsate Blank	
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
Phenol	10	U	10	U	10	U	10	U	10	U	10	U
Bis(2-Chloroethyl)ether	10	U	10	U	10	U	10	U	10	U	10	U
2-Chlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
2-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
2,2'-oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U	10	U	10	U
N-Nitroso-di-n-propylamine	10	U	10	U	10	U	10	U	10	U	10	U
Hexachloroethane	10	U	10	U	10	U	10	U	10	U	10	U
Nitrobenzene	10	U	10	U	10	U	10	U	10	U	10	U
Isophorone	10	U	10	U	10	U	10	U	10	U	10	U
2-Nitrophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dimethylphenol	10	U	10	U	10	U	10	U	10	U	10	U
Bis(2-Chloroethoxy)Methane	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	10	U	10	U	10	U	10	U
4-Chloroaniline	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorobutadiene	10	U	10	U	10	U	10	U	10	U	10	U
4-Chloro-3-methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
2-Methylnaphthalene	1	J	10	U	10	U	10	U	10	U	10	U
Hexachlorocyclopentadiene	10	U	10	U	10	U	10	U	10	U	10	U
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4,5-Trichlorophenol	25	U	25	U	25	U	25	U	25	U	25	U
2-Chloronaphthalene	10	U	10	U	10	U	10	U	10	U	10	U
2-Nitroaniline	25	U	25	U	25	U	25	U	25	U	25	U
Dimethylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
Acenaphthylene	10	U	10	U	10	U	10	U	10	U	10	U
2,6-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U	10	U
3-Nitroaniline	25	U	25	U	25	U	25	U	25	U	25	U
Acenaphthene	1	J	10	U	10	U	2	J	2	J	10	U
2,4-Dinitrophenol	25	U	25	U	25	U	25	U	25	U	25	U
4-Nitrophenol	25	U	25	U	25	U	25	U	25	U	25	U

U - Not detected, UJ - Detection limit approximate, J - Quantitation approximate,

* - From dilution analysis, R - Rejected, EB/TB - Equipment/Trip Blank contamination

Aqueous Semivolatile Organic Analysis (ug/l) UNVALIDATED DATA

Site: Tank Farm 4

Case 0288; SDG: E1091

Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01	
Station Location	48-MW-805-01		45-MW-807-01		45-MW-808-01		48-MW-809-01		TF4-MW-DUP-01		TF4-MW-RB-01	
Date Sampled	7/9/98		7/8/98		7/8/98		7/9/98		7/9/98		7/8/98	
Date Extracted	7/13/98		7/10/98		7/10/98		7/13/98		7/13/98		7/10/98	
Date Analyzed	7/23/98		7/24/98		7/24/98		7/23/98		7/24/98		7/24/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		Field Dup 48-MW-424-02		Rinsate Blank	
Dibenzofuran	1	J	10	U	10	U	2	J	2	J	10	U
2,4-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U	10	U
Diethylphthalate	10	U	10	U	10	U	10	U	10	U	2	J
4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U	10	U	10	U
Fluorene	2	J	10	U	1	J	2	J	2	J	10	U
4-Nitroaniline	25	U	25	U	25	U	25	U	25	U	25	U
4,6-Dinitro-2-methylphenol	25	U	25	U	25	U	25	U	25	U	25	U
N-Nitroso-diphenylamine	10	U	10	U	10	U	10	U	10	U	10	U
4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
Pentachlorophenol	25	U	25	U	25	U	25	U	25	U	25	U
Phenanthrene	2	J	10	U	10	U	10	U	10	U	10	U
Anthracene	10	U	10	U	10	U	10	U	10	U	10	U
Carbazole	10	U	10	U	10	U	10	U	10	U	10	U
Di-n-Butylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
Fluoranthene	10	U	10	U	10	U	10	U	10	U	10	U
Pyrene	10	U	10	U	10	U	10	U	10	U	10	U
Butylbenzylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
3,3'-Dichlorobenzidine	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(a)anthracene	10	U	10	U	10	U	10	U	10	U	10	U
Chrysene	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	2	J	10	U	10	U	10	U	10	U
Di-n-octylphthalate	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(b)fluoranthene	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(k)fluoranthene	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(a)pyrene	10	U	10	U	10	U	10	U	10	U	10	U
Indeno(1,2,3-cd)pyrene	10	U	10	U	10	U	10	U	10	U	10	U
Dibenzo(a,h)Anthracene	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(g,h,i)Perylene	10	U	10	U	10	U	10	U	10	U	10	U

Aqueous TAL And Dissolved Metal Analysis (ug/l)
Site. Tank Farm 4
Case 0288, SDG E1091

UNVALIDATED DATA

Station Location	45-MW-330-02		45-MW-330-02F		48-MW-424-02		48-MW-424-02F		48-MW-425-02		48-MW-425-02F	
Station Location	45-MW-330-02		45-MW-330-02F		48-MW-424-02		48-MW-424-02F		48-MW-425-02		48-MW-425-02F	
Date Sampled	7/8/98		7/8/98		7/9/98		7/9/98		7/9/98		7/9/98	
Date Extracted												
Date Analyzed												
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		Field Dup 48-MW-424-02		Field Dup 48-MW-424-02F		None		None	
Arsenic	2 0	U	2 0	U	2 0	U	2 0	U	2 0	U	3 7	B
Barium	10 8	B	2 2	B	17 1	B	21 4	B	24 6	B	22 2	B
Cadmium	1 9	B	1 3	B	1 0	U	1 1	B	1 4	B	2 6	B
Chromium	0 75	B	0 60	U	0 60	U	0 60	U	0 60	U	0 60	U
Lead	2 1	U*	2 1	U*	2 1	U*	2 0	U	2 1	U*	2 1	U*
Mercury	0 36		0 09	U	0 10	B	0 09	U	0 11	B	0 96	
Selenium	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U
Silver	7 7	B	7 0	B	2 0	U	2 0	U	8 6	B	3 1	B
	Note The "F" in the sample number indicates the sample was analyzed for dissolved metals											

Aqueous TAL And Dissolved Metal Analysis (ug/l) UNVALIDATED DATA
Site. Tank Farm 4
Case 0288, SDG E1091

Station Location	38-MW-605-01		38-MW-605-01F		42-MW-801-01		42-MW-801-01F		45-MW-802-01		45-MW-802-01F		48-MW-805-01		48-MW-805-01F	
Station Location	38-MW-605-01		38-MW-605-01F		42-MW-801-01		42-MW-801-01F		45-MW-802-01		45-MW-802-01F		48-MW-805-01		48-MW-805-01F	
Date Sampled	7/9/98		7/9/98		7/8/98		7/8/98		7/8/98		7/8/98		7/9/98		7/9/98	
Date Extracted																
Date Analyzed																
Dilution Factor	1		1		1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		None		None		None		None	
Arsenic	2 0	U	2 0	U	2 5	B	9 9	B	10 6		2 0	U	2 0	U	2 0	U
Barium	24 5	B	24 2	B	17 6	B	41 3	B	98 6	B	16 4	B	5 4	B	13 5	B
Cadmium	2 3	B	2 2	B	1 4	B	1 5	B	2 4	B	2 5	B	1 0	U	1 3	B
Chromium	0 60	U	0 60	U	2 4	B	19 1		32 3		0 60	U	2 6	B	0 60	U
Lead	2 1	U*	2 1	U*	2 1	U*	2 1	U*	18 7	*	2 1	U*	30 6	*	2 0	U
Mercury	0 09	U	0 09	U	0 09	U	0 18	B	0 09	U	0 11	B	0 10	B	0 09	U
Selenium	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U
Silver	6 4	B	5 5	B	43 5		18 3	B	8 9	B	7 7	B	3 7	B	2 9	B
			Note The "F" in the sample number indicates the sample was analyzed for dissolved metals													

Aqueous TAL And Dissolved Metal Analysis (ug/l) UNVALIDATED DATA
Site. Tank Farm 4
Case 0288, SDG E1091

Station Location	45-MW-807-01		45-MW-807-01F		45-MW-808-01		45-MW-808-01F		48-MW-809-01		48-MW-809-01F		TF4-MW-DUP-01	
Station Location	45-MW-807-01		45-MW-807-01F		45-MW-808-01		45-MW-808-01F		48-MW-809-01		48-MW-809-01F		TF4-MW-DUP-01	
Date Sampled	7/8/98		7/8/98		7/8/98		7/8/98		7/9/98		7/9/98		7/9/98	
Date Extracted														
Date Analyzed														
Dilution Factor	1		1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		None		None		Field Dup. 48-MW-424-02	
Arsenic	2 0	U	2 0	U	2 8	B	2 0	U	13 0		5 6	B	2 0	U
Barium	13 3	B	7 8	B	16 0	B	9 4	B	42 6	B	28 6	B	17 6	B
Cadmium	1 8	B	1 1	B	2 4	B	1 0	U	1 7	B	3 7	B	1 4	B
Chromium	1 7	B	0 60	U	1 8	B	0 60	U	7 5	B	0 60	U	0 70	B
Lead	2 1	U*	2 1	U*	2 1	U*	2 1	U*	2 1	U*	2 1	U*	2 1	U*
Mercury	0 10	B	0 11	B	0 10	B	0 09	U	0 12	B	0 17	B	0 09	U
Selenium	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U	5 0	U
Silver	10 3	B	7 5	B	17 1	B	9 7	B	3 8	B	4 3	B	2 0	U
			Note The "F" in the sample number indicates the sample was analyzed for dissolved metals											

Aqueous TAL And Dissolved Metal Analysis (ug/l)

UNVALIDATED DATA

Site: Tank Farm 4

Case 0288, SDG E1091

Station Location	TF4-MW-DUP-01F		TF4-MW-RB-01		TF4-MW-RB-01F	
Station Location	TF4-MW-DUP-01F		TF4-MW-RB-01		TF4-MW-RB-01F	
Date Sampled	7/9/98		7/8/98		7/8/98	
Date Extracted						
Date Analyzed						
Dilution Factor	1		1		1	
Percent Solids	0 0		0 0		0 0	
QC Identifier	Field Dup 48-MW-424-02F		Rinsate Blank		Rinsate Blank	
Arsenic	2 0	U	3 0	B	2 0	U
Barium	18 9	B	3 7	B	1 0	U
Cadmium	1 0	U	1 1	B	1 0	U
Chromium	0 60	U	0 80	B	0 60	U
Lead	2 1	U*	2 1	U*	2 1	U*
Mercury	0 09	B	0 14	B	0 13	B
Selenium	5 0	U	5 0	U	5 0	U
Silver	2 3	B	19 0	B	13 8	B
	Note The "F" in the sample number indicates the sample was analyzed for dissolved metals					

Aqueous Total Petroleum Hydrocarbon Analysis (mg/l) UNVALIDATED DATA
Site. Tank Farm 4
Case: 0288; SDG E1091

EPA Sample Number	38-MW-605-01		42-MW801-01		45-MW-330-02		45-MW-802-01		45-MW-807-01		45-MW-808-01	
Station Location	38-MW-605-01		42-MW-801-01		45-MW-330-02		45-MW-802-01		45-MW-807-01		45-MW-808-01	
Date Sampled	7/9/98		7/8/98		7/8/98		7/8/98		7/8/98		7/8/98	
Date Extracted	7/12/98		7/12/98		7/12/98		7/12/98		7/12/98		7/12/98	
Date Analyzed	7/13/98		7/13/98		7/13/98		7/13/98		7/13/98		7/13/98	
Dilution Factor	1		1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0		0 0	
QC Identifier	None		None		None		None		None		None	
Total Petroleum Hydrocarbons	1 1	U	1 0	U	1 8		3 6		1 1	U	1 1	U

U - Not detected, J - Estimated value below the CRQL,
B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Total Petroleum Hydrocarbon Analysis (mg/l) UNVALIDATED DATA

Site: Tank Farm 4

Case: 0288; SDG. E1091

EPA Sample Number	48-MW-424-02		48-MW-425-02		48-MW-805-01	48-MW-809-01		TF4-MW-DUP-01	TF4-MW-RB-01	
Station Location	48-MW-424-02		48-MW-425-02		48-MW-805-01	48-MW-809-01		TF4-MW-DUP-01	TF4-MW-RB-01	
Date Sampled	7/9/98		7/9/98		7/9/98	7/9/98		7/9/98	7/8/98	
Date Extracted	7/14/98		7/14/98		7/14/98	7/14/98		7/14/98	7/12/98	
Date Analyzed	7/15/98		7/15/98		7/15/98	7/15/98		7/15/98	7/13/98	
Dilution Factor	1		1		1	1		1	1	
Percent Solids	0 0		0 0		0 0	0 0		0 0	0 0	
QC Identifier	Field Dup 48-MW-424-02		None		None	None		Field Dup 48-MW-424-02	Rinsate Blank	
Total Petroleum Hydrocarbons	1 7		1 0	U	1 5	1 0	U	4 0	1.1	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Gasoline Range Organic Analysis (mg/l) UNVALIDATED DATA

Site: Tank Farm 4

Case: 0288; SDG: E1091

EPA Sample Number	48-MW-424-02		48-MW-425-02		TF4-MW-DUP-01		TF4-MW-RB-02		TF4-MW-TB-02	
Station Location	48-MW-424-02		48-MW-425-02		TF4-MW-DUP-01		TF4-MW-RB-02		TF4-MW-TB-02	
Date Sampled	7/9/98		7/9/98		7/9/98		7/9/98		7/9/98	
Date Extracted										
Date Analyzed	7/21/98		7/16/98		7/21/98		7/17/98		7/16/98	
Dilution Factor	1		1		1		1		1	
Percent Solids	0 0		0 0		0 0		0 0		0 0	
QC Identifier	Field Dup 48-MW-424-02		None		Field Dup 48-MW-424-02		Rinsate Blank		Trip Blank	
Gasoline Range Organics	0 50	U	0 50		0 50	U	0 50	U	0 50	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

TETRA TECH NUS, INC. INTERNAL CORRESPONDENCE

C-NAVY-8-98-1227W

Date: September 24, 1998 cc: File N0288A-4.10

To: James Forrelli

From: Linda Terzis

Subject: Data Review, Project No. 0288, SDG No. E1018
Mitkem Corporation
NETC Tank Farm 4 Site, Newport, RI

TPH:

4/Soils/ 42-SB-806-1416, 45-SB-807-1416, 45-SB-807-2425, 45-SB-808-1921 (Field Duplicate Pair 48-SB-809-1517/ TF4-SB-DUP-02 in SDG E0951)

1/Aqueous Rinsate Blank/ TF4-SB-RB-01 (located in SDG E0951)

VOC/SVOC/TPH:

1/Aqueous/ TF4-XX-01

A cursory data review was performed on the volatile, semivolatile, and total petroleum hydrocarbon data associated with the soil and aqueous samples collected at the NETC Tank Farm 4 site, on June 24, 25, and 26, 1998. The volatile organic compounds were analyzed by USEPA SW-846 Method 8260A The semivolatile organic compounds were analyzed by USEPA SW-846 Method 8270B, and the total petroleum hydrocarbons (TPH) were analyzed by USEPA Method 418.1.

The data package was checked for completeness. The TPH sample analysis dates are incorrectly noted as 98/12/30 on the sample plots. The raw data indicate that the samples were analyzed on 7/1/98, and the data are not affected. The laboratory was contacted on August 8, 1998 for verification of the volatile instrument calibration percent difference values, which were reported as 0% for all compounds. Corrected Form VIIs were received at TtNUS on August 14, 1998 and the data package is complete.

The data package was checked for blank contamination and laboratory and field precision. Rinsate blank TF4-SB-RB-01 is associated with the TPH samples of this SDG, and is located in SDG E0951. The laboratory and field blanks were free of contamination. The relative percent difference (RPD) of the TPH matrix spike and matrix spike duplicate analyses exceeded 50% (63%). The data user is cautioned in using the positive TPH results due to poor matrix spike precision.

The field duplicate pair associated with the samples of this SDG (48-SB-809-1517/TF4-SB-DUP-02) are located in SDG E0951. The RPD of the field duplicate pair results was greater than 50%. The high RPD value may be a result of laboratory blank contamination (near the reporting limit) associated with the analysis of the field duplicate pair.

The review included a check for major non-compliances in the quality control summary forms and data summary forms. The sample chromatographs and plots were reviewed for agreement with the positive hits from the sample data.

The summary table results should be used with caution since the sample data have not been validated. TPH results should be used with caution due to poor matrix spike precision.

Aqueous Volatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site: Tank Farm 4

Case. 0288, SDG E1018

EPA Sample Number	TF4-XX-01	
Station Location	TF4-XX-01	
Date Sampled	6/26/98	
Date Extracted	6/30/98	
Date Analyzed	7/7/98	
Dilution Factor	1	
Percent Solids	0 0	
QC Identifier		
Dichlorodifluoromethane	5	U
Chloromethane	5	U
Vinyl Chloride	5	U
Bromomethane	5	U
Chloroethane	5	U
Trichlorofluoromethane	5	U
1,1-Dichloroethene	5	U
Acetone	5	
Iodomethane	5	U
Carbon Disulfide	5	U
Methylene Chloride	5	U
Methyl tert-Butyl Ether	5	U
trans-1,2-Dichloroethene	5	U
1,1-Dichloroethane	5	U
Vinyl Acetate	5	U
2-Butanone	5	U
cis-1,2-Dichloroethene	5	U
2,2-Dichloropropane	5	U
Bromochloromethane	5	U
Chloroform	5	U
1,1,1-Trichloroethane	5	U
1,1-Dichloropropene	5	U
Carbon Tetrachloride	5	U
1,2-Dichloroethane	5	U
Benzene	5	U
Trichloroethene	5	U
1,2-Dichloropropane	5	U
Dibromomethane	5	U
Bromodichloromethane	5	U
2-Chloroethylvinyl ether	5	U
cis-1,3-Dichloropropene	5	U
4-Methyl-2-Pentanone	5	U
Toluene	5	U
trans-1,3-Dichloropropene	5	U
1,1,2-Trichloroethane	5	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank; * - Result from dilution analysis

Aqueous Volatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site: Tank Farm 4

Case: 0288; SDG: E1018

EPA Sample Number	TF4-XX-01	
Station Location	TF4-XX-01	
Date Sampled	6/26/98	
Date Extracted	6/30/98	
Date Analyzed	7/7/98	
Dilution Factor	1	
Percent Solids	0 0	
QC Identifier		
1,3-Dichloropropane	5	U
Tetrachloroethene	5	U
2-Hexanone	5	U
Dibromochloromethane	5	U
1,2-Dibromoethane	5	U
Chlorobenzene	5	U
1,1,1,2-Tetrachloroethane	5	U
Ethylbenzene	5	U
Total Xylenes	5	U
Styrene	5	U
Bromoform	5	U
Isopropylbenzene	5	U
1,1,2,2-Tetrachloroethane	5	U
1,2,3-Trichloropropane	5	U
Bromobenzene	5	U
n-Propylbenzene	5	U
2-Chlorotoluene	5	U
1,3,5-Trimethylbenzene	5	U
4-Chlorotoluene	5	U
tert-Butylbenzene	5	U
1,2,4-Trimethylbenzene	5	U
sec-Butylbenzene	5	U
p-Isopropyltoluene	5	U
1,3-Dichlorobenzene	5	U
1,4-Dichlorobenzene	5	U
n-Butylbenzene	5	U
1,2-Dichlorobenzene	5	U
1,2-Dibromo-3-chloropropane	5	U
1,2,4-Trichlorobenzene	5	U
Hexachlorobutadiene	5	U
Naphthalene	5	U
1,2,3-Trichlorobenzene	5	U

Aqueous Semivolatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site Tank Farm 4

Case 0288, SDG E1018

EPA Sample Number	TF4-XX-01	
Station Location	TF4-XX-01	
Date Sampled	6/26/98	
Date Extracted	6/30/98	
Date Analyzed	7/21/98	
Dilution Factor	1	
Percent Solids	0 0	
QC Identifier		
Phenol	10	U
Bis(2-Chloroethyl)ether	10	U
2-Chlorophenol	10	U
1,3-Dichlorobenzene	10	U
1,4-Dichlorobenzene	10	U
1,2-Dichlorobenzene	10	U
2-Methylphenol	10	U
2,2'-oxybis(1-Chloropropane)	10	U
4-Methylphenol	10	U
N-Nitroso-di-n-propylamine	10	U
Hexachloroethane	10	U
Nitrobenzene	10	U
Isophorone	10	U
2-Nitrophenol	10	U
2,4-Dimethylphenol	10	U
Bis(2-Chloroethoxy)Methane	10	U
2,4-Dichlorophenol	10	U
1,2,4-Trichlorobenzene	10	U
Naphthalene	10	U
4-Chloroaniline	10	U
Hexachlorobutadiene	10	U
4-Chloro-3-methylphenol	10	U
2-Methylnaphthalene	10	U
Hexachlorocyclopentadiene	10	U
2,4,6-Trichlorophenol	10	U
2,4,5-Trichlorophenol	25	U
2-Chloronaphthalene	10	U
2-Nitroaniline	25	U
Dimethylphthalate	10	U
Acenaphthylene	10	U
2,6-Dinitrotoluene	10	U
3-Nitroaniline	25	U
Acenaphthene	10	U
2,4-Dinitrophenol	25	U
4-Nitrophenol	25	U

U - Not detected, J - Estimated value below the CRQL,

B - Analyte was found in the associated laboratory blank, * - Result from dilution analysis

Aqueous Semivolatile Organic Analysis (ug/l)

UNVALIDATED DATA

Site: Tank Farm 4

Case 0288, SDG E1018

EPA Sample Number	TF4-XX-01	
Station Location	TF4-XX-01	
Date Sampled	6/26/98	
Date Extracted	6/30/98	
Date Analyzed	7/21/98	
Dilution Factor	1	
Percent Solids	0 0	
QC Identifier		
Dibenzofuran	10	U
2,4-Dinitrotoluene	10	U
Diethylphthalate	2	J
4-Chlorophenyl-phenylether	10	U
Fluorene	10	U
4-Nitroaniline	25	U
4,6-Dinitro-2-methylphenol	25	U
N-Nitroso-diphenylamine	10	U
4-Bromophenyl-phenylether	10	U
Hexachlorobenzene	10	U
Pentachlorophenol	25	U
Phenanthrene	10	U
Anthracene	10	U
Carbazole	10	U
Di-n-Butylphthalate	6	J
Fluoranthene	10	U
Pyrene	10	U
Butylbenzylphthalate	10	U
3,3'-Dichlorobenzidine	10	U
Benzo(a)anthracene	10	U
Chrysene	10	U
bis(2-Ethylhexyl)phthalate	10	U
Di-n-octylphthalate	10	U
Benzo(b)fluoranthene	10	U
Benzo(k)fluoranthene	10	U
Benzo(a)pyrene	10	U
Indeno(1,2,3-cd)pyrene	10	U
Dibenzo(a,h)Anthracene	10	U
Benzo(g,h,i)Perylene	10	U

Soil Total Petroleum Hydrocarbon Analysis (mg/kg) UNVALIDATED DATA

Site: Tank Farm 4

Case. 0288, SDG E1018

EPA Sample Number	42-SB-806-1416		45-SB-807-1416		45-SB-807-2425		45-SB-808-1921	
Station Location	42-SB-806-1416		45-SB-807-1416		45-SB-807-2425		45-SB-808-1921	
Date Sampled	6/24/98		6/25/98		6/25/98		6/26/98	
Date Extracted	7/1/98		7/1/98		7/1/98		7/1/98	
Date Analyzed	7/1/98		7/1/98		7/1/98		7/1/98	
Dilution Factor	1		10		10		1	
Percent Solids	80 0		90 3		83 0		87 3	
QC Identifier	None		None		None		None	
Total Petroleum Hydrocarbons	12	U	17000		21000		3700	

Aqueous Total Petroleum Hydrocarbon Analysis (mg/l)

UNVALIDATED DATA

Site Tank Farm 4

Case 0288, SDG E1018

EPA Sample Number	TF4-XX-01	
Station Location	TF4-XX-01	
Date Sampled	6/26/98	
Date Extracted	7/1/98	
Date Analyzed	7/1/98	
Dilution Factor	1	
Percent Solids	0 0	
QC Identifier		
Total Petroleum Hydrocarbons	1 0	U