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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)
Northern and Central California, Nevada, and Utah
Contract Number N62474-94-D-7609
Contract Task Order 226

Prepared For

DEPARTMENT OF THE NAVY

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MOFFETT FEDERAL AIRFIELD, CALIFORNIA
(Formerly Naval Air Station Moffett Field)

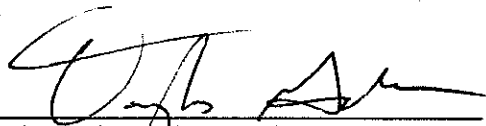
BASEWIDE PETROLEUM SITE
EVALUATION METHODOLOGY
TECHNICAL MEMORANDUM

DRAFT
APPENDIX D
SITE 15 PETROLEUM EVALUATION

June 2, 2000

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June 2, 2000

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**Subject: Draft Appendix D - Site 15 Petroleum Evaluation
Moffett Federal Airfield, California
CLEAN Contract Number N62474-94-D-7609, Contract Task Order 226**

Dear Ms. Marianna Potacka:

Attached are three copies of the above-referenced document. This document presents site-specific application of the petroleum methodology described in the Basewide Petroleum Site Evaluation Technical Memorandum (TM) prepared by Tetra Tech EM Inc. (TtEMI) and dated October 2, 1998. On behalf of the Navy, TtEMI has also forwarded copies of this report to the regulatory agencies and other interested parties.

Site 15 consists of 10 tanks (Tanks 25, 42, 54, 58, 59, 62, 62A, 63, 64, and 130) distributed across Moffett Federal Airfield. Two of these, Sumps 25 and 42, (referred to as tanks in these reports) are addressed in Appendix F because they are closely associated with the tanks in that appendix. Tanks 54, 59, 62, 62A, 63, 64 and 130 will not be addressed in this report because they either did not contain petroleum constituents or because minimal petroleum contamination was detected in the adjacent area and associated groundwater. Tanks 54, 59, 62, 62A, 63, 64 and 130 are addressed in a separate document (currently in production) that requests closure based on petroleum cleanup levels negotiated with the Regional Water Quality Control Board in 1994. Tank 58 was the only tank at Site 15 known to have released petroleum constituents at Site 15; as such, it is the only tank addressed in this document.

The Tank 58 evaluation uncovered no unacceptable human health and environmental risks from petroleum releases to soil or groundwater. Upon review of the document and approval of TtEMI comments, please submit a cover letter on Navy letterhead to TtEMI. TtEMI will reproduce and submit the document for agency review upon receipt of the cover letter.

Please call Douglas Gale at (303) 382-8789 or Timothy Mower at (303) 312-8874 with questions or comments.

Sincerely,

Douglas Gale
Project Geologist

Timothy Mower
Project Manager

cc: Mr. Don Chuck, EFAWEST

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical of concern
COPEC	Chemical of potential ecological concern
DQO	Data quality objective
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ft/ft	Feet of drop per foot of distance
HI	Hazard index
IRP	Installation Restoration Program
JP	Jet petroleum
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
msl	Mean sea level
MFA	Moffett Federal Airfield
MQO	Measurement quality objective
MTBE	Methyl tertiary butyl ether
MW	Montgomery Watson
NA	Not applicable
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	Not detected
NPWC	Navy Public Works Center
NS	Not sampled
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
QA/QC	Quality assurance and quality control
RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RI	Remedial investigation
RWQCB	Regional Water Quality Control Board

ACRONYMS AND ABBREVIATIONS (Continued)

SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
SWEA	Site-wide ecological assessment
SWRCB	California State Water Resources Control Board
TM	Basewide Petroleum Site Evaluation Methodology Technical Memorandum
TPH	Total petroleum hydrocarbons
TPH-e	Total petroleum hydrocarbons extractable
TPH-p	Total petroleum hydrocarbons purgeable
TtEMI	Tetra Tech EM Inc.
UST	Underground storage tank
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This document is an appendix to the Basewide Petroleum Site Evaluation Methodology Technical Memorandum (TM) for Moffett Federal Airfield (MFA), California. This appendix evaluates human health and environmental risks from residual petroleum contamination of soil and groundwater at the Tank 58 area located at Site 15. Petroleum sites at MFA are evaluated and closed separately from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites under the guidance of the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB).

The ultimate goal of the petroleum sites evaluation at MFA is to obtain site closure. RWQCB guidance drives the petroleum sites evaluation methodology, and RWQCB ultimately grants site closure. Petroleum sites, including Site 15, are evaluated based on the methodology presented in the TM (TtEMI 1998). Site 15 was evaluated using the data quality objectives (DQOs) developed for MFA petroleum sites; DQOs are described fully in Section 4.0.

Site 15 consists of 10 tanks (Sumps 25 and 42 and Tanks 54, 58, 59, 62, 62A, 63, 64, and 130) distributed across MFA. Two of these, Sumps 25 and 42, are addressed in Appendix F (Naval Exchange Service Station) because they are closely associated with the tanks in that appendix. Tanks 54, 59, 62, 62A, 63, 64 and 130 will not be addressed in this report because they either did not contain petroleum constituents or because minimal petroleum contamination was detected in the adjacent area and associated groundwater. Tanks 54, 59, 62, 62A, 63, 64 and 130 are addressed in a separate document (Tank Closure Report) that requests closure based on petroleum cleanup levels negotiated with RWQCB in 1994. Tank 58 was the only tank at Site 15 known to have released petroleum constituents at Site 15; as such, it is the only tank addressed in this document.

Tank 58 was a 300-gallon oil/water separator removed by the Navy Public Works Center in April 1994. After the tank removal action, constituents remaining in soil included ethylbenzene, xylene, total petroleum hydrocarbons purgeable (TPH-p) as gasoline, TPH-extractable (TPH-e) as diesel, 2-methylnaphthalene, naphthalene, TPH-e as jet petroleum (JP)-5, and TPH-e as motor oil.

The following elements were considered in evaluating residual risk from petroleum contamination:

- Groundwater impact
- Sensitive receptors
- Human health risk
- Ecological risk

The following factors were significant in the evaluation:

- All sources of petroleum contamination in the Tank 58 area have been removed.
- Petroleum constituents have been identified in samples of both soil and groundwater; however, no free product has been identified.
- The closest surface water receptor is more than 7,000 feet north of Tank 58 and is not likely to be affected by TPH constituents that remain in the soil.
- Two existing water supply wells at MFA draw water from an aquifer different from the one in which petroleum constituents at Tank 58 were identified, and are not likely to be affected by groundwater at the Tank 58 area. Both supply wells are more than 4,000 feet away from the Tank 58 area.
- Groundwater chemical data collected after Tank 58 removal demonstrate that concentrations of petroleum constituents have decreased over time. The most recent sampling event occurred in 1999; concentrations of benzene, TPH-p as gasoline, and TPH-e as diesel have decreased; and methyl tertiary butyl ether (MTBE) was not detected.
- A Tier 1 risk-based corrective action (RBCA) screening of chemicals of concern (COCs) in soil was conducted. A comparison of all maximum chemical concentrations in soil to risk-based screening levels (RBSLs) for construction and occupational workers indicates that COCs in soil at the Tank 58 area do not present an unacceptable human health risk.
- Petroleum COCs do not present an unacceptable ecological risk in the Tank 58 area. As discussed in the site-wide ecological assessment (SWEA) (PRC and MW 1997), petroleum constituents are not significant chemicals of potential ecological concern (COPECs).

The data from Tank 58 at Site 15 indicate that COCs detected in soil and groundwater do not present a human health or ecological risk. In addition, the dissolved-phase TPH in the Tank 58 area is unlikely to affect a water source and its concentrations are decreasing. Therefore, no further evaluation or action is recommended to address petroleum contaminants in soil or groundwater at Tank 58.

The following tables present a summary of tank characterization and removal activities, chemical concentrations in soil and groundwater, and RBCA Tier 1 screening evaluation results.

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION**

**APPENDIX D - SITE 15
TANK 58 CLOSURE CHECKLIST**

A tank closure checklist is included in this Executive Summary for Tank 58, which assessed in this appendix to the TM.

- The Navy recommends tank closure.
- The Navy recommends further action.

TANK INFORMATION

Site Number	Tank Type and Number	Tank Size (gallons)	Contents
15	58 Oil/Water Separator	300	Oily Wastewater

TANK INSTALLATION AND REMOVAL

Date Installed	Active (Yes, No)	Closed (In-Place, Removed, Active)	Date Closed	Condition of Tank	Condition of Piping
NA	No	Removed	April 1994	NA	NA

Note:
NA Information not available

LEAK AND CONTAMINATION

Identified Source or Leak (Yes, No)	Contaminants identified in medium (Soil, Groundwater, None) ¹
Yes	Soil, Groundwater

Note:
¹ Contaminants are defined as petroleum compounds above instrument detection limits.

INVESTIGATION CONDUCTED

Number of Soil Borings	Number of Monitoring Wells
3	1

Note:
Excavation samples were also collected

REPORTS

Title	Date
U.S. Navy. Draft Tank Data Report, Moffett Federal Airfield, California.	March 1995
PRC Environmental Management. Final Station-Wide Remedial Investigation Report, Moffett Federal Airfield, California.	May 1996

**MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15
 TANK 58 CLOSURE CHECKLIST (Continued)**

**MAXIMUM CHEMICAL CONCENTRATIONS
 IN SOIL**

This table is a summary of soil data collected during the 1994 Navy excavation activity and TtEMI investigations during 1994 and 1995.

Chemical	Sample Name	Date	Soil Concentration (detection limits or range in parentheses) (mg/kg)
TPH-p as gasoline	58B ¹	5/94	740
TPH-e as diesel	58W ¹	5/94	4,300
Benzene	-	-	ND (0.0007 - 1.6)
Toluene	-	-	ND (0.0006 - 1.6)
Ethylbenzene	58W ¹	5/94	0.42
Xylene	SB58-1	11/94	54
MTBE	-	-	NS
TPH-e as JP-5	58W ¹	11/94	2,500
Naphthalene	SB58-1	11/94	0.86 ²
2-Methylnaphthalene	SB58-1	11/94	2.60
TPH-e as other heavy constituents	-	-	NS
TPH-e as other light constituents	-	-	NS
TPH-e as kerosene	-	-	ND (12-130)
TPH-e as motor oil	58W ¹	5/94	5,000
Benzo(a)pyrene	-	-	ND (0.44)

Notes:

¹ Tank excavation sample
² Estimated concentration
 - No information
 JP Jet petroleum
 mg/kg Milligrams per kilogram

MTBE Methyl tertiary butyl ether
 ND Not detected
 NS Not sampled
 TPH-e Total petroleum hydrocarbons extractable
 TPH-p Total petroleum hydrocarbons purgeable

**MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D – SITE 15
 TANK 58 CLOSURE CHECKLIST (Continued)**

**MAXIMUM CHEMICAL CONCENTRATIONS
 IN GROUNDWATER**

This table is a summary of groundwater data collected during the Navy 1994 excavation activity and Tetra Tech EM Inc. investigations during 1995 and 1999.

Chemical	Well Number	Maximum Concentration (detection limits or range in parentheses) (µg/L)		Most Recent Groundwater Sample from Same Well (detection limits in parentheses) (µg/L)	
		Date	Concentration	Date	Concentration
TPH-p as gasoline	W58-1	11/94	250	8/99	ND (50)
TPH-e as diesel	W58-1	9/95	860	8/99	200
Benzene	W58-1	11/95	1.3	8/99	ND (1)
Toluene	W58-1	11/94	0.65	8/99	ND (1)
Ethylbenzene	W58-1	11/94	0.56	8/99	ND (1)
Xylene	W58-1	11/94	3.50	8/99	ND (1)
MTBE	–	–	ND (10)	8/99	NS
TPH-e as JP-5	–	–	ND (50-100)	–	ND (500)
Naphthalene	–	–	ND (10)	–	NS
2-Methylnaphthalene	–	–	ND (10)	–	NS
TPH-e as other heavy components	W58-1	3/95	1,200 ¹	9/95	ND (100)
TPH-e as other light components	W58-1	3/95	200	9/95	ND (50)
TPH-e as kerosene	W58-1	11/94	220	11/95	ND (100)
TPH-e as motor oil	W58-1	11/95	440	8/99	ND (500)
Benzo(a)pyrene	–	–	ND (10)	–	NS

Notes:

- ¹ Estimated concentration
- No information
- JP Jet petroleum
- µg/L Micrograms per liter
- MTBE Methyl tertiary butyl ether
- ND Not detected
- NS Not sampled
- TPH-e Total petroleum hydrocarbons extractable
- TPH-p Total petroleum hydrocarbons purgeable

**MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D – SITE 15
 TANK 58 CLOSURE CHECKLIST (Continued)**

REMEDIATION CONDUCTED

Material	Action (Treatment Type, Disposal Destination)	Date
Free Product	NA	–
Soil	NA	–
Groundwater	NA	–
Vapor	NA	–

Note:

NA Not applicable

TIER 1 SCREENING

Did the screening values exceed...	...the Cumulative Carcinogenic Risk Ratio of 1E-04?	...the Noncarcinogenic Hazard Index of 1.0?
Occupational Worker Exposure Scenario – Direct Exposure to Soil	NA	NA
Occupational Worker Exposure Scenario – Inhalation of Volatiles from Groundwater	No	No
Occupational Worker Exposure Scenario – Inhalation of Volatiles from Subsurface Soil	No	No
Construction Worker Exposure Scenario – Direct Exposure to Soil	No	No

Notes:

NA Evaluation of this scenario is not available because the area is paved. There is no exposure pathway for this scenario.

SUMMARY

Low-Risk Screening	Yes/No
Has the source, including all free product, been removed?	Yes
Has the site been adequately characterized?	Yes
Does groundwater impact exist?	Yes
If yes, is the dissolved-phase hydrocarbon plume migrating?	Unknown
If no, list which tanks.	–
Are any water wells, deeper drinking water aquifers, surface water, or other sensitive receptors likely to be affected?	No
Does the site present a significant risk to human health?	No
Does the site present a significant risk to the environment?	No
Recommend additional monitoring?	No
If yes, what?	–
Recommended additional investigation?	No
If yes, describe.	–
Recommend Closure?	Yes

1.0 INTRODUCTION

This document is an appendix to the Basewide Petroleum Site Evaluation Methodology Technical Memorandum (TM) for Moffett Federal Airfield (MFA), California. This appendix evaluates human health and environmental risks from residual petroleum contamination of soil and groundwater at Installation Restoration Program (IRP) Site 15 (Tank 58). Petroleum sites at MFA are evaluated and closed separately from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites under the guidance of the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB). The ultimate goal of the petroleum sites evaluation at MFA is to obtain site closure. RWQCB guidance drives the petroleum site evaluation methodology, and RWQCB ultimately grants site closure. The evaluation of Tank 58 was based on the methodology presented in the TM (TtEMI 1998).

The evaluation of the Site 15 Tank 58 area was guided by the data quality objectives (DQOs) presented in Section 4.0. This appendix presents actual or potential human health and environmental risks posed at Site 15 by uncontrolled releases of petroleum compounds to the environment. This appendix does not evaluate releases of nonpetroleum compounds; nonpetroleum compounds are addressed under the CERCLA program. The petroleum evaluation follows risk-based corrective action (RBCA) procedures presented in American Society for Testing and Materials (ASTM) Guide E 1739-95 (ASTM 1995), and follows guidance by RWQCB Region 2 (San Francisco Bay Area) and the California State Water Resources Control Board (SWRCB) (RWQCB 1996). These two documents are more fully described in the TM.

This appendix is organized as follows: Section 2.0 presents background information; Section 3.0 describes previous tank site investigations; Section 4.0 presents DQOs for Site 15; Section 5.0 presents physical site characteristics; Section 6.0 describes the geology and hydrogeology; 7.0 presents the nature and extent of contamination; Section 8.0 presents the risk evaluation; Section 9.0 presents the low risk criteria evaluation; Section 10.0 presents conclusions; and Section 11.0 presents references cited in the text. Figures and tables follow Section 11.0. Attachment D1, which contains soil boring logs and monitoring well diagram; Attachment D2 presents photographs of Tank 58; and attachment D3 is a copy of the County of Santa Clara Tank Closure Report. The three attachments follow the figures and tables. A 3.5-inch floppy diskette, included with this appendix, contains information that fulfills RWQCB's reporting requirements for a No Further Action Request for an underground storage tank (UST).

2.0 BACKGROUND

The following subsections describe Site 15 and Tank 58 background information.

2.1 SITE BACKGROUND

Site 15 consists of nine subsites and 10 tanks or sumps geographically distributed throughout MFA: Sumps 25, 42, and Tanks 54, 58, 59, 62, 62A, 63, 64, and 130 (Figure D1 and Table D1). Two of these, Sumps 25 and 42, are addressed in Appendix F (Naval Exchange Service Station), because they are closely associated with the tanks addressed in that appendix. Seven of the tanks (Tanks 54, 59, 62, 62A, 63, 64, and 130) at Site 15 were used for nonpetroleum purposes or, if used for petroleum purposes, did not release petroleum contamination to adjacent soil or groundwater. These seven tanks are addressed in the Tank Closure Report (in progress) that requests closure based on petroleum cleanup levels negotiated with RWQCB in 1994 (Tetra Tech EM Inc. [TtEMI] 1998). These tanks will not be discussed further in this document. Tank 58 is the only tank addressed in this document.

2.2 BACKGROUND OF TANK 58

Tank 58 was a 300-gallon oil/water separator that received drainage and washwater from the auto hobby shop, Building 544 (PRC 1996). Figures D1 and D2 illustrate its location before it was removed. Tank 58 collected the oil removed by the separator; the clean water was discharged to the sanitary sewer. Tank 58 was located in a paved area north of and adjacent to Building 544, in the transportation yard near the southern gate of MFA. The oil/water separator was located in the subsurface at a depth of approximately 4.7 feet below ground surface (bgs). For consistency, this oil/water separator will be referred to as Tank 58 in the remainder of the document. Tank 58 was located at these coordinates: longitude 122.05036 and latitude 37.40565.

3.0 INVESTIGATIONS OF PREVIOUS TANK SITE

Petroleum-related contaminants have been identified at the Tank 58 area during excavation, soil and groundwater investigations, and quarterly groundwater monitoring. The following subsections summarize the investigations conducted at the Tank 58 area.

3.1 NAVY PUBLIC WORKS REMOVAL OF TANK 58

Tank 58 was removed by the Navy Public Works Center (NPWC) in April 1994. Four soil samples were collected from the Tank 58 excavation, samples 58A, 58B, 58W, and 58E (U.S. Navy 1995) (Figure D2). Exact sample depths are uncertain, but they were most likely collected between 4 and 5 feet bgs because the tank was located at approximately 4.7 feet bgs. Navy soil data are presented in Tables D2 and D3 following the text. Maximum concentrations of petroleum construction remaining in soil are presented in Section 7.2.

3.2 TtEMI INVESTIGATION OF THE TANK 58 AREA

TtEMI, then known as PRC Environmental Management, Inc. (PRC), subsequently investigated the Tank 58 area in November 1994. Three borings, SB58-1, SB58-2, and SB58-3, were advanced and sampled (Figure D2). Three samples were collected from boring SB58-1, and two samples were collected from each of borings SB58-2 and SB58-3. TtEMI soil sample results are presented in Tables D4 and D5 following the text and in Section 7.2. Soil boring SB58-1 was converted into monitoring well W58-1.

3.3 TtEMI QUARTERLY GROUNDWATER MONITORING, TANK 58 AREA

TtEMI conducted four quarterly monitoring events at well W58-1 in March, June, September, and November 1995. TtEMI also collected a groundwater sample in August 1999. TtEMI groundwater data from samples collected at well W58-1 are included in Tables D6 and D7 following the text.

4.0 DATA QUALITY OBJECTIVES

DQOs for petroleum sites at MFA guide the methodology of this evaluation. The following sections identify and respond to the seven steps identified in the U.S. Environmental Protection Agency (EPA) Draft DQO Process for Hazardous Waste Site Investigations (EPA 1999a). Seven steps were identified to define the problem, develop decision rules, and assess data collection. The seven steps as they apply to the Tank 58 area are summarized in Table D8 following the text. The DQO process is iterative; it has been applied to previously collected data and observations, and will be applied to any additional data or observations recommended at this site.

4.1 STEP 1: STATE THE PROBLEM

The problem is to assess whether Tank 58 can be closed or whether it requires further evaluation. Tank 58 at Site 15 contained petroleum products that were released to the environment. Chemicals of concern (COCs) identified in samples of soil and groundwater include total petroleum hydrocarbons (TPH) purgeable (TPH-p) as gasoline; benzene, toluene, ethylbenzene, and xylene (BTEX) constituents; 2-methylnaphthalene; naphthalene; and TPH extractable (TPH-e) as diesel, motor oil, other heavy components, and other light components. Potential exposure pathways and receptors are illustrated in Figure D3. Potential exposure pathways include infiltration to groundwater and groundwater transport; volatilization of contaminants to the atmosphere; and exposure to contaminated soils. Potential receptors include surface water, supply wells, ecological receptors, and occupational and construction workers. Potential exposure pathways and receptors are discussed in more detail in the TM.

4.2 STEP 2: IDENTIFY THE DECISION

The petroleum sites program at MFA is designed to provide the information required to make the following decisions (Figure D4):

- Has a petroleum release occurred?
- Has the source been removed?
- Is free product present?
- Have surface water or supply wells been affected?
- Has the plume stabilized?
- Does the Tier 1 RBCA screening of the exposure pathways indicate an acceptable risk?
- Do petroleum constituents present an unacceptable ecological risk?
- Did the tank contain gasoline and is analysis for methyl tertiary butyl ether (MTBE) needed? If so, are MTBE concentrations in groundwater below the 13 micrograms per liter ($\mu\text{g/L}$) level required for site closure?

4.3 STEP 3: IDENTIFY THE INPUTS TO THE DECISION

The decisions for petroleum site closure were evaluated using historical site or tank information (Section 3.0) soil and groundwater data from previous investigations, regulatory guidance, RBCA Tier 1 screening evaluation data, and results of the ecological study (PRC and MW 1997). Inputs to each decision are discussed in the following paragraph.

Observations during tank removal and soil and groundwater data are used to assess whether a petroleum release has occurred. Source removal is evaluated based on tank removal reports and TPH

constituent data for soils. The presence of free product is evaluated based on field observations and soil and groundwater data. Effects to surface water and potential supply wells are evaluated considering the distance to the receptor and contaminant transport mechanisms. Plume stability is assessed based on contaminant concentrations in samples of groundwater collected at wells located at and downgradient of the source. Tier 1 risk-based screening levels (RBSLs) are used to evaluate the human health risk from COCs that remain in soil (TtEMI 1998). Potential risk to ecological receptors risk were evaluated using the results of the site-wide ecological assessment (SWEA) (PRC and MW 1997).

4.4 STEP 4: DEFINE THE STUDY BOUNDARIES

The study boundaries are defined as the area surrounding Tank 58 that may have been contaminated by a petroleum release. Data were collected during investigations from 1994 to 1995 and in 1999 in the area where releases were suspected to have occurred based on tank location, field observations of the release, and the direction of groundwater flow. Soil and groundwater samples were collected from the tank excavations and soil and groundwater samples were collected downgradient of the tank. Investigations and sample locations are discussed in Section 3.0.

4.5 STEP 5: DEVELOP DECISION RULES

For the evaluation process, the following decision rules will be observed (Figure D4):

1. Petroleum Release: If petroleum was observed in the excavation, analytical results for soil or groundwater indicate the presence of petroleum constituents, or holes or cracks were observed in the tank or tank piping, then it is assumed that a petroleum release has occurred and the next decision rule will be evaluated. If a petroleum release is not evidenced, one groundwater sample for analysis of MTBE will be collected if the tank held gasoline. If a release is not evidenced and the tank held diesel or jet fuel, the site will be recommended for closure.
2. Source Removal: If the tank was removed and free product is not present, then the source will be considered to have been removed and the next decision rule will be evaluated. If the tank, free product, or both are present, then further action will be required.
3. Groundwater Impact: If petroleum constituents may reach surface water or supply wells, then further evaluation will be required. If surface water or a supply well has not been affected, then the next decision rule will be evaluated.
4. Groundwater Plume Stability: If concentrations of petroleum constituents in groundwater samples at the source and downgradient appear to be stable or decreasing, then the plume will be considered stable and the next decision rule will be evaluated. If the plume does not appear to be stable, then further evaluation will be required.
5. Human Health Risk: If the Tier 1 RBCA screening indicates an unacceptable human health risk, then further evaluation will be required. If the screening indicates acceptable human health risk, then the next decision rule will be evaluated.

6. Ecological Risk: If it is found that ecological receptors are affected by the petroleum release, then further evaluation will be required. If ecological receptors are not affected, then the next decision rule will be evaluated.
7. MTBE: If MTBE analysis is necessary (see item 1) and if the concentration of MTBE exceeds 13 µg/L in a groundwater sample, then further evaluation will be required. If the MTBE concentration is below 13 µg/L, then the site will be recommended for closure.

4.6 STEP 6: SPECIFY LIMITS ON DECISION ERRORS

Limits on decision errors are specified to limit uncertainty in the analytical data and in the results of statistical tests. Areas of uncertainty in the analytical data include error related to the analytical method, sampling, and sample heterogeneity. Measurement quality objectives (MQOs) were established to verify that data quality and quantity requirements were met. The analytical uncertainties were checked through established quality assurance and quality control (QA/QC) procedures.

No background populations were established for petroleum constituents; however, statistical methods can be used to evaluate risk and compare the site data with cleanup levels established by RWQCB. If this testing indicates that site concentrations of petroleum constituents exceed cleanup levels, then a human health risk assessment will be conducted to evaluate whether petroleum constituent concentrations at the site present an unacceptable risk to human health or the environment.

4.7 STEP 7: OPTIMIZING THE DESIGN FOR OBTAINING DATA

The primary objective of petroleum sites investigations is to assess whether a release of petroleum has occurred that presents an unacceptable risk to human health and the environment. Sample locations were selected using a judgmental (nonprobability-based) design to target known areas of potential release. Because a nonprobability-based design was used, the number of samples collected was not determined by statistical analysis of existing data (EPA 1999a) and was based on site-specific information, such as tank location and groundwater flow direction.

5.0 PHYSICAL CHARACTERISTICS OF SITE

The majority of the Tank 58 area is paved and no surface water sources are adjacent to the site. The nearest surface water is located more than 7,000 feet from the site and is not likely to be affected by petroleum constituents that remain in soil and groundwater at Tank 58. Therefore, surface water at MFA is not addressed further in this evaluation.

Water supply wells at MFA are not likely to be affected by petroleum constituents in groundwater because they are not located near the former location of Tank 58. One deep water supply well is located in the northwestern corner of the Ames Research Center area near National Aeronautics and Space Administration (NASA) Building 267, more than 9,000 feet northwest of the Tank 58 area. Water is pumped from this well only for fire-fighting, composting, and agricultural purposes. The other deep water supply well is near the National Full-scale Aerodynamics Complex wind tunnel in the NASA Ames Research Center area, more than 5,000 feet northwest of the former location of Tank 58; this well is used only to monitor groundwater elevation and quality. Both wells are generally downgradient of the Tank 58 area. Neither well is used to supply drinking water.

According to NASA personnel, these two supply wells are screened in the C aquifer. It is unlikely that any operating water supply wells screened in the C aquifer would be affected by constituents remaining in soil or groundwater at Tank 58. The C aquifer is confined by the B/C clay aquitard (a layer of confining clay between the B and C aquifers), which is considered an effective barrier to any potential downward migration of contaminants from the A aquifer above. The B/C aquitard is continuous and the C aquifer exhibits a strong upward gradient to the A and B aquifers (PRC 1996). The C aquifer extends from about 150 to 500 feet bgs at MFA. It is highly unlikely that deep aquifers used as a drinking water supply will be affected by petroleum contamination at MFA because (1) thick, low-permeability aquitards lie between the B and C aquifers, (2) a strong upward gradient exists from the C aquifer to the upper aquifers, (3) most fuel products are less dense than water, (4) the presence of silt and clay soils in the unsaturated zone will most likely inhibit the migration of petroleum compounds to the water table, and (5) dissolved-phase constituents would not be expected to be found in deeper aquifers unless transported there under advective flow (TtEMI 1998). These characteristics will likely prevent the vertical migration of petroleum constituents. A more complete discussion of the aquifers at MFA is included in the TM.

NASA planning documents indicate that MFA likely will remain an airfield in the future. Groundwater in the A aquifer is not currently used as a water supply source at MFA because of poor ambient quality and low potential yield to a supply well. Although the A1-aquifer zone is considered a potential drinking water source under EPA and RWQCB guidelines, water in the A1-aquifer zone is unlikely to be used before contaminants degrade to acceptable levels because of its poor quality and low yield. Currently, water is supplied to MFA from the Hetch Hetchy Aqueduct owned by the City of San Francisco; this water supply source will most likely be used for any future development at or around the Tank 58 area.

Decreases in petroleum concentrations in groundwater samples indicate that biodegradation is most likely occurring. Furthermore, groundwater in the shallow aquifer at MFA typically contains sufficient dissolved oxygen to initiate aerobic biodegradation. Therefore, natural attenuation of petroleum contaminants is most likely occurring at Tank 58.

6.0 GEOLOGY AND HYDROGEOLOGY

General geologic conditions are similar across MFA, including the Tank 58 area. A general discussion on basewide geology and hydrogeology is included in the TM. This section will focus on site-specific geologic and hydrogeologic conditions.

Three soil borings were drilled and continuously logged to depths up to 20 feet bgs at the Tank 58 area (PRC 1996). Boring logs indicate that the site-specific geology consists of stream-channel and flood plain deposits common to MFA. The upper 13 feet of subsurface soils at Tank 58 is composed mainly of clayey silt and silty clay. At approximately 13 feet bgs, silty sand and very fine- to medium-grained sand predominate to a depth of at least 20 feet bgs (the depth of the deepest boring drilled at Tank 58). Figure D2 illustrates the location of Tank 58 and depicts the plan view of the cross section. Figure D5 presents a cross-sectional illustration of the geology of the shallow soils near Tank 58 including the location of soil samples collected from these borings and Figure D6 presents select petroleum concentrations in soil on plan view. Soil boring logs and the monitoring well construction diagram are included in Attachment D1.

Water levels measured at monitoring wells on the southwestern side of MFA indicate the average groundwater level was 6 feet bgs during baseflow conditions in November 1998 (TtEMI 1999). Using data from this period, the groundwater flow direction in the area near Tank 58 was calculated as approximately north 5 degrees east, with a gradient ranging from approximately 0.006 to 0.01 feet of drop per foot of distance (ft/ft). Groundwater flow directions and gradients were calculated using groundwater elevations referenced to mean sea level (msl). Figure D7 illustrates shallow groundwater flow contours near Tank 58.

7.0 NATURE AND EXTENT OF CONTAMINATION

This section discusses soil and groundwater impact in the Tank 58 area. The evaluation of soil and groundwater impact considers whether the source has been removed, whether free product is present,

and whether the plume has stabilized. Groundwater impacts from petroleum releases to soil have been evaluated through the analysis of soil and groundwater samples.

7.1 PETROLEUM CONTAMINANT SOURCE REMOVAL

Tank 58 is the apparent source of petroleum contamination, and has been removed. Furthermore, free product was not observed during any of the investigations at Tank 58.

7.2 SOIL CONTAMINATION

Petroleum contamination in the Tank 58 area is likely the result of a leaking tank. Contamination may have also resulted from leaking or tank overfilling. However, soil data indicate petroleum constituents in soil that could be leached to groundwater by infiltrating rainwater.

Four soil samples were collected from the Tank 58 excavation during Navy tank removal activities, samples 58A, 58B, 58W, and 58E (U.S. Navy 1995) (Figure D2). TPH-e as JP-5 and motor oil, ethylbenzene, xylene, TPH-e as diesel (chromatogram does not match a calibrated diesel fuel pattern but does resemble a fuel pattern), and TPH-p as gasoline (chromatogram does not match a calibrated gasoline fuel pattern but does resemble a fuel pattern) were detected in soil samples the Navy collected during Tank 58 removal.

TtEMI collected soil samples from three borings, SB58-1, SB58-2, and SB58-3, were advanced and sampled (Figure D2). Three samples were collected from boring SB58-1, and two samples were collected from each of borings SB58-2 and SB58-3. The samples were analyzed for TPH-p, TPH-e, semivolatile organic compounds (SVOCs), and BTEX (PRC 1996). Xylene, 2-methylnaphthalene, naphthalene, and TPH-e as JP-5 and motor oil were detected in the soil samples. TtEMI soil sample results are presented in Tables D4 and D5 following the text. Soil boring SB58-1 was converted into monitoring well W58-1. Maximum concentrations of petroleum constituents that remain in soil are summarized in the table below and are depicted on Figure D6.

**MAXIMUM CONCENTRATIONS OF PETROLEUM
CONSTITUENTS REMAINING IN SOIL
SITE 15 TANK 58
MOFFETT FEDERAL AIRFIELD**

Chemical	Sample Name	Date	Concentration (detection limit range in parentheses) (mg/kg)
TPH-p as gasoline	58W	5/94	740 ²
TPH-e as diesel	58W ¹	5/94	4,300 ²
Benzene	NA	NA	ND (0.007-1.6)
Toluene	NA	NA	ND (0.0006-1.6)
Ethylbenzene	58W ¹	5/94	0.42
Xylene	SB58-1	11/94	54
MTBE	NS	NA	NA
TPH-e as JP-5	58W ¹	11/94	2,500
Naphthalene	SB58-1	11/94	0.86 ³
2-Methylnaphthalene	SB58-1	11/94	2.60
TPH-e as other heavy constituents	NS	NA	NA
TPH-e as other light constituents	NS	NA	NA
TPH-e as kerosene	NA	NA	ND (12-130)
TPH-e as motor oil	58W ¹	5/94	5,000
Benzo(a)pyrene	NA	NA	ND (0.44)

Notes:

- | | | |
|------------------------------------------------------------------------------------------|-------|----------------------------------------------|
| ¹ Tank excavation sample | mg/kg | Milligrams per kilogram |
| ² Pattern does not match calibrated fuel pattern but resembles a fuel pattern | NA | Not applicable (not detected or not sampled) |
| | ND | Not detected |
| ³ Estimated concentration | NS | Not sampled |

7.3 GROUNDWATER CONTAMINATION

Groundwater impacts at the Tank 58 area have been evaluated through laboratory analysis of samples obtained during six sampling events conducted at well W58-1 between 1994 and 1999; the last sampling event took place in August 1999. Groundwater samples from this well were analyzed for TPH-p, TPH-e, and BTEX. TPH-e as other light components, motor oil, and other heavy components were detected sporadically in groundwater samples. Benzene was detected in samples from all four quarters from 1994 to 1995. Xylene was detected once; ethylbenzene and toluene were not detected in any samples. TPH-e as diesel concentrations peaked in the sample collected in September 1995 and decreased in the last two sampling events.

TtEMI collected a groundwater sample in August 1999 and the sample was analyzed for TPH-p, TPH-e, BTEX, and MTBE. TPH-e as diesel was detected in this sample; however, BTEX, MTBE, and TPH-p as gasoline were not detected. TtEMI groundwater data from samples collected at well W58-1 are included in Tables D6 and D7 following the text. Figure D8 presents select petroleum concentration in groundwater.

Sample results indicate that TPH-e as diesel, TPH-p as gasoline, and BTEX concentrations in groundwater have decreased from November 1995 to August 1999 when the lowest concentrations of all sampling events were detected. Maximum petroleum constituent concentrations are presented in the following table.

**WELL W58-1
TANK 58 AREA GROUNDWATER SAMPLING**

Groundwater Sampling Event	Maximum Concentration (detection limit in parentheses) (µg/L)						
	TPH-p (Gasoline)	TPH-e (Diesel)	TPH-e (JP-5)	B	T	E	X
November 1994	250	62 ¹	ND (100)	ND (0.5)	0.65	0.56	3.5
March 1995	ND (50)	ND (50)	ND (50)	1	ND (0.5)	ND (0.5)	ND (0.5)
June 1995	ND (50)	ND (50)	ND (50)	1 ¹	ND (0.5)	ND (0.5)	0.2 ¹
September 1995	60 ¹	860 ²	ND (100)	0.84	ND (0.5)	ND (0.5)	ND (0.5)
November 1995	150 ²	600	ND (100)	1.3	ND (0.5)	ND (0.5)	ND (0.5)
August 1999	ND (50)	200 ²	ND (500)	ND (1)	ND (1)	ND (1)	ND (1)

Notes:

ND Not detected

¹ Estimated concentration

² Pattern does not match calibrated fuel pattern but resembles a fuel pattern

µg/L Micrograms per liter

7.4 CONCLUSION FOR SOIL AND GROUNDWATER CONTAMINATION

In summary, the evaluation of soil and groundwater impact considers whether the source has been removed, whether free product is present, which surface water or well water sources may be affected, and whether the plume has stabilized. Tank 58, identified as the contaminant source, was removed in April 1994. No records of free product have been located for the Tank 58 area; there is no mention of free product seen during the excavation or at the monitoring well. Free product has never been observed in the tank excavation or in the monitoring well. As previously discussed, groundwater at or near Tank 58 is unlikely to affect any water sources at MFA. COCs in groundwater have decreased over time and TPH-e as diesel is the only remaining COC in groundwater.

Recently, a California statute was passed concerning closure of petroleum sites. Pursuant to Health and Safety Code 25299.37.1, (amended by California Senate Bill 989) testing for MTBE is required for all tank sites that contained gasoline before RWQCB or a local agency may issue a closure letter. MTBE was not detected in a sample collected from well W58-1 in August 1999.

8.0 RISK ASSESSMENT

The following subsections identify the potential sensitive receptors at Tank 58 area and present human health and ecological risk assessments for Tank 58 area. Potential sensitive receptors at the Tank 58 area include commercial, industrial, and construction workers. Complete exposure pathways for the occupational exposure scenario include inhalation of volatile organic compounds (VOCs) and particulates from subsurface soil and inhalation of VOCs from groundwater released into enclosed-space air (the auto hobby shop). Complete exposure pathways for the construction worker exposure scenario include ingestion of, dermal contact with, and inhalation of VOCs and particulates from subsurface soil. Transport mechanisms include volatilization and atmospheric dispersion; volatilization into enclosed-space air; and groundwater leaching and transport. Tank 58 is identified as the primary source for exposure scenarios at the Tank 58 area. Secondary sources for exposure scenarios at the site include contaminated subsurface soil and dissolved-phase TPH. Figure D9 provides an exposure scenario flow chart for the Tank 58 area.

8.1 HUMAN HEALTH RISK EVALUATION

The human health risk evaluation for Tank 58 is presented in Section 6.3.1 of the TM. The following paragraphs summarize results of the screening evaluation, present the conclusions of the risk assessment, and describe the uncertainty associated with the risk assessment process. Tier 1 screening evaluation

results for Tank 58 are presented in Tables D11 through D14 following the text. Both Navy and TtEMI investigation data are used to evaluate risk.

8.1.1 Tier 1 Screening Evaluation Results

In the Tier 1 screening evaluation for Tank 58, maximum detected chemical concentrations, obtained from soil and groundwater samples collected by TtEMI and the Navy, were compared with RBSLs. Maximum detected chemical concentrations in the 0- to 2-foot depth interval and 0- to 10-foot depth interval are used to evaluate direct exposure to soil under the occupational and construction worker scenarios. Table D9 presents maximum detected chemical concentrations in samples from the 0- to 10-foot depth interval. No samples were collected in the 0- to 2-foot depth interval at the Tank 58 area; therefore, the occupational scenario for direct exposure to soil could not be evaluated. Furthermore, the site is paved with asphalt, eliminating direct exposure to soil as a complete exposure pathway. However, maximum detected chemical concentrations in samples from the 0- to 10-foot depth interval were used to evaluate volatilization from soil into enclosed-space air for the occupational worker.

Concentrations of volatile petroleum compounds in groundwater are used to evaluate occupational exposure to chemicals that volatilize from groundwater into enclosed-space air. Table D10 presents the maximum detected chemical concentrations from the most recent groundwater sampling event. As shown in Table D10, no volatile petroleum compounds were detected in groundwater in August 1999; therefore, this exposure pathway is not evaluated for Tank 58.

Tier 1 soil RBSLs for the construction and occupational worker exposure scenarios are presented in Tables D11 and D12. Occupational Tier 1 RBSLs are EPA Region 9 preliminary remediation goals (PRGs) (EPA 1999b). EPA Region 9 PRGs are unavailable for the construction worker exposure scenario; therefore, Tier 1 RBSLs were derived using intake algorithms and exposure parameters presented in EPA Region 9 guidance (EPA 1999b). Intake algorithms and exposure parameters used to derive RBSLs for the construction worker are presented in Tables 12 and 13 of the TM. Occupational Tier 1 RBSLs for inhalation of VOCs from subsurface soil into enclosed-space air were developed using the California Department of Toxic Substances Control (DTSC) version (V1.3 February 1999) of the Johnson and Ettinger (1991) vapor intrusion model; these RBSLs are presented in Table D12.

Chemical-specific Tier 1 RBSLs for occupational and construction workers correspond to a carcinogenic risk of $1E-06$ or a noncarcinogenic hazard index (HI) of 1.0. To calculate the HI for noncarcinogenic chemicals, the maximum detected chemical concentration was divided by the RBSL and multiplied by 1.0 (the target hazard quotient level). To calculate the cancer risk for carcinogenic chemicals, the

maximum detected chemical concentration was divided by the RBSL and multiplied by 1E-06 (the target risk level). If the cumulative HI or cancer risk exceeds 1.0 or 1E-06, then the site may require additional evaluation, such as a Tier 2 risk-based evaluation.

In the 0- to 10-foot depth interval, maximum detected concentrations of noncarcinogens (ethylbenzene, 2-methylnaphthalene, naphthalene, xylene, TPH-e as diesel, TPH-p as gasoline, TPH-e as JP-5, and TPH-e as motor oil) were below available construction worker RBSLs, resulting in a cumulative HI of 0.28. The cumulative cancer risk from maximum detected concentrations of carcinogens (TPH-e as diesel and TPH-p as gasoline) was 1.8E-07. The cumulative HI and cancer risk are less than 1.0 and 1E-06, indicating an acceptable level of human health risk.

Tank 58 is located adjacent to the auto hobby shop building; therefore, indirect exposure via inhalation of VOCs in subsurface soil released into enclosed-space (building) air is a potential exposure pathway and was evaluated for the occupational worker exposure scenario. Table D14 presents the results of the Tier 1 screening evaluation for indirect exposure to VOCs in subsurface soil from enclosed-space air. No carcinogenic chemicals were detected in subsurface soil. The inhalation HI for soil is 0.0073. The inhalation scenario at the Tank 58 area resulted in a cumulative HI of less than 1.0, indicating an acceptable level of risk to human health.

Uncertainties in the Tier 1 Screening Evaluation

A discussion of uncertainty is an important component of the Tier 1 risk-based screening evaluation because many factors contribute to uncertainty. The magnitude of uncertainty can greatly influence the results and conclusions of a risk-based screening evaluation, as well as the perception of site-related risk by risk managers. Some of the sources of uncertainty in this screening evaluation include:

- Underlying assumptions regarding future potential land use and exposed receptors
- The quality and appropriateness of scientific studies that form the basis of toxicity values
- Unknown differences in absorption, distribution, metabolism, and excretion between humans and laboratory animals
- Statistical models used to extrapolate low doses for human exposure using experimental animal data that were generated from high dose exposures
- The basic underlying assumption in the dose-response model for carcinogens that there is no threshold involved in the tumorigenesis of cancer

- The magnification of uncertainty through the multiplicative combination of many upper-bound, conservative exposure assumptions

Furthermore, in deriving EPA Region 9 PRGs, extrapolations were used when toxicity values were unavailable for a given route of exposure. According to EPA Region 9, oral cancer slope factors and reference doses were used for both oral and inhaled exposure for organic compounds that lack inhalation values (EPA 1999b). Also, inhalation slope factors and inhalation reference doses were frequently used for both inhaled and oral exposure of organic compounds that lack oral values. This practice does not follow national EPA guidance (EPA 1989); however, it results in more conservative PRGs.

Among the most significant sources of uncertainty in the risk-based evaluation is the selection of hypothetical exposure scenarios. One of the basic assumptions was that all construction workers would be exposed to the maximum chemical concentrations located in deep subsurface soil profiles. Using this conservative assumption, chemical concentrations are not reduced by soil mixing; in reality, however, mixing would effectively dilute, and thereby reduce the exposure.

8.1.3 Human Health Risk Evaluation Conclusions

EPA regards an excess lifetime cancer risk between $1E-06$ and $1E-04$ as the target level for exposure to carcinogens (ERA 1991). Generally, EPA considers risks below $1E-06$ to be insignificant, and risks between $1E-04$ and $1E-06$ may not require remediation. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Title 40 Code of Federal Regulations Section 300.430(e)(2), states that "the 10^{-6} risk level shall be used as the point of departure for determination goals for alternatives when applicable or relevant and appropriate regulations are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure." The State of California follows this procedure. The acceptability of total risks lower than $1E-04$ depends on several factors, such as proper site characterization, adequate sampling density, and a validated conceptual site model. EPA and RWQCB likewise consider a hazard index calculated following EPA procedures of below 1.0 to be protective of human health.

At the Tank 58 area, a comparison of all maximum chemical concentrations in soil with occupational and construction worker RBSLs indicates carcinogenic risks less than $1E-06$ and cumulative noncarcinogenic hazard indices less than 1.0. At the Tank 58 area, a comparison of all maximum chemical concentrations in soil with construction worker RBSLs indicates cumulative noncarcinogenic hazard indices less than 1.0 and a cumulative cancer risk less than $1E-06$. The results for the occupational soil vapor intrusion scenario indicate an HI less than 1. Therefore, COCs in soil at the Tank 58 area do not present an unacceptable human health risk, and further evaluation is not necessary.

8.2 ECOLOGICAL RISK EVALUATION

Tank 58 is not located within or directly adjacent to a wetland habitat that may harbor sensitive wetlands fauna or flora. According to the habitat map presented in the station-wide RI report (PRC 1996), the wetland habitats are located approximately 7,000 feet from Tank 58. The distance between the Tank 58 area and wetland habitats at MFA will prevent any impacts to the ponds from contamination at the site. In addition, groundwater at Tank 58 does not discharge to any surface water bodies at or adjacent to the site.

As indicated in the TM and detailed in the Phase II SWEA (PRC and MW 1997), petroleum compounds in general are not significant chemicals of potential ecological concern (COPECs). Much of the Tank 58 area is paved; therefore, ecological receptors are not able to reside there. Because of the industrialized nature at the area near Tank 58, it is unlikely that ecological receptors will inhabit the site in the future. Therefore, petroleum compounds at the Tank 58 area do not appear to present an ecological risk.

9.0 LOW RISK CRITERIA EVALUATION

The low risk soil and groundwater criteria evaluation are presented in the following table.

Steps	Low-Risk Soil and Groundwater Screening for Tank 58	Yes/No
Step 1	Has the leak stopped, and have all sources, including all free product, been removed or remediated?	Yes
Step 2	Has the site been adequately characterized?	Yes
Step 3	Does groundwater impact exist?	Yes
	If yes, is the dissolved-phase hydrocarbon plume migrating?	No
Step 4	Are any water wells, deeper drinking water aquifers, surface water, or other sensitive receptors likely to be impacted?	No
Step 5	Does the site present a significant risk to human health?	No
Step 6	Does the site present a significant risk to the environment?	No

10.0 CONCLUSIONS

Soil and groundwater at the Tank 58 area were contaminated with petroleum products most likely released from the former Tank 58. Released fuels potentially include gasoline, jet fuel, diesel, and other waste oils. The evaluation found that residual contaminants at the Tank 58 area do not pose a risk to human health or the environment, and Tank 58 is recommend for closure. The following statements summarize the evaluation.

Sources removed and no free product encountered. After Tank 58 was removed, petroleum constituents remaining in soil include TPH-e as diesel, TPH-e as gasoline, xylene, naphthalene, and 2-methylnaphthalene. Previous investigations have not identified free product in soil or groundwater.

Water supply well not affected. NASA planning documents indicate that MFA will remain an airfield for the near future. Groundwater in the A aquifer is not currently used as a water supply source at MFA because of poor ambient quality and low formation yield. Currently, water is supplied to the airfield by the Hetch Hetchy Aqueduct; this supply source will most likely be used for any future development at or around Tank 58. Furthermore, groundwater at or downgradient of Tank 58 is not currently used, nor is it likely to be used before contaminants degrade to acceptable levels.

Stable groundwater plume. Groundwater data for samples from well W58-1 indicate that petroleum constituent concentrations are decreasing. Analytical results for the sample collected from well 58-1 in August 1999 indicated no detections of TPH-p as gasoline and benzene; both were detected in small quantities in November 1995. TPH-e as diesel decreased from 600 µg/L in November 1995 to 200 µg/L in August 1999.

Biodegradation likely occurring. Although groundwater at Tank 58 was not evaluated for nutrient content, concentrations of petroleum constituents have decreased, indicating that natural attenuation is occurring and will most likely continue to occur. It is likely that petroleum contaminants detected in groundwater will be degraded to acceptable levels before the groundwater is used as a drinking water source.

No human health risk. The Tier 1 evaluation indicates no current unacceptable human health risks from exposure to petroleum compounds in soil near Tank 58. A comparison of all maximum chemical concentrations in soil with occupational vapor intrusion RBSLs and with construction worker dermal exposure RSBLs indicates cumulative noncarcinogenic hazard indices less than 1.0 and carcinogenic risks less than 1E-06. A comparison of all maximum chemical concentrations in groundwater with occupational vapor intrusion RBSLs also indicate cumulative noncarcinogenic hazard indices less than 1.0 and carcinogenic risks less than 1E-06. Therefore, COCs in soil at Tank 58 do not present an unacceptable human health risk.

No ecological risk. There are no ecological receptors or habitats near Tank 58 and, because of the industrialized nature of this area, it is unlikely that ecological receptors will inhabit the site in the future.

MTBE not detected. Tank 58 may have contained gasoline; therefore, a groundwater sample collected at the site must be analyzed for MTBE. MTBE was not detected in a sample collected from well W58-1 in August 1999.

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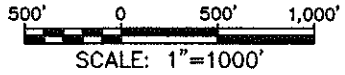
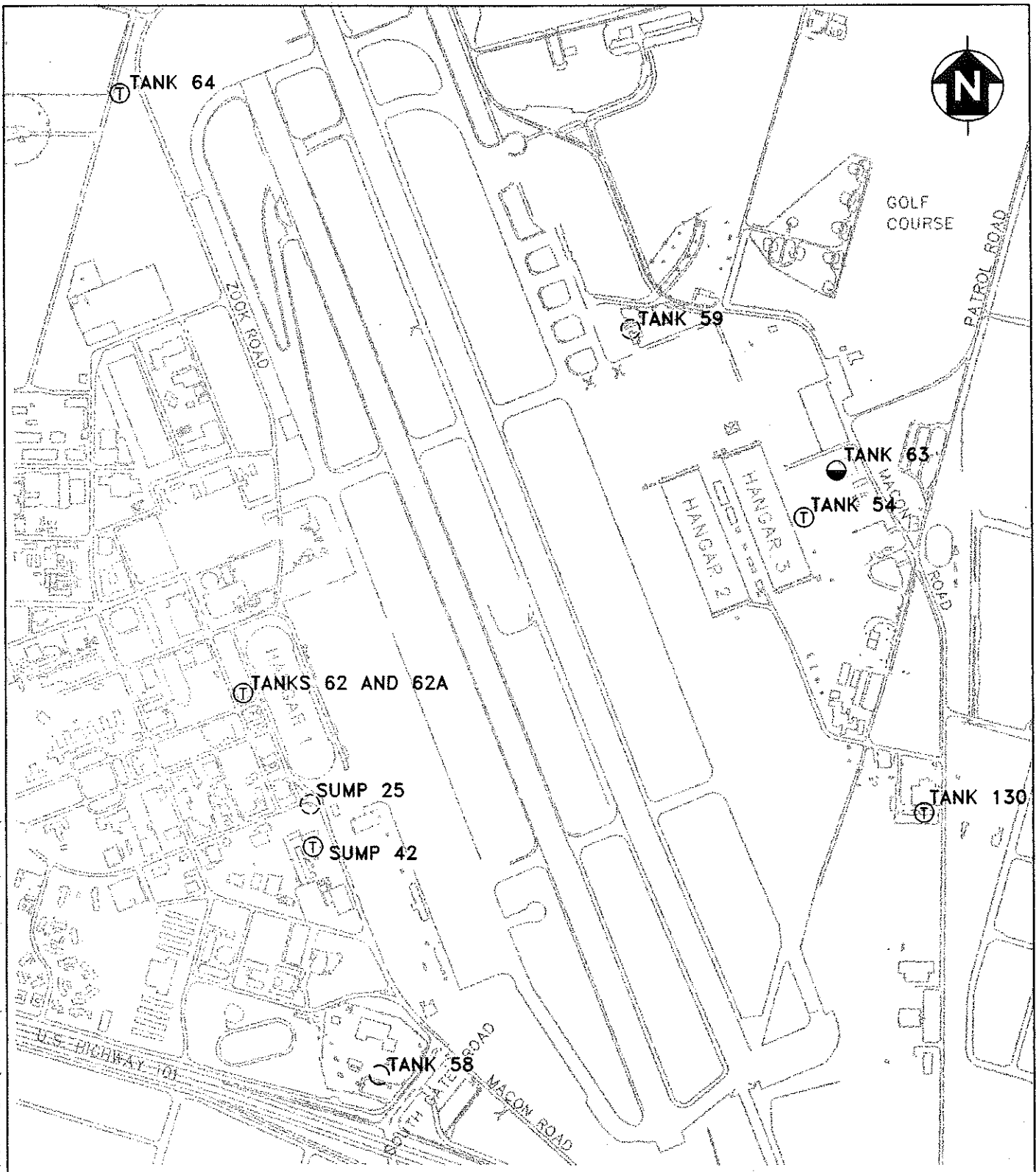
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DATE: 03/28/00 KRS DN



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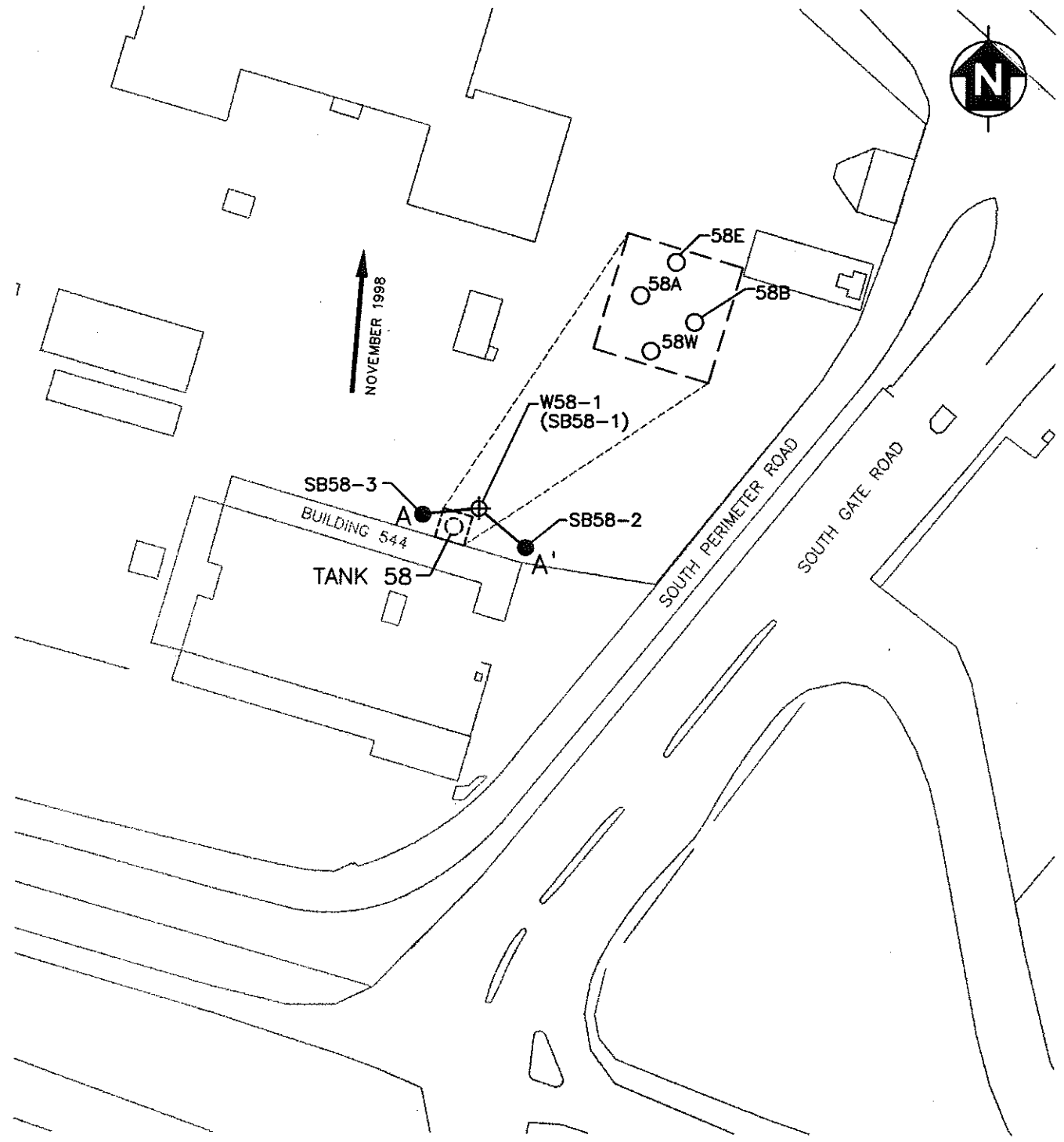
-  OIL/WATER SEPARATOR
-  CATCH BASIN
-  TANK OR SUMP

FIGURE D1
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15
SITE LOCATION MAP

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NOVEMBER 1998



LEGEND

- A—A' LINE OF CROSS SECTION
- SB58-2 SOIL BORING
- 58W SOIL SAMPLE LOCATION (TANK EXCAVATION)
- ⊕ W58-1 MONITORING WELL IN A1-AQUIFER ZONE
- TANK
- - - APPROXIMATE LIMIT OF EXCAVATION
- ← NOVEMBER 1998 APPROXIMATE DIRECTION OF GROUNDWATER FLOW

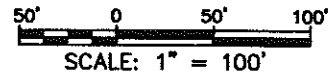


FIGURE D2
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
CROSS-SECTION, SOIL AND
GROUNDWATER SAMPLE LOCATIONS

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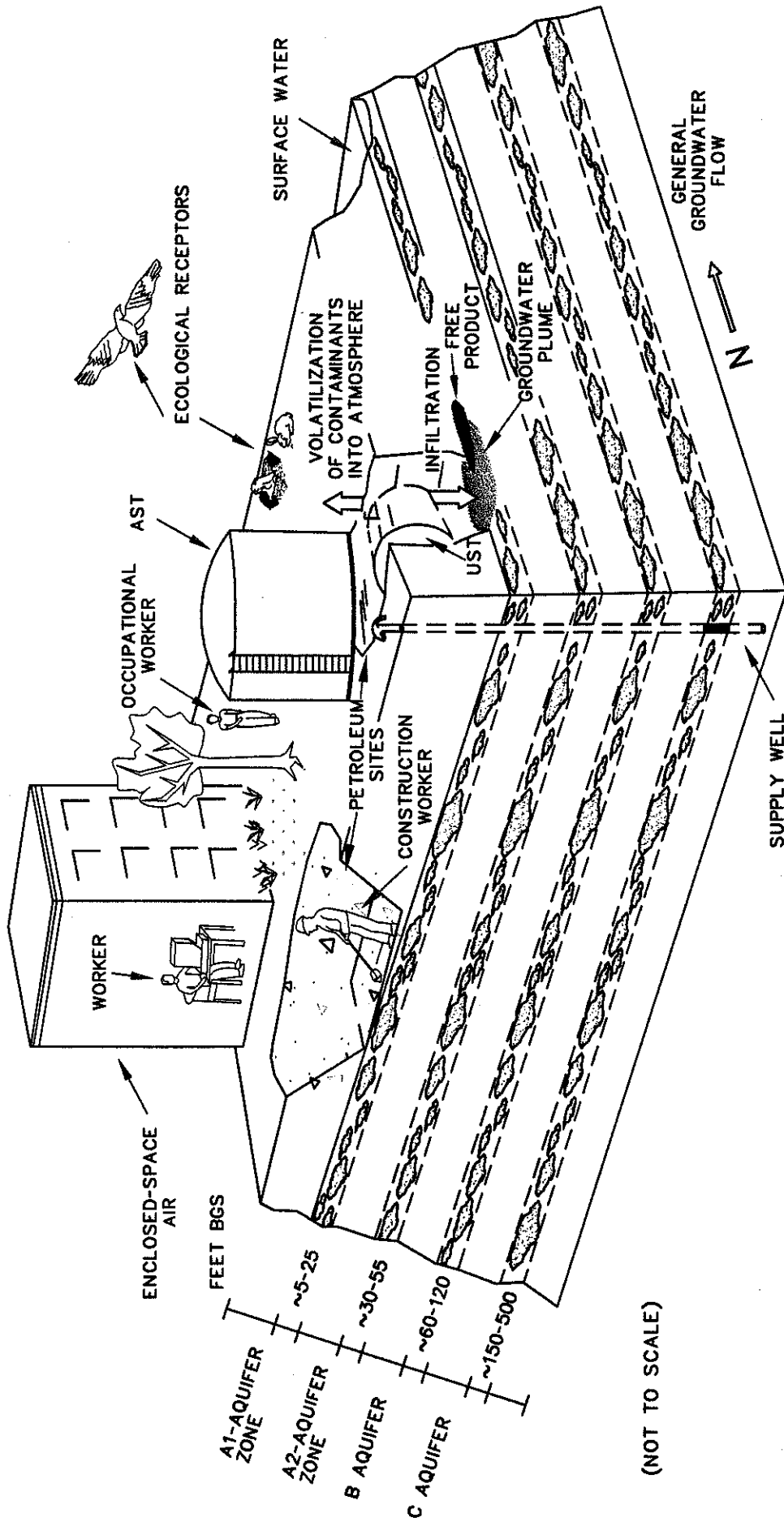
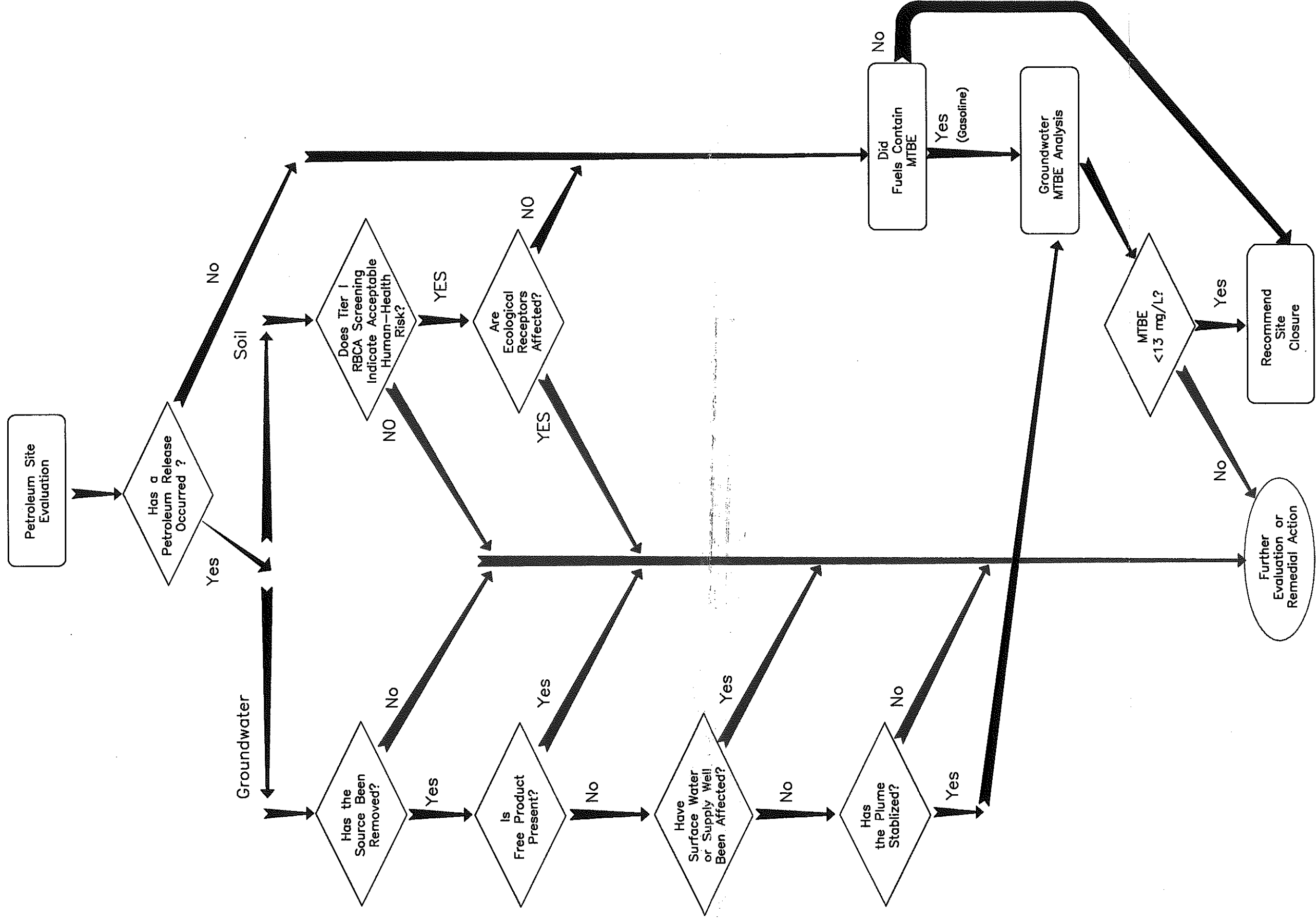


FIGURE D3
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
CONCEPTUAL SITE MODEL

- NOTES:
- AST = ABOVEGROUND STORAGE TANK
 - BGS = BELOW GROUND SURFACE
 - UST = UNDERGROUND STORAGE TANK

[Faint, illegible text, possibly bleed-through from the reverse side of the page]

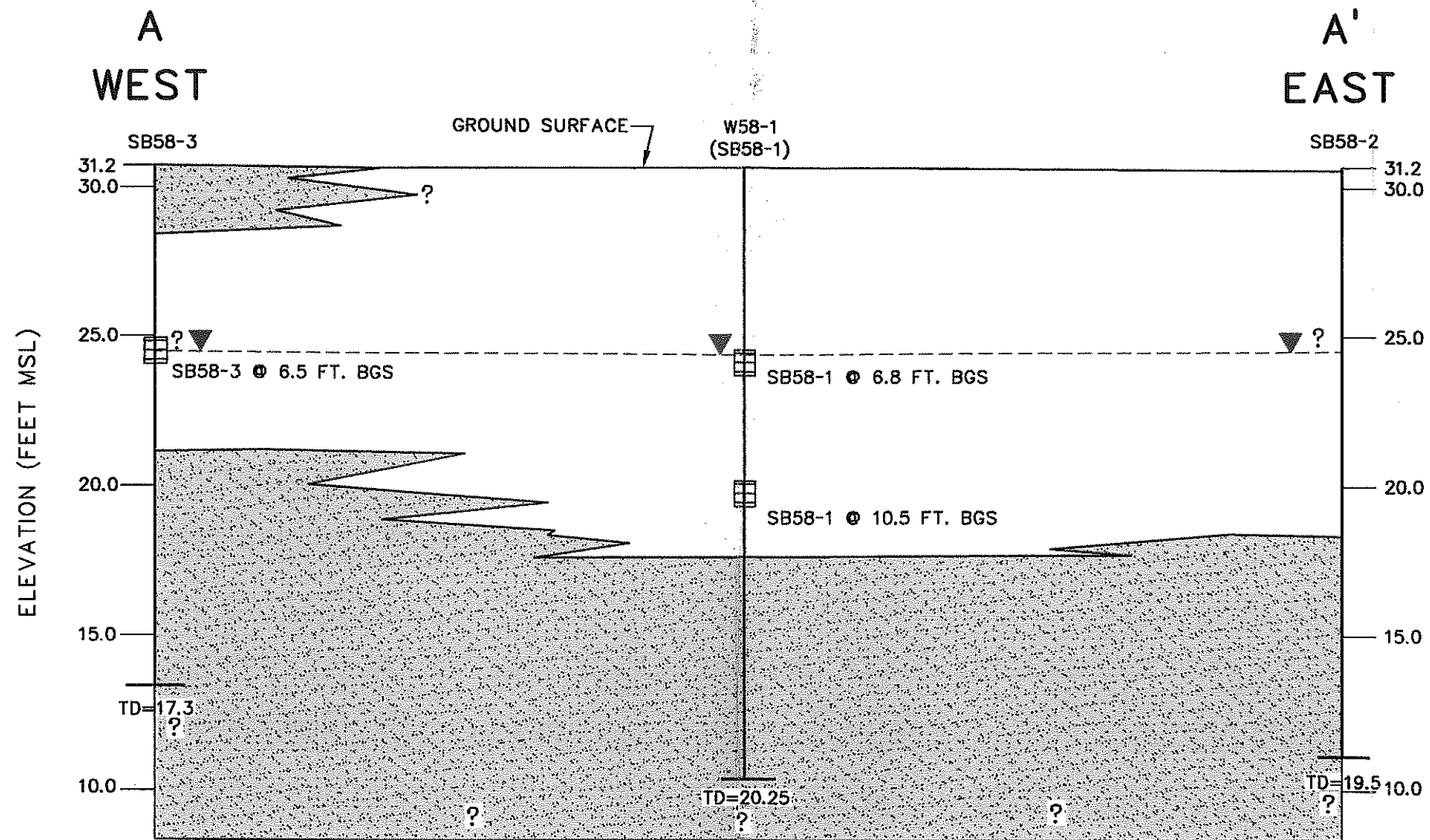









NOTES:
MTBE = METHYL TERTIARY BUTYL ETHER
RBCA = RISK-BASED CORRECTIVE ACTION
µg/L = MICROGRAMS PER LITER
< = LESS THAN

FIGURE D4
MOFFET FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
DECISION FLOW CHART

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LEGEND

-  HOLOCENE HIGH-PERMEABILITY ALLUVIUM (GRAVEL, SAND AND SILTY SAND) QUERIED WHERE INFERRED
-  HOLOCENE LOW-PERMEABILITY ALLUVIUM (SILT AND CLAY) QUERIED WHERE INFERRED
-  POTENTIOMETRIC SURFACE IN NOVEMBER 1998, QUERIED WHERE INFERRED
-  LITHOLOGY UNCERTAIN
- MSL MEAN SEA LEVEL
- FT. FEET
- BGS BELOW GROUND SURFACE
- SB58-1  SOIL BORING/WELL NAME AND TOTAL DEPTH IN FEET BELOW GROUND SURFACE (BGS)

NOTE: GRAVEL FILL PRESENT AT TOP OF BORINGS TO A MAXIMUM DEPTH OF 2.5 FEET BGS

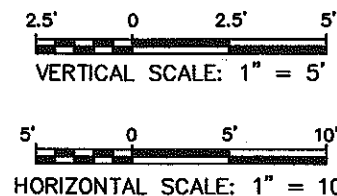
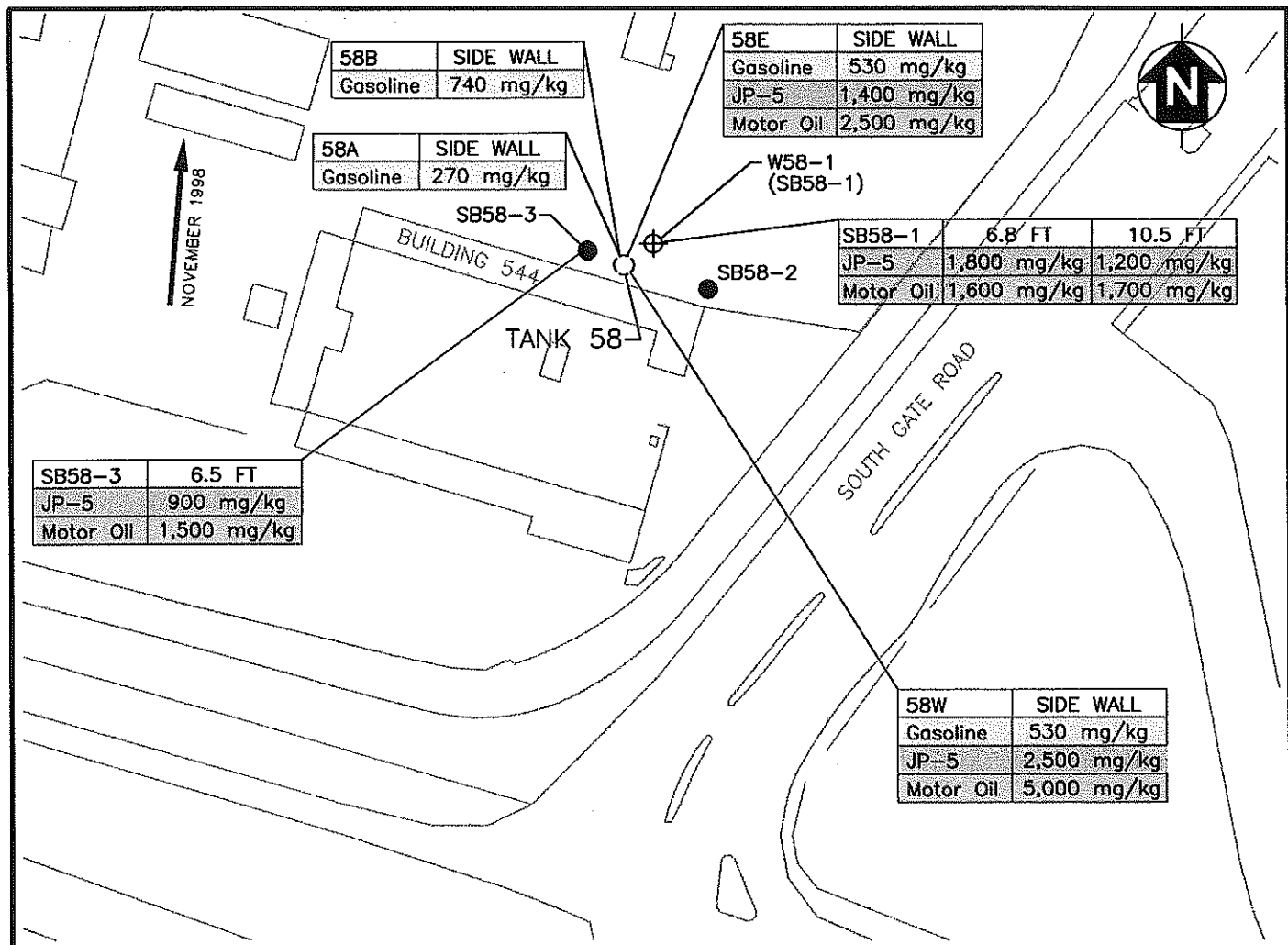
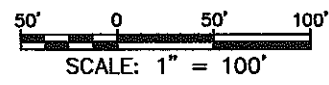
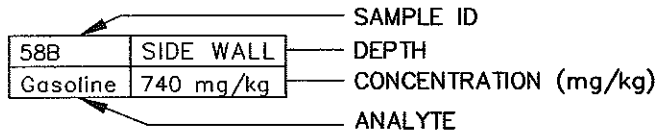


FIGURE D5
 MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 GEOLOGIC CROSS SECTION A-A'



LEGEND



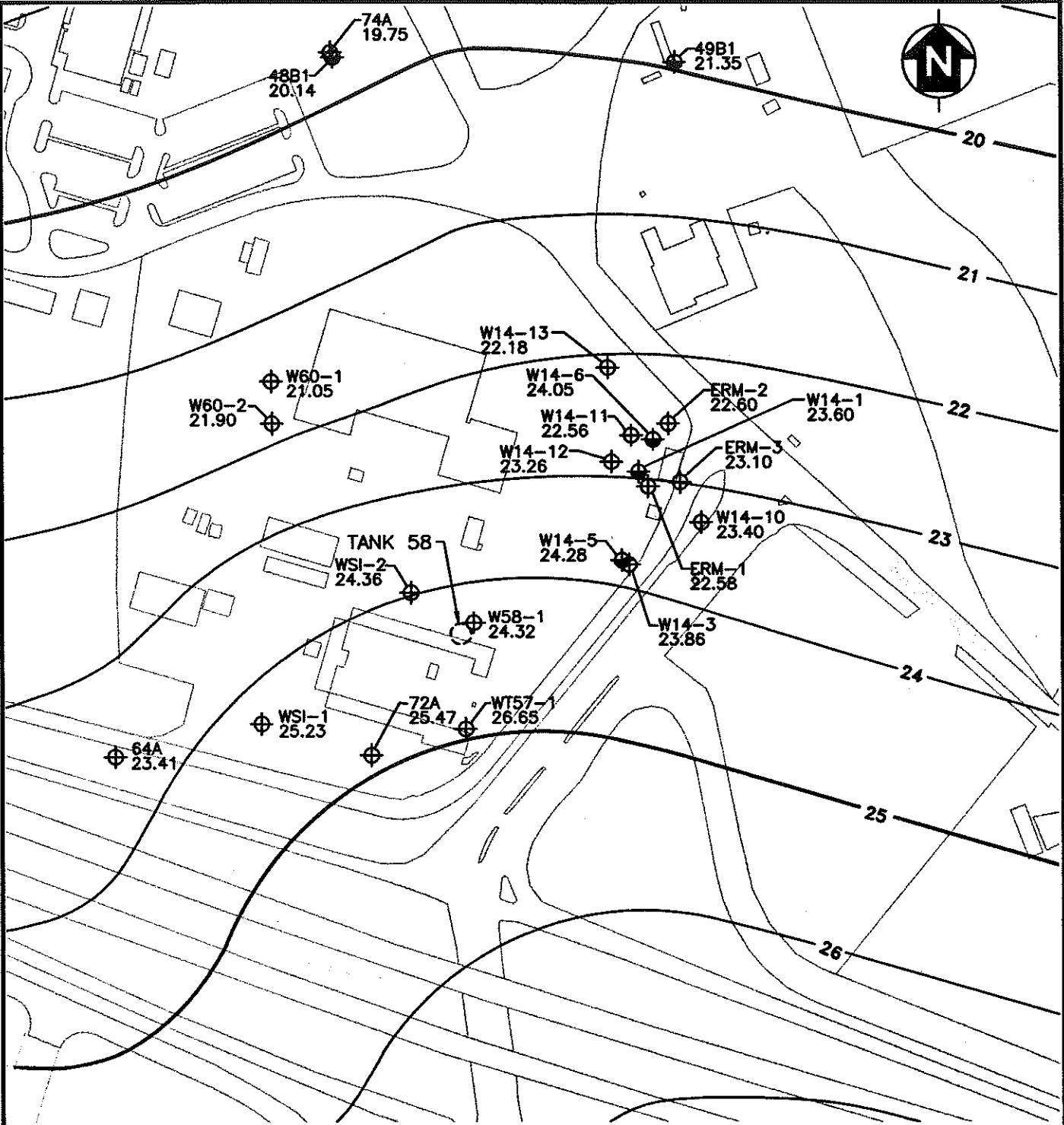
NOVEMBER 1998 APPROXIMATE DIRECTION OF GROUNDWATER FLOW

- ⊕ W58-1 MONITORING WELL IN A1-AQUIFER ZONE
- SB58-2 SOIL BORING
- TANK
- TPH-E TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE
- TPH-P TOTAL PETROLEUM HYDROCARBONS PURGEABLE
- FT FEET
- JP JET PETROLEUM
- mg/kg MILLIGRAMS PER KILOGRAM
- TPH-E AS JP-5
- TPH-E AS MOTOR OIL
- TPH-P AS GASOLINE

FIGURE D6
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
SELECTED PETROLEUM DETECTIONS
REMAINING IN SOIL

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LEGEND

- ⊕ W14-4 22.60 A1 AQUIFER MONITORING WELL
GROUNDWATER ELEVATION (FEET, msl)
- ⊕ 49B1 20.14 A2 AQUIFER MONITORING WELL, WITH WELL NAME
GROUNDWATER ELEVATION (FEET, msl)
- 26— GROUNDWATER ELEVATION
- msl MEAN SEA LEVEL

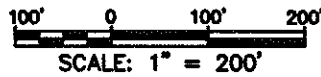
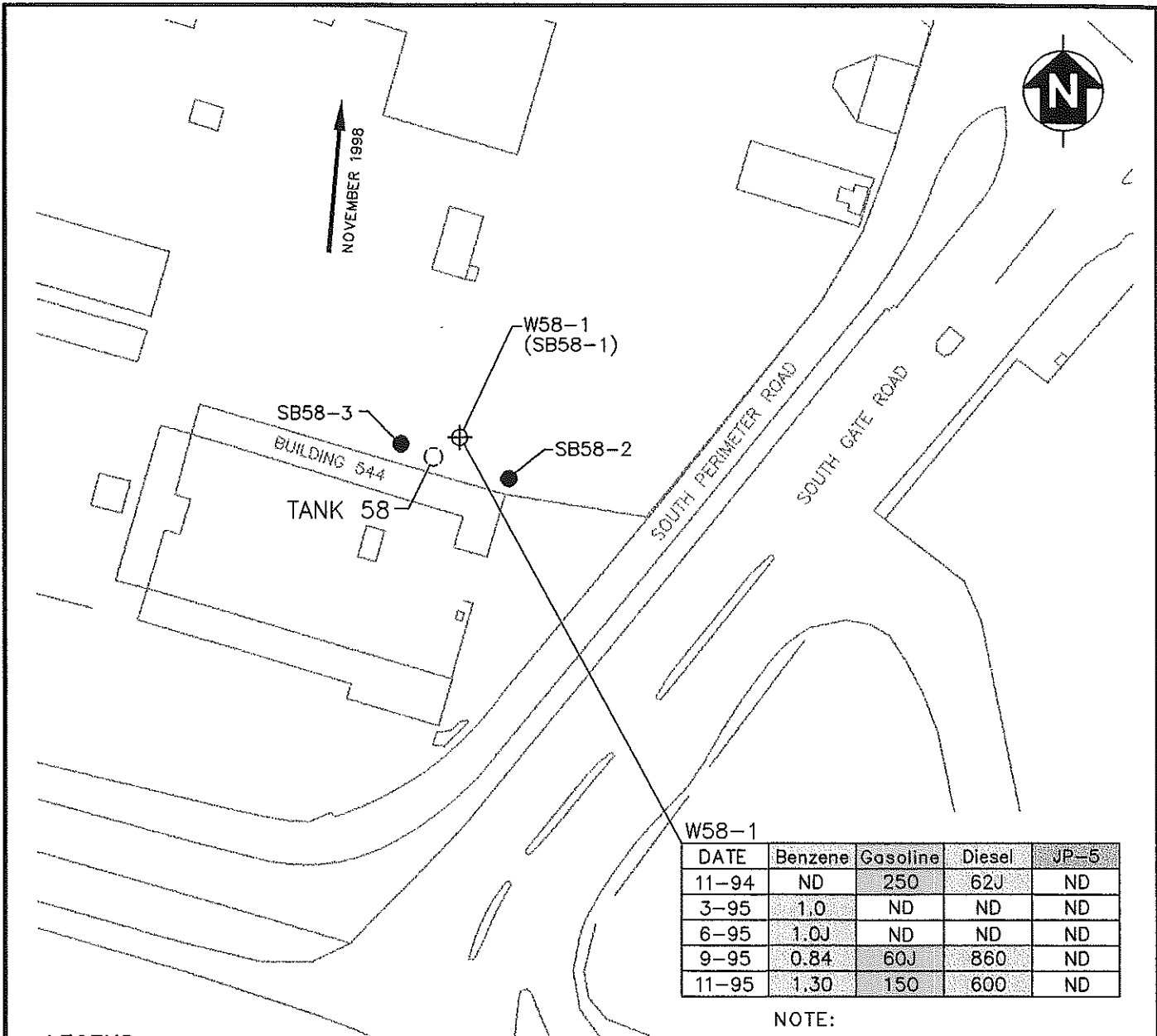


FIGURE D7
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
SHALLOW (A-AQUIFER)
GROUNDWATER CONTOUR MAP

MODIFIED FROM: NOVEMBER 1998 QUARTERLY REPORT,
 MOFFETT FEDERAL AIRFIELD, CALIFORNIA (TREM1 APRIL,1999)



LEGEND

⊕ W58-1 MONITORING WELL in A1-AQUIFER ZONE

● SB58-2 SOIL BORING

○ TANK

← NOVEMBER 1998 APPROXIMATE DIRECTION OF GROUNDWATER FLOW

J ESTIMATED CONCENTRATION

JP JET PETROLEUM

ND NOT DETECTED

TPH-E TOTAL PETROLEUM HYDROCARBONS EXTRACTABLE

TPH-P TOTAL PETROLEUM HYDROCARBONS PURGEABLE

● BENZENE

● TPH-P AS GASOLINE

● TPH-E AS DIESEL

● TPH-E AS JP-5

NOTE:

CONCENTRATIONS IN MICROGRAMS PER LITER (µg/L)

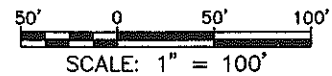
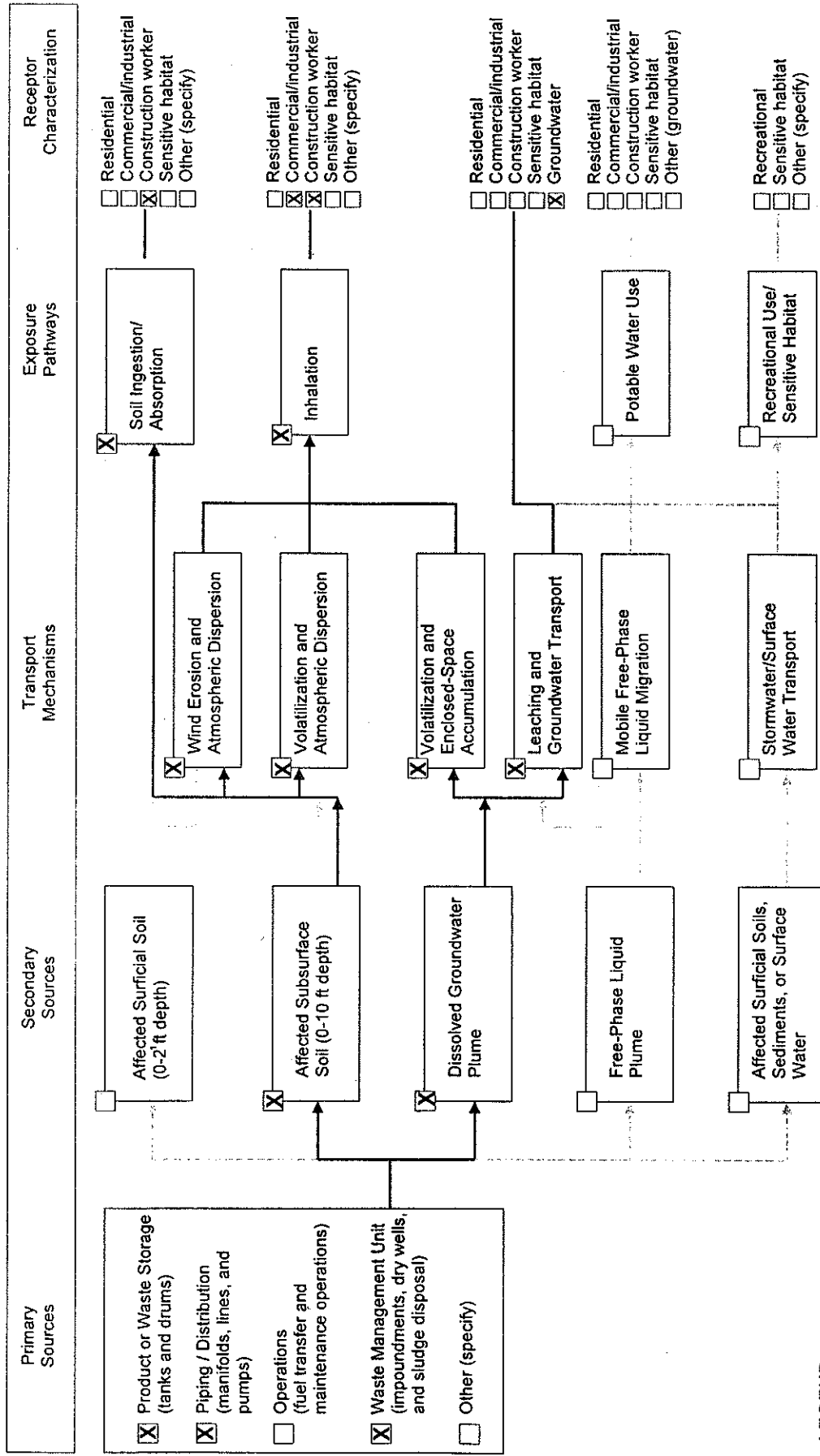


FIGURE D8
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D – SITE 15 – TANK 58
SELECTED GROUNDWATER DETECTIONS

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LEGEND

- APPLICABLE SOURCE, MECHANISM, EXPOSURE PATHWAY, OR RECEPTOR
- COMPLETE FLOWPATH
- INCOMPLETE FLOWPATH
- OCCUPATIONAL SCENARIO ONLY

FIGURE D9
MOFFETT FEDERAL AIRFILED
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
EXPOSURE SCENARIO FLOWCHART

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TABLE D1

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15
SUMMARY OF SITE 15 TANKS**

Tank	Tank Type	Capacity (Gallons)	Contents	Status	Removal Date	Additional Notes
25	Oil/water Separator	2,000	Aircraft Wash Wastewater	Removed	1994 (month unknown)	Addressed with NEX tanks in Appendix F
42	Sump	100	Condensed Gasoline Vapor	Removed	October 1990	Addressed with NEX tanks in Appendix F
54	UST	1,620	Wastewater	Removed	December 1992	Addressed in Tank Closure Report ²
58	Oil/water Separator	300	Oily Wastewater	Removed	April 1994	Addressed in Tank Closure Report ²
59	Oil/water Separator	1,400	Oily Wastewater	Active	Not removed	Addressed in Tank Closure Report ²
62 & 62A	Recirculation Tanks at Paint Shop	13,000	Paint Wastewater	Inactive	Not removed	Addressed in Tank Closure Report ²
63	Drain	200	Stripping Wastewater	Inactive	Not removed	Addressed in Tank Closure Report ²
64	Stormwater Diversion Box	Unknown	Stormwater	Removed	1994 (month unknown)	Addressed in Tank Closure Report ²
130 (65) ¹	Wastewater Sump	Unknown	Battery Locker Wastewater	Inactive	Not removed	Addressed in Tank Closure Report ²

Notes:

- ¹ Noted in some Navy documents as Tank or Sump 65
- ² TtEMI in progress
- NEX Naval Exchange Service Station
- UST Underground Storage Tank

TABLE D2

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 NAVY SOIL DATA

(Concentrations in milligrams per kilogram)

Chemical Name: BENZENE			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	0.005 U
58B	4.0-5.0	12-Apr-94	0.005 U
58E	4.0-5.0	4-May-94	0.005 U
58W	4.0-5.0	4-May-94	0.005 U
Chemical Name: DIESEL-RANGE ORGANIC COMPOUNDS			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	2,300 Y
58B	4.0-5.0	12-Apr-94	220 Y
58E	4.0-5.0	4-May-94	2,300 Y
58W	4.0-5.0	4-May-94	4,300 Y
Chemical Name: ETHYLBENZENE			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	0.005 U
58B	4.0-5.0	12-Apr-94	0.005 U
58E	4.0-5.0	4-May-94	0.005 U
58W	4.0-5.0	4-May-94	0.42
Chemical Name: GASOLINE-RANGE ORGANIC COMPOUNDS			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	270 Y
58B	4.0-5.0	12-Apr-94	740 Y
58E	4.0-5.0	4-May-94	530 Y
58W	4.0-5.0	4-May-94	630 Y
Chemical Name: JP-5			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58E	4.0-5.0	4-May-94	1,400
58W	4.0-5.0	4-May-94	2,500
Chemical Name: MOTOR OIL			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58E	4.0-5.0	4-May-94	2,500
58W	4.0-5.0	4-May-94	5,000
Chemical Name: TOLUENE			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	0.005 U
58B	4.0-5.0	12-Apr-94	0.005 U
58E	4.0-5.0	4-May-94	0.005 U
58W	4.0-5.0	4-May-94	0.005 U

TABLE D2 (Continued)

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
NAVY SOIL DATA**

(Concentrations in milligrams per kilogram)

Chemical Name: XYLENE				
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>	
58A	4.0-5.0	12-Apr-94	0.70	
58B	4.0-5.0	12-Apr-94	0.005	U
58E	4.0-5.0	4-May-94	3.1	
58W	4.0-5.0	4-May-94	6.5	

Notes:

- U - Analyzed for but not detected (reported value is detection limit)
- Y - Pattern does not match calibration fuel pattern, but resembles a fuel pattern.
- 1 - Feet below ground surface (exact depth unknown)

TABLE D3

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 NAVY SOIL DATA - DETECTED PETROLEUM COMPOUNDS ONLY
 (Concentrations in milligram per kilogram)

Chemical Name: DIESEL-RANGE ORGANIC COMPOUNDS			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	2,300 Y
58B	4.0-5.0	12-Apr-94	220 Y
58E	4.0-5.0	4-May-94	2,300 Y
58W	4.0-5.0	4-May-94	4,300 Y
Chemical Name: ETHYLBENZENE			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58W	4.0-5.0	4-May-94	0.42
Chemical Name: GASOLINE-RANGE ORGANIC COMPOUNDS			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	270 Y
58B	4.0-5.0	12-Apr-94	740 Y
58E	4.0-5.0	4-May-94	530 Y
58W	4.0-5.0	4-May-94	630 Y
Chemical Name: JP-5			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58E	4.0-5.0	4-May-94	1,400
58W	4.0-5.0	4-May-94	2,500
Chemical Name: MOTOR OIL			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58E	4.0-5.0	4-May-94	2,500
58W	4.0-5.0	4-May-94	5,000
Chemical Name: XYLENE			
<u>Location/Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
58A	4.0-5.0	12-Apr-94	0.70
58B	4.0-5.0	12-Apr-94	0.005 U
58E	4.0-5.0	4-May-94	3.1
58W	4.0-5.0	4-May-94	6.5

Notes:

- U - Analyzed for but not detected (reported value is detection limit)
- Y - Pattern does not match calibration fuel pattern, but resembles a fuel pattern.
- 1 - Feet below ground surface (exact depth unknown)

TABLE D4

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
TtEMI SOIL DATA
(Concentrations in milligrams per kilogram)**

Chemical Name: 2-METHYLNAPHTHALENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	2.60
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	1.90
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	2.10 J-S
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.42 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.46 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	0.44 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.42 U
Chemical Name: BENZENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1.60 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	0.62 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	1.60 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1.60 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.00062 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.012 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.0007 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.014 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	0.66 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	1.60 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.00063 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.013 U
Chemical Name: BENZO(A)PYRENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	0.44 UJ-L
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	0.42 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	0.42 UJ-L
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.42 UJ-L
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.46 UJ-L
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	0.44 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.42 UJ-L
Chemical Name: DIESEL-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	130.0 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	62.0 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	120.0 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	12.0 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	14.0 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	130.0 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	13.0 U
Chemical Name: ETHYLBENZENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1.60 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	0.62 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	1.60 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1.60 U

TABLE D4 (Continued)

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 TtEMI SOIL DATA
 (Concentrations in milligrams per kilogram)

Chemical Name: ETHYLBENZENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.00062 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.012 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.0007 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.014 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	0.66 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	1.60 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.00063 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.013 U
Chemical Name: GASOLINE-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	160.0 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	62.0 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	160.0 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.62 UJ-S
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.70 UJ-S
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	66.0 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.63 U
Chemical Name: JP5-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1,800.0
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	610.0
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1,200.0
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	12.0 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	14.0 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	900.0
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	13.0 U
Chemical Name: KEROSENE-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	130.0 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	62.0 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	120.0 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	12.0 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	14.0 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	130.0 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	13.0 U
Chemical Name: MOTOR OIL-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1,600.0
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	700.0
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1,700.0
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	12.0 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	14.0 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	1,500.0
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	13.0 U

TABLE D4 (Continued)

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
TtEMI SOIL DATA
(Concentrations in milligrams per kilogram)**

Chemical Name: NAPHTHALENE			
<u>Location - Sample ID</u>	<u>Sample Depth¹</u>	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	0.63
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	0.41 J
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	0.86 J-S
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.42 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.46 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	0.44 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.42 U
Chemical Name: TOLUENE			
<u>Location - Sample ID</u>	<u>Sample Depth¹</u>	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1.60 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	0.62 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	1.60 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1.60 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.00062 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.012 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.0007 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.014 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	0.66 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	1.60 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.00063 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.013 U
Chemical Name: XYLENES (TOTAL)			
<u>Location - Sample ID</u>	<u>Sample Depth¹</u>	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1.60 U
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	28.0
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	1.60 U
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	27.0
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1.60 U
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	54.0
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.00062 U
SB58-2 - SB58-002(08.8-09.1)	8.8	08-NOV-94	0.012 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.0007 U
SB58-2 - SB58-002(14.8-15.1)	14.8	08-NOV-94	0.014 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	1.60 U
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	7.70
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.00063 U
SB58-3 - SB58-003(10.5-10.9)	10.5	08-NOV-94	0.013 U

Notes:

- J - The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
- L - Internal standard recoveries are out of quality control limits.
- S - Value is estimated because the surrogate recovery was out of quality control limits.
- U - Analyzed for but not detected (reported value is detection limit).
- Dup - Duplicate sample
- 1 - Feet below ground surface

TABLE D5

**MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 TtEMI SOIL DATA - DETECTED PETROLEUM COMPOUNDS ONLY
 (Concentrations in milligrams per kilogram)**

Chemical Name: 2-METHYLNAPHTHALENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	2.60
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	1.90
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	2.10 J-S
Chemical Name: JP5-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1,800.0
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	610.0
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1,200.0
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	900.0
Chemical Name: MOTOR OIL-RANGE ORGANIC COMPOUNDS			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	1,600.0
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	700.0
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	1,700.0
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	1,500.0
Chemical Name: NAPHTHALENE			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	0.63
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	0.41 J
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	0.86 J-S
Chemical Name: XYLENES (TOTAL)			
<u>Location - Sample ID</u>	<u>Sample Depth</u> ¹	<u>Sample Date</u>	<u>Concentration</u>
SB58-1 - SB58-001(06.8-07.2)	6.8	07-NOV-94	28.0
SB58-1 - SB58-001(08.7-09.0)	8.7	07-NOV-94	27.0
SB58-1 - SB58-001(10.5-11.0)	10.5	07-NOV-94	54.0
SB58-3 - SB58-003(06.5-06.9)	6.5	08-NOV-94	7.70

Notes:

- J - The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
- S - Value is estimated because the surrogate recovery was out of quality control limits.
- Dup - Duplicate sample
- 1 - Feet below ground surface

TABLE D6

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
TtEMI GROUNDWATER DATA
(Concentrations in micrograms per liter)**

Chemical Name: 2-METHYLNAPHTHALENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
Chemical Name: BENZENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	0.50 U
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
W58-1 - W58-1	16-MAR-95	1.0
W58-1 - W58-1	16-MAR-95	2.0 U-B
W58-1 - W58-1	12-JUN-95	0.60
W58-1 - W58-1	12-JUN-95	1.0 J
W58-1 - W58-1	08-SEP-95	0.80
W58-1 - W58-1	08-SEP-95	0.84
W58-1 - W58-1	10-NOV-95	0.90 J-S
W58-1 - W58-1	10-NOV-95	1.30
W58-1 - W58-1	25-AUG-99	1.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	1.0 U
Chemical Name: BENZO(A)PYRENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
Chemical Name: DIESEL-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	62.0 J
W58-1 - W58-1	16-MAR-95	50.0 UJ-S
W58-1 - W58-1	12-JUN-95	50.0 UJ-S
W58-1 - W58-1	08-SEP-95	860.0 Y
W58-1 - W58-1	10-NOV-95	600.0
W58-1 - W58-1	25-AUG-99	200.0 Y
W58-1 - W58-99-2 (Dup)	25-AUG-99	200.0 Y
Chemical Name: ETHYLBENZENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	0.56
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
W58-1 - W58-1	16-MAR-95	0.50 U
W58-1 - W58-1	16-MAR-95	2.0 U
W58-1 - W58-1	12-JUN-95	0.50 U
W58-1 - W58-1	12-JUN-95	2.0 U
W58-1 - W58-1	08-SEP-95	0.50 U
W58-1 - W58-1	08-SEP-95	2.0 U
W58-1 - W58-1	10-NOV-95	0.50 U
W58-1 - W58-1	25-AUG-99	1.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	1.0 U

TABLE D6 (Continued)

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 TtEMI GROUNDWATER DATA
 (Concentrations in micrograms per liter)

Chemical Name: GASOLINE-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	250.0
W58-1 - W58-1	16-MAR-95	50.0 U
W58-1 - W58-1	12-JUN-95	50.0 U
W58-1 - W58-1	08-SEP-95	60.0 J-K
W58-1 - W58-1	10-NOV-95	150.0 Y
W58-1 - W58-1	25-AUG-99	50.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	50.0 U
Chemical Name: JP5-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	100.0 U
W58-1 - W58-1	16-MAR-95	50.0 UJ-S
W58-1 - W58-1	12-JUN-95	50.0 UJ-S
W58-1 - W58-1	08-SEP-95	100.0 U
W58-1 - W58-1	10-NOV-95	100.0 U
W58-1 - W58-1	25-AUG-99	500.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	500.0 U
Chemical Name: KEROSENE-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	220.0
W58-1 - W58-1	16-MAR-95	50.0 UJ-S
W58-1 - W58-1	12-JUN-95	50.0 UJ-S
W58-1 - W58-1	08-SEP-95	100.0 U
W58-1 - W58-1	10-NOV-95	100.0 U
Chemical Name: M,P-XYLENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	08-SEP-95	2.0 U
Chemical Name: METHYL-T-BUTYL ETHER		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	25-AUG-99	10.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	10.0 U
Chemical Name: MOTOR OIL-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	100.0 U
W58-1 - W58-1	16-MAR-95	500.0 UJ-S
W58-1 - W58-1	12-JUN-95	500.0 UJ-S
W58-1 - W58-1	08-SEP-95	1,000.0 U
W58-1 - W58-1	10-NOV-95	440.0 Z
W58-1 - W58-1	25-AUG-99	500.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	500.0 U

TABLE D6 (Continued)

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 TEMI GROUNDWATER DATA
 (Concentrations in micrograms per liter)

Chemical Name: NAPHTHALENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
Chemical Name: O-XYLENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	08-SEP-95	2.0 U
Chemical Name: OTHER HEAVY TPH COMPONENTS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	16-MAR-95	1,200.0 J-SY
W58-1 - W58-1	12-JUN-95	900.0 YJ-S
W58-1 - W58-1	08-SEP-95	100.0 U
Chemical Name: OTHER LIGHT TPH COMPONENTS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	16-MAR-95	200.0 Y
W58-1 - W58-1	12-JUN-95	180.0 Y
W58-1 - W58-1	08-SEP-95	50.0 U
Chemical Name: TOLUENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	0.65
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
W58-1 - W58-1	16-MAR-95	0.50 U
W58-1 - W58-1	16-MAR-95	2.0 U
W58-1 - W58-1	12-JUN-95	0.50 U
W58-1 - W58-1	12-JUN-95	2.0 U
W58-1 - W58-1	08-SEP-95	0.50 U
W58-1 - W58-1	08-SEP-95	2.0 U
W58-1 - W58-1	10-NOV-95	0.50 U
W58-1 - W58-1	25-AUG-99	1.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	1.0 U
Chemical Name: XYLENES (TOTAL)		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	3.50
W58-1 - MW58-001(14.5)	11-NOV-94	10.0 U
W58-1 - W58-1	16-MAR-95	0.50 U
W58-1 - W58-1	16-MAR-95	2.0 U
W58-1 - W58-1	12-JUN-95	0.20 J
W58-1 - W58-1	12-JUN-95	0.50 U
W58-1 - W58-1	08-SEP-95	0.50 U
W58-1 - W58-1	08-SEP-95	2.0 U
W58-1 - W58-1	10-NOV-95	0.50 U
W58-1 - W58-1	25-AUG-99	1.0 U
W58-1 - W58-99-2 (Dup)	25-AUG-99	1.0 U

TABLE D6 (Continued)
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
TtEMI GROUNDWATER DATA
(Concentrations in micrograms per liter)

Notes:

- B** - Organic analyte found in the associated blank as well as the sample.
- J** - The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
- K** - Value is estimated because calibration or Gas Chromatograph/Mass Spectrometer tuning criteria were out of quality control limits.
- S** - Value is estimated because the surrogate recovery was out of quality control limits.
- U** - Analyzed for but not detected (reported value is detection limit).
- Y** - Pattern does not match calibration fuel pattern, but resembles a fuel pattern.
- Z** - Unknown single peaks or patterns were detected, but did not resemble a typical fuel pattern.
- Dup** - Duplicate sample

TABLE D7

**MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
TtEMI GROUNDWATER DATA - DETECTED PETROLEUM COMPOUNDS ONLY
(Concentrations in micrograms per liter)**

Chemical Name: BENZENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	16-MAR-95	1.0
W58-1 - W58-1	12-JUN-95	0.60
W58-1 - W58-1	12-JUN-95	1.0 J
W58-1 - W58-1	08-SEP-95	0.80
W58-1 - W58-1	08-SEP-95	0.84
W58-1 - W58-1	10-NOV-95	0.90 J-S
W58-1 - W58-1	10-NOV-95	1.30
Chemical Name: DIESEL-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	62.0 J
W58-1 - W58-1	08-SEP-95	860.0 Y
W58-1 - W58-1	10-NOV-95	600.0
W58-1 - W58-1	25-AUG-99	200.0 Y
W58-1 - W58-99-2 (Dup)	25-AUG-99	200.0 Y
Chemical Name: ETHYLBENZENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	0.56
Chemical Name: GASOLINE-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	250.0
W58-1 - W58-1	08-SEP-95	60.0 J-K
W58-1 - W58-1	10-NOV-95	150.0 Y
Chemical Name: KEROSENE-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	220.0
Chemical Name: MOTOR OIL-RANGE ORGANIC COMPOUNDS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	10-NOV-95	440.0 Z
Chemical Name: OTHER HEAVY TPH COMPONENTS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	16-MAR-95	1,200.0 J-SY
W58-1 - W58-1	12-JUN-95	900.0 YI-S
Chemical Name: OTHER LIGHT TPH COMPONENTS		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - W58-1	16-MAR-95	200.0 Y
W58-1 - W58-1	12-JUN-95	180.0 Y

TABLE D7 (Continued)

**MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 TEMI GROUNDWATER DATA - DETECTED PETROLEUM COMPOUNDS ONLY
 (Concentrations in micrograms per liter)**

Chemical Name: TOLUENE		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	0.65
Chemical Name: XYLENES (TOTAL)		
<u>Location - Sample ID</u>	<u>Sample Date</u>	<u>Concentration</u>
W58-1 - MW58-001(14.5)	11-NOV-94	3.50
W58-1 - W58-1	12-JUN-95	0.20 J

Notes:

- J - The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
- K - Value is estimated because calibration or Gas Chromatograph/Mass Spectrometer tuning criteria were out of quality control limits.
- S - Value is estimated because the surrogate recovery was out of quality control limits.
- Y - Pattern does not match calibration fuel pattern, but resembles a fuel pattern.
- Z - Unknown single peaks or patterns were detected, but did not resemble a typical fuel pattern.
- Dup - Duplicate sample

TABLE D8

MOFFETT FEDERAL AIRFIELD - PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 DATA QUALITY OBJECTIVES

DQO STEP	DESCRIPTION	DETAILS
STEP 1	State the Problem	<p>The problem is to assess whether the Tank 58 area can be closed or requires further evaluation. ANUST at Site 15 (Tank 58) contained oily wastewater that was released to the environment. This release may have resulted in petroleum contamination in soil and groundwater; therefore, the site requires evaluation to assess whether an unacceptable risk to human health or the environment exists.</p>
STEP 2	Identify the Decisions	<ul style="list-style-type: none"> • <u>Petroleum Release</u>: Has a petroleum release occurred? • <u>Source Removal</u>: Has the source been removed and is free product present? • <u>Groundwater Impact</u>: Have surface water or supply wells been affected? • <u>Groundwater Plume Stability</u>: Has the plume stabilized? • <u>Human Health Risk</u>: Does Tier 1 RBCA screening of the exposure pathways indicate an acceptable risk? • <u>Ecological Risk</u>: Do petroleum constituents present an acceptable ecological risk? • <u>MTBE</u>: Did the tank contain gasoline and is MTBE analysis needed? If so, are MTBE concentrations in groundwater above 13 µg/L?
STEP 3	Identify the Inputs to the Decisions	<ul style="list-style-type: none"> • Historical site and tank information • Soil and groundwater data from previous investigations • Regulatory guidance including the RBCA Tier 1 screening criteria, and the 1994 negotiated action levels • Ecological study results
STEP 4	Define Study Boundaries	<p>The study boundaries are defined as the area surrounding Tank 58 that may have been affected by a petroleum release.</p> <p><u>Lateral boundaries</u>: Adjacent area, approximately 25-foot radius</p> <p><u>Vertical boundaries</u>: Ground surface to the total depth of the A1-aquifer zone</p> <p><u>Temporal boundaries</u>: Samples collected between 1994 to 1995 and 1999</p>
STEP 5	Develop Decision Rules	<p>For the evaluation process, the following decision rules will be observed:</p> <ol style="list-style-type: none"> (1) <u>Petroleum release</u>: If petroleum was observed, analytical results for soil or groundwater indicate the presence of petroleum constituents, or holes or cracks were observed in the tank or tank piping, then it is assumed that a petroleum release has occurred and the next decision rule will be evaluated. If a petroleum release is not evidenced, one groundwater sample for analysis of MTBE will be collected if the tank held gasoline. If a petroleum release is not evidenced and the tank held diesel or jet fuel, then the site will be recommended for closure. (2) <u>Source Removal</u>: If the tanks were removed and free product is not present, then the source will be considered to have been removed and the next decision rule will be evaluated. If the tank, free product, or both are present, then further action will be required. (3) <u>Groundwater Impact</u>: If petroleum constituents may reach surface water or supply wells, then further evaluation will be required. If surface water or a supply well has not been affected, then the next decision rule will be evaluated. (4) <u>Groundwater Plume Stability</u>: If concentrations of petroleum constituents in groundwater samples at the source and downgradient appear to be stable or decreasing, then the plume will be considered stable and the next decision rule will be evaluated. If the plume does not appear to be stable, then further evaluation will be required. (5) <u>Human Health Risk</u>: If the Tier 1 RBCA screening indicates an unacceptable human health risk, then further evaluation will be required. If the screening indicates acceptable human health risk, then the next decision rule will be evaluated. (6) <u>Ecological Risk</u>: If it is found that ecological receptors are adversely affected by the petroleum release, then further evaluation will be required. If ecological receptors are not affected, then the next decision rule will be evaluated. (7) <u>MTBE</u>: If MTBE analysis is necessary (see item 1) and if the concentration of MTBE exceeds 13 µg/L in a groundwater sample, then further evaluation will be required. If the MTBE concentration is below 13 µg/L, then the site will be recommended for closure.
STEP 6	Specify Limits on Decision Errors	<ol style="list-style-type: none"> (1) Analytical uncertainties will be checked through established QA/QC procedures. (2) The proposed sampling design is biased toward areas of known release. Because the sampling method is a non-probability-based design, statistical methods cannot be applied to reduce uncertainty.
STEP 7	Optimize Sampling Design	<p>Samples were collected on a biased basis to identify the presence of petroleum releases using site-specific information.</p>

Notes:

µg/L Micrograms per liter
 MTBE Methyl tertiary butyl ether

QA/QC Quality assurance and quality control
 RBCA Risk-based corrective action
 UST Underground storage tank

TABLE D9

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 RBCA EVALUATION

PETROLEUM COMPOUNDS DETECTED IN SOIL (0 TO 10 FEET)

Chemical	Frequency of Detection	SQL (mg/kg)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Volatiles Organic Compounds (VOCs)				
Benzene	0/14	0.00062-1.60	ND	ND
Toluene	0/14	0.00062-1.60	ND	ND
Ethylbenzene	1/14	0.00062-1.62	4.20E-01	4.20E-01
Xylene	7/16	0.00062-1.60	7.00E-01	5.40E+01
TPH-p as gasoline	4/10	0.62-160.0	2.70E+02	7.40E+02
Naphthalene	3/6	0.42-0.46	4.10E-01	8.60E-01
Semivolatile Organic Compounds (SVOCs)				
2-Methylnaphthalene	3/6	0.42-0.46	1.90E+00	2.60E+00
Benzo(a)pyrene	0/6	0.42-0.46	ND	ND
TPH-e as diesel	4/10	12.0-130.0	2.20E+02	4.30E+03
TPH-e as JP-5	6/8	12.0-13.0	6.10E+02	2.50E+03
TPH-e as kerosene	0/6	12.0-130.0	ND	ND
TPH-e as motor oil	6/8	12.0-14.0	7.00E+02	5.00E+03

Notes:

- mg/kg
- ND
- RBCA
- SQL
- TPH-e
- TPH-p
- JP
- Milligrams per kilogram
- Not detected
- Risk-based corrective action
- Sample quantitation limit
- Total petroleum hydrocarbons - extractable
- Total petroleum hydrocarbons - purgeable
- Jet petroleum

TABLE D10

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 RBCA EVALUATION

PETROLEUM COMPOUNDS DETECTED IN MOST RECENT GROUNDWATER SAMPLES¹

Analyte	Sample Date	Maximum Detected Result (mg/L)
Volatile Organic Compounds (VOCs)		
Benzene	August 1999	ND
Toluene	August 1999	ND
Ethylbenzene	August 1999	ND
Xylene	August 1999	ND
Naphthalene	November 1994	ND
IPH-p as gasoline	August 1999	ND

Notes:

mg/L Milligrams per liter

ND Not detected

RBCA Risk-based corrective action

TPH-p Total petroleum hydrocarbons - purgeable

¹ Because the risk evaluation for groundwater is limited to the vapor intrusion exposure pathway, sample results shown are limited to petroleum compounds that are volatile.

TABLE D11
MOFFETT FEDERAL AIRFIELD
PETROLEUM SITE EVALUATION
APPENDIX D - SITE 15 - TANK 58
RBCA EVALUATION TIER 1 SOIL RBSLs
CONSTRUCTION WORKER EXPOSURE SCENARIO

Chemical	Construction Worker RBSLs	
	Carcinogenic Soil PRG (mg/kg)	Noncarcinogenic Soil (mg/kg)
Volatile Organic Compounds (VOCs)		
Ethylbenzene	NA	1.19E+04 (2.34E+02) ²
Xylene	NA	1.10E+04 (2.14E+02) ²
TPH-p as gasoline	2.19E+04	1.06E+05
Naphthalene	NA	4.53E+02 (2.25E+02) ²
Semivolatile Organic Compounds (SVOCs)		
2-Methylnaphthalene	NA	---
TPH-e as diesel	2.98E+04	---
TPH-e as JP-5	NA	9.36E+03

Notes:

- mg/kg Milligrams per kilogram
- EPA U.S. Environmental Protection Agency
- PRG Preliminary remediation goal
- RBCA Risk-based corrective action
- RBSL Risk-based screening level
- TPH-e Total petroleum hydrocarbons - extractable
- TPH-p Total petroleum hydrocarbons - purgeable
- NA Not available

¹ RBSLs based on direct soil exposure (soil ingestion, absorption [dermal contact], or inhalation of particles and volatiles released from soil to outdoor air) were updated to reflect new dermal exposure assumptions used by EPA Region 9 to develop PRGs (EPA 1999b). The updated RBSLs incorporate revisions to the exposed skin surface area and the soil-to-skin adherence factor and revisions to default absorption factors for volatile organic compounds. Although EPA Region 9 PRGs are not available for the construction worker exposure scenario, soil RBSLs for this exposure scenario were calculated based on exposure assumptions and intake algorithms presented in EPA Region 9 guidance (1999b).

² The value shown in parentheses is the chemical-specific saturation concentration in soil. This value is shown because it is lower than the calculated RBSL, and therefore represents the concentration that is to be used for screening; however, for estimating chemical-specific hazard quotients, the calculated RBSL (underlined value) is used.

TABLE D12

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58

RBCA EVALUATION TIER 1 SOIL RBSLS¹
 OCCUPATIONAL WORKER VAPOR INTRUSION EXPOSURE SCENARIO

Chemical	Soil	
	Carcinogenic RBSL (mg/kg)	Noncarcinogenic RBSL (mg/kg)
Volatile Organic Compounds (VOCs)		
Ethylbenzene	NA	1.35E+03 (2.34E+02) ²
Xylene	NA	1.08E+04 (2.14E+02) ²
Naphthalene	NA	3.74E+02 (2.25E+02) ²

Notes:

- mg/kg
- NA
- RBCA
- RBSL
- 1

Milligrams per kilogram
 Not applicable
 Risk-based corrective action
 Risk-based screening level
 RBSLs for the vapor intrusion exposure pathway were developed using the California Department of Toxic Substances Control (DTSC) version (VI.3, February 1999) of the Johnson and Ettinger (1991) vapor intrusion model. Except for the following parameters, default assumptions included in the model were used to calculate the RBSLs. Values for these parameters were revised to account for an occupational exposure scenario rather than model's default residential exposure scenario.

- (1) The exposure frequency (EF), exposure duration (ED), and averaging time for noncarcinogens (ATnc) were revised to 250 days/year, 25 years, and 10,950 days, respectively. These values are used by EPA Region 9 (1999b) to calculate occupational PRGs.
 - (2) The default value of 15 centimeters (cm) was selected to represent the depth below grade to the bottom of the enclosed-space floor (Lf). The model currently provides a selection of 15 cm or 200 cm to represent Lf. Use of 15 cm (for example, for buildings with slab on grade construction rather than a basement) is representative of occupational exposures.
 - (3) The building ventilation rate (Qbuilding) was revised to incorporate an occupational air exchange rate. The default occupational air rate of 0.83 air changes per hour presented by ASTM (1995) was used.
- The value shown in parentheses is the chemical-specific saturation concentration for the indicated chemical. This value shown is because it is lower than the calculated RBSL and therefore represents the concentration that is used for screening; however, for estimating chemical-specific hazard quotients, the calculated RBSL (underlined value) is used.

TABLE D13

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 RBCA EVALUATION
 CONSTRUCTION WORKER EXPOSURE SCENARIO

Chemical	Maximum Detected Soil Concentration ¹ (mg/kg)	Construction Worker RBSL (mg/kg)	Chemical-specific Hazard Quotient or Risk Ratio
Noncarcinogenic Chemicals			
Ethylbenzene	4.20E-01	1.19E+04	3.53E-05
2-Methylnaphthalene	2.60E+00	---	NA
Naphthalene	8.60E-01	4.53E+02	1.90E-03
Xylene	5.40E+01	1.10E+04	4.91E-03
TPH-e as diesel	4.30E+03	---	NA
TPH-p as gasoline	7.40E+02	1.06E+05	6.98E-03
TPH-e as JP-5	2.50E+03	9.36E+03	2.67E-01
TPH-e as motor oil	5.00E+03	---	NA
Total Noncarcinogenic Hazard Index Ratio for Exposure			
Carcinogenic Chemicals			
TPH-e as diesel	4.30E+03	2.98E+04	1.44E-07
TPH-p as gasoline	7.40E+02	2.19E+04	3.38E-08
Total Carcinogenic Risk Ratio for Exposure			
1.78E-07			

Notes:

- JP Jet petroleum
- mg/kg Milligrams per kilogram
- RBCA Risk-based corrective action
- RBSL Risk-based screening level
- TPH-e Total petroleum hydrocarbons - extractable
- TPH-p Total petroleum hydrocarbons - purgeable
- Not available
- NA Not applicable
- 1 Maximum chemical concentrations in the 0- to 10-foot depth interval were used in the petroleum tier 1 screening evaluation for construction worker exposure scenario.

TABLE D14

MOFFETT FEDERAL AIRFIELD
 PETROLEUM SITE EVALUATION
 APPENDIX D - SITE 15 - TANK 58
 RBCA EVALUATION

OCCUPATIONAL EXPOSURE SCENARIO: INHALATION OF VOLATILE CONSTITUENTS
 INTO ENCLOSED-SPACE AIR FROM SUBSURFACE SOIL

Chemical	Maximum Detected Soil Concentration ¹ (mg/kg)	Inhalation from Soil to Enclosed Space Air RBSL (mg/kg)	Chemical-specific Hazard Quotient or Risk Ratio
Noncarcinogenic Chemicals			
Ethylbenzene	4.20E-01	1.35E+03	3.11E-04
Xylene	5.40E+01	1.08E+04	5.00E-03
Naphthalene	8.60E-01	3.74E+02	2.30E-03
Total Noncarcinogenic Hazard Index Ratio for Exposure			7.30E-03

Notes:

- mg/kg Milligrams per kilogram
- RBCA Risk-based corrective action
- RBSL Risk-based screening level
- ND Not detected
- NA Not applicable
- ¹ Maximum chemical concentrations in the 0- to 10-foot depth interval were used in the petroleum tier I screening evaluation for the occupational worker inhalation exposure scenario. Chemicals evaluated are limited to petroleum compounds that are volatile.

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ATTACHMENT D1

**SOIL BORING LOGS AND MONITORING WELL
DIAGRAM**

BOREHOLE LOG

LOCATION OF BOREHOLE	JOB NO.:	BOREHOLE DESIGNATION: SB58-001
	CLIENT: U.S. NAVY	SURFACE ELEVATION:
	SITE: Moffett Federal Airfield	DEPTH TO WATER:
	SUBSITE: Sump 58	LOGGED BY: Brian Schuller
	DRILLING CO.: Bayland	DRILLING DATE(S): 11-7-94
	DRILLING PERSONNEL/METHOD:	
Rob Slagle (driller), John Bass (helper)/CME-75 with hollow stem auger, 6.5" OD, sampled with 5-foot CME core barrel (CB)		

SAMPLER TYPE	SAMPLE DEPTH		BLOWS/5 IN. SAMPLE	RECOVERED	DRIVEN	TIME	PID Rdg.	ANLYS PHYS CHEM	WELL Info.	DEPTH in Ft.	USCS SOIL TYPE GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT										
CB	0			3.0/4.0		1309				1	ML	1258 - Cut through approximately 0.8 feet of asphalt. 1.0 to 2.5 feet: SILT with CLAY and SAND (ML); light olive brown (2.5Y 5/4), large rock fragments (to 0.2 foot diameter), possibly fill. 2.5 to 4.0 feet: CLAYEY SILT (ML); typical, very dark gray to black, slightly plastic, stiff, total depth measured at 4.5 at 1310.
										2		
										3		
		4								4		
CB	4			5.0/5.0		1315				5	CL/ML	4.0 to 13.0 feet: SILTY CLAY to CLAYEY SILT (CL/ML); gray (5Y 5/1) with 5Y 6/1 mottles, color lightens with depth to bluish gray (5B 6/1), blocky (crumbly), some organic material, land snail at 4.5 feet, gasoline odor throughout, increasing plasticity with depth, reacts with HCl, grades to below.
										6		
								X		7		
										8		
CB	9			5.0/5.0		1322				9		13.0 to 14.0 feet: SILTY SAND (SM); olive (5Y 4/3), very fine to fine, slight hydrocarbon odor throughout, roots, well sorted, no reaction with HCl, water measured at 13.4 feet. 14.0 to 19.0 feet: No recovery at 1350. Driller installs sand trap and proceeds to resample. Total depth in augers measured at 16.25 feet and water measured at 15.1 feet. 14.0 to 18.0 feet: SILTY SAND (SM); gray (5Y 5/1) to gray brown, very fine to fine, moist to saturated with depth, color change at bottom 1.0 foot of sample to dark greenish gray (5G 4/1), slight coarsening with depth, some black pebbles, roots, no odor.
										10		
								X		1		
							300 - 450			2		
CB	14			4.0/5.0		1350 1357				3	SM	
										4		
										5		
										6		
										7		
										8		
CB	19			1.25/ 2.0		1422				9		
										20		

BOREHOLE LOG

LOCATION OF BOREHOLE	JOB NO.:	BOREHOLE DESIGNATION: SB58-001
	CLIENT:	SURFACE ELEVATION:
	SITE:	DEPTH TO WATER:
	SUBSITE:	LOGGED BY:
	DRILLING CO.:	DRILLING DATE(S):
	DRILLING PERSONNEL/METHOD:	

SAMPLER TYPE	SAMPLE DEPTH		BLOWS/ 8 IN. SAMPLE	RECOVERED	DRIVEN	TIME	PID Rdg.	ANLYS		WELL Info.	DEPTH in Ft.	USCS SOIL TYPE GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYS	CHEM.				
	21.25											ML	19.0 to 21.25 feet: As above; grades to medium sand, color as above to olive brown at 19.3. Total depth drilled 21.25 feet. Total depth measured 20.25 feet.
											1		
											2		
											3		
											4		
											5		
											6		
											7		
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											40		

BOREHOLE LOG

LOCATION OF BOREHOLE	JOB NO.: 044-0235IRRM1	BOREHOLE DESIGNATION: SB58-02A
	CLIENT: U.S. NAVY	SURFACE ELEVATION:
	SITE: Moffett Federal Airfield	DEPTH TO WATER:
	SUBSITE: Sump 58	LOGGED BY: Brian Schuller
	DRILLING CO.: Bayland	DRILLING DATE(S): 11-8-94
	DRILLING PERSONNEL/METHOD: Rob Slagle (driller), John Bass (helper)/CME-75 with hollow stem auger, 6.5" OD, sampled with 5-foot CME core barrel (CB)	

SAMPLER TYPE	SAMPLE DEPTH		BLOWS/5 IN. SAMPLE	RECOVERED	DRIVEN	TIME	PID Rdg.	ANLYS		WELL Info.	DEPTH in Ft.	USCS SOIL TYPE GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYS	CHEM				
CB	0			2.7/4.5		1008					1		1000 - offset approximately 1.5 feet from SB58-002 and cut approximately 0.5 feet through asphalt.
											2		0.5 to 1.0 feet: FILL; coarse sand and gravel, dark yellowish brown, loose.
											3	CL	1.0 to 1.5 feet: FILL; coarse sand and gravel, angular, some clay, olive brown.
											4		1.5 to 2.7 feet: SILTY CLAY (CL); typical, dark gray to black, stiff, slightly plastic.
CB	4.5	4.5		5.0/5.0		1015	5.0 - 10.0				5	CL/ML	4.5 to 12.4 feet: SILTY CLAY to CLAYEY SILT (CL/ML); gray to dark gray (5Y 5/1 to 4/1) with light gray (5Y 8/1) mottling, color becomes lighter with depth to light gray (5Y 7/1), blocky (crumbly), increasing clay with depth, roots, no odor, some shell fragments from 9.0 to 9.5 feet.
											6		
											7		
											8		
CB	9.5	9.5		4.3/5.0		1028			X		9		
											10		
											1		
											2	SC	12.4 to 13.8 feet: CLAYEY SAND (SC); dark gray to olive gray (5Y 4/1 to 4/2), fine to very fine, roots, moist, no odor.
											3		
CB	14.5	14.5		5.0/5.0		1033	0		X		4	SM	14.5 to 19.0 feet: SAND (SM); dark grayish brown (2.5Y 4/2), fine, moist to saturated (saturated from 16.5 to 17.0 feet), well sorted, rust-colored roots, no odor, water measured at 18.5 feet in augers at 1031.
											5		
											6		
											7		
											8	SM	
											9		19.0 to 19.5 feet: SAND (SM); very dark gray (3/N3/), fine (but slightly coarser than above, saturated, roots, slightly blocky,
	19.5										20		

BOREHOLE LOG

LOCATION OF BOREHOLE	JOB NO.:	BOREHOLE DESIGNATION: SB58-003
	CLIENT: U.S. NAVY	SURFACE ELEVATION:
	SITE: Moffett Federal Airfield	DEPTH TO WATER:
	SUBSITE: Sump 58	LOGGED BY: Brian Schuller
	DRILLING CO.: Bayland	DRILLING DATE(S): 11-8-94
	DRILLING PERSONNEL/METHOD:	
Rob Slagle (driller), John Bass (helper)/CME-75 with hollow stem auger, 6.5" OD, sampled with 5-foot CME core barrel (CB)		

SAMPLER TYPE	SAMPLE DEPTH		BLOWS/ 8 IN. SAMPLE	RECOVERED	DRIVEN	TIME	PID Rdg.	ANLYS		WELL Info.	DEPTH in Ft.	USCS SOIL TYPE GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYS	CHEM				
CB	0			3.2/4.0		0815					1	GP	0805 - Cut approximately 0.8 feet through asphalt. 0.8 to 1.3 feet: GRAVEL (GP); dark yellowish brown (10YR 3/4), angular gravels with some silty sand, loose, probably fill. 1.3 to 2.2 feet: SAND (SP); light olive brown (2.5Y 5/4), numerous granules, pebbles, and gravels in a fine- to medium- grained sand matrix, no odor. 2.2 to 3.0 feet: CLAYEY SILT (ML); typical, black to gray, slightly plastic, stiff, grades to below. 3.0 to 9.5 feet: CLAYEY SILT to SILTY CLAY (ML/CL); bluish gray (5B 6/1 to 5/1) with gray and olive brown mottles, blocky (crumbly), increasing clay with depth, strong reaction with HCl, gasoline odor (strongest between 6.0 and 7.0 feet).
											2	SP	
											3	ML	
CB	4.5			5.0/5.0		0820	70.0 - 80.0				4	ML/CL	
							400				5		
											6		
							170		X		7		
											8		
CB	9.5			5.0/5.0		0835					9	SC	
											10		
											1		
							20.0 - 30.0		X		2		
											3		
CB	14.5			2.0/5.0		0848					4	SM	
											5		
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	19.5										20		

14.5 to 16.5 feet: SAND (SM); olive brown (2.5Y 4/3), fine to very fine, wet to saturated, less clay than above, roots, no odor, crumbly.

Total depth measured at 17.3 feet at 0848.
 Depth to water measured at 13.5 feet at 0900.

MONITORING WELL COMPLETION DIAGRAM

CONCRETE PAD

FLUSH-MOUNTED PROTECTIVE CASING

ELEVATION TOC: FEET

GROUND ELEVATION: -0.15 FEET

WELL

WELL NO.: W58-001

BOREHOLE NO.: SB58-001

SITE: Moffett Federal Airfield

SUBSITE: Sump 58

DATE: 11-07-94

CEMENT/BENTONITE GROUT

FROM 0.15 TO 8.9 FT. BELOW GROUND

BENTONITE SLURRY

FROM 8.9 TO 10.6 FT. BELOW GROUND

2" PVC RISER CASING

FROM 0.15 TO 12.1 FT. BELOW GROUND

TYPE OF INSTALLATION

OEPN HOLE

INSIDE HOLLOW STEM AUGER

MEASURING POINT

TOP OF CASING

GROUND SURFACE

TOP OF PROTECTIVE CASING

#2/16 SAND PACK

FROM 10.6 TO 17.5 FT. BELOW GROUND

0.01 SLOT PVC SCREEN

FROM 12.14 TO 17.1 FT. BELOW GROUND

DRILLING INFORMATION

DRILLING COMPANY:

Bayland

DRILLING METHOD:

Hollow Stem Auger

DRILLING DATE(S):

11-7-94

INSTALLATION DATE(S):

11-7-94 and 11-8-94

BOTTOM OF WELL

17.7 FEET:

WATER ADDED DURING DRILLING

YES GALLONS:

NO

PVC SILT TRAP

FROM TO FT. BELOW GROUND

STAINLESS STEEL CENTRALIZERS:

FEET

FEET

TOTAL DEPTH OF BOREHOLE: 19.3 FT.

6.5" BOREHOLE

BACKFILL MATERIAL: Bentonite and Sand

BOREHOLE LOG

LOCATION OF BOREHOLE	JOB NO.: 044-0235TRRIMI	BOREHOLE DESIGNATION: SB58-002
	CLIENT: U.S. NAVY	SURFACE ELEVATION:
	SITE: Moffett Federal Airfield	DEPTH TO WATER:
	SUBSITE: Sump 58	LOGGED BY: Brian Schuller
	DRILLING CO.: Bayland	DRILLING DATE(S): 11-8-94
	DRILLING PERSONNEL/METHOD:	
Rob Stagle (driller), John Bass (helper)/CME-75 with hollow stem auger, 6.5" OD, sampled with 5-foot CME core barrel (CB)		

SAMPLER TYPE	SAMPLE DEPTH		BLOWS/ 6 IN. SAMPLE	RECOVERED	DRIVEN	TIME	PID Rdg.	ANALYS		WELL Info.	DEPTH in Ft.	USCS SOIL TYPE GRAPHIC LOG	SOIL DESCRIPTION
	TOP	BOT						PHYS	CHEM				
CB	0			1.1/4.5		0940					1		0933 - Cut through approximately 0.5 feet asphalt. 0.5 to 2.6 feet: FILL; gravel, dark yellowish brown, angular, loose. NOTE: Poor recovery.
											2		
											3		
											4		
CB	4.5	4.5		0.3/5.0		0945					4	CL	4.5 to 4.8: SILTY CLAY (CL); dark gray (2.5Y 4/1), slightly plastic, no odor. NOTE: Poor recovery - rock may be blocking shoe.
											5		
											6		
											7		
CB	9.5	9.5		0.0/5.0		0947					9		9.5 to 14.5 feet: As above; no odor. NOTE: Rock stuck in shoe, will offset. Also, noted water seepage from under asphalt.
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ATTACHMENT D2
PHOTOGRAPHS OF TANK 58

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PHOTOGRAPHS OF TANK 58

**MOFFETT FEDERAL AIRFIELD
APPENDIX D - SITE 15 - TANK 58**



Tank 58 under the painted white "X" next to Building 544



Tank 58 looking into the concrete vault

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PHOTOGRAPHS OF TANK 58 (Continued)

**MOFFETT FEDERAL AIRFIELD
APPENDIX D - SITE 15 - TANK 58**



The other half of Tank 58 vault

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ATTACHMENT D3

**COUNTY OF SANTA CLARA
TANK CLOSURE INSPECTION**

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County of Santa Clara

Environmental Resources Agency
Department of Environmental Health
2220 Moorpark Avenue
San Jose, California 95128
(408) 299-6930
FAX (408) 280-6479



HAZARDOUS MATERIALS STORAGE
 HAZARDOUS WASTE GENERATOR
OFFICIAL NOTICE OF INSPECTION

DATE 4-12-94

DBA/NAME NAS Moffett Field # 58A & 58B

Comments: (see marked violations on page 1) + 4/6 Tank # 58

Facility Closure Inspection - #58A & B
Tank Closure Inspection Tank #58

2 - oil/water separators within same excavation
removed by Navy Public Works per County
requirements.

Diesel odor detected at time of removal

2 soil samples collected by Navy & analysed
by Sierra Laboratories.

Analysis Results: Sample # 4D71504 (58A) 2,300 mg/kg T.
4D71505 (58B) 220 " " T.
1 Xylene - .7 mg/kg
1 XBTXE - N.D.

~~177~~ ~~Proctor~~ ~~copy of tank~~

Received by:

[Signature]

Inspected by:

R. Holston

Hazardous Materials Compliance Division

Samples taken? Yes No

Photos taken? Yes No

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DNC

**RESPONSE TO COMMENTS
BASEWIDE PETROLEUM SITE EVALUATION METHODOLOGY
TECHNICAL MEMORANDUM DRAFT APPENDIX D SITE 15 - TANK 58
PETROLEUM EVALUATION
MOFFETT FIELD AIRFIELD**

June 2, 2000

Tetra Tech EM Inc. (TtEMI) received Navy (Kelli Hill, Wilson Doctor, and Don Chuck) comments on internal draft Appendix D on January 27, 2000. Draft Appendix D has been revised to address these comments. Navy comments are presented in bold, followed by TtEMI's response. The format of Appendix D has been revised per the Navy (Don Chuck) and Regional Water Quality Control Board (RWQCB) comments on the petroleum site evaluation on April 15, 2000.

COMMENTS BY KELLI HILL

GENERAL COMMENTS

Comment 1:

For Section 5.0 Human Health Risk Evaluation: Throughout this section and in the Tables (D-8 through D-11) there is a discussion of "ethylbenzene" being used for risk calculations. Nowhere in this document is there a sample with a detection of this contaminant. According to this document, the only detections of this chemical occurred after tank removal by Navy Public Works Center (NPWC). But it also states that these samples are not included (even though it appears that the table on pg. D-8 contains a partial listing.) Please rectify this situation. NPWC also had detections of benzene, toluene, etc., which were not used to calculate risk. It is unclear why these detections were not used. Please clarify.

Response:

Tables (D-9 through D12) have been revised and Tables D-2 and D-3 following the text have been added to include the NPWC soil data that were collected after Tank 58 was removed. Furthermore, Tables D13 and D14 have also been added. Both Navy and TtEMI data are used to calculate risk.

SPECIFIC COMMENTS

Comment 1:

Executive Summary:

- a. Indicate size and use of tanks in this section.
- b. ES-2; bullet 5. This bullet indicates the dissolved TPH concentrations are stable. This contradicts the next sentence that indicates "TPH-e...has increased".
- c. ES-2; paragraph 2; sentence 2. This sentence states, "The plume stability is uncertain". Please clarify if this means "movement" of the plume or "chemical concentration" of the plume. Make sure it does not contradict with #2b.
- d. ES-2; paragraph 2; line 8. Add "is" after "this".
- e. ES-4 and ES-5. Maximum Chemical Concentration Tables. Include detection limits for "ND".

- f. **ES-5. Maximum Concentrations in Groundwater; Benzene. Correct date (11/91) from "Most Recent Groundwater Sample" column.**
- g. **ES-6. Tier 1 Screening. Occupational Worker Exposure Scenario (Direct Exposure to Soil). According to Section 5.0 this scenario was not performed. Please explain how the ratios were determined.**

Response:

- 1a. The first sentence of the third paragraph has been revised to include tank size (300 gallons) and its use (oil/water separator).
- 1b. August 1999 groundwater data indicate that concentrations of total petroleum hydrocarbons (TPH) have decreased. The text has been revised accordingly.
- 1c. This paragraph has been revised using 1999 groundwater data, which indicate that petroleum constituent concentrations have decreased.
- 1d. This sentence has been removed because the paragraph was revised.
- 1e. Tables on pages ES-4 and ES-5 and in the text on D8 and D10 have been revised to indicate the detection limits next to "ND" in parentheses.
- 1f. The table on ES-5 has been revised to reflect the most recent sample date for this constituent (August 1999).
- 1g. The Tier 1 screening table on ES-6 has been revised to indicate that Occupational Worker Exposure Scenario (Direct Exposure to Soil) is not applicable (NA).

Comment 2:

Section 1.0 Introduction:

- a. **D-1; paragraph 2, line 8. Add "by the" after "presented".**
- b. **D-2; Section 1.3; line 5. Add "are" after "area".**
- c. **D-5; Section 1.3.6. Limits on Decision Errors. There is no mention in the document of a "t-test" being performed. Is it necessary? Also, add "are" after "petroleum constituents" on line 3.**

Response:

- 2a. Paragraph 2, line 8 on Page D-1 has been revised to state "...presented by the..."
- 2b. Section 1.3, line 5 on page D-2 is now Section 4.0; however, it has been revised accordingly.
- 2c. Section 1.3.6 is now Section 4.6. A t-test is unnecessary for this site because: the minimal cleanup criteria for Petroleum Sites at Moffett Federal Airfield were established by the Regional Water Quality Control Board (RWQCB); and concentrations of petroleum constituents are below these cleanup criteria. Therefore, there is no risk. A t-test would be used to indicate background or natural concentrations of petroleum

constituent at a site to aid in assessing risk. In addition, line 3 has been revised to include the word "are" after Tank 58 area.

Section 2.2.1, Navy Public Works Removal of Tank 58.

- a. Indicate month of the tank removal along with the year.
- b. Reference Figure D4 for soil sample locations.
- c. Last sentence. A portion of the NPWC data is located on the Table on page D-8. Please correct this sentence to reflect this.
- d. Data from these samples should be included. Since, many of the analytes (i.e., benzene, toluene, and ethylbenzene) were "ND" in later soil sampling, it may be argued that the excavation data needs to be used where appropriate for "maximum concentrations". If the data is to be excluded it should indicate why (i.e., over-excavation of soil around the tank was completed).

3a. Section 2.2.1 is now Section 2.2. The first sentence has been revised to state that Tank 58 was removed in April 1994.

3b. TEMI has revised the second sentence to include Figure D4 as a reference.

3c. The NPWC soil data for the Tank 58 removal have been included in the table on page D9 that shows the highest concentrations and have been added as Tables D2 and D3 following the text. A sentence has been added to indicate that the data are also presented in the following section.

3d. Refer to response to comment 3c.

Comment 4:

Section 3.1, Petroleum Contaminant Source Removal. Sentence 2. This sentence seems to indicate that the remaining contamination in the soil may be a "contaminant source". If this is not true please remove or re-write.

Response:

Section 3.1 has now become Section 7.1, and this section has been revised to indicate that contamination remaining in soil is not a source.

Comment 5:

Section 3.4, Groundwater Plume Stabilization. Paragraph 2. This paragraph makes statements about trends, but there is not enough information to make them. Delete the first two sentences.

Response:

Paragraph 2 of Section 3.4 is now included in Section 7.3 and has been revised to reflect the results from the most recent sample in August 1999. These two sentences were removed from the revised paragraph.

Comment 6:

Section 3.5, Groundwater Impact Evaluation Conclusion:

- a. Discuss "source removal".

b. **D-11; paragraph 1. There is no information supporting an increase in total petroleum hydrocarbons-extractable (TPH-e) with precipitation. Either explain or delete.**

Response:

6a. This sentence is now included in Section 7.1 Sentence 2 indicates that Tank 58 was the source and that Tank 58 has been removed.

6b. The sentence referring to TPH-e increasing with precipitation has been removed.

Comment 7:

Section 4.0, Sensitive Receptor Evaluation. Reference the "California state guidance".

Response:

Section 4.0 has now been included in Section 8.0, but Section 4.0 has been revised to state, "Potential sensitive receptors at the Tank 58 area include commercial, industrial, and construction workers." California state guidance has not been referenced.

Comment 8:

Section 5.1, Tier 1, Screening Evaluation Results.

a. **D-12; paragraph 2; line 1. This sentence indicates the Occupational scenario could not be completed because where were no samples from 0-2 ft. Please specify which scenario is being discussed. According to Figure D-10 there isn't even a complete exposure pathway for this scenario. Please correct this contradiction.**

b. **D-12; paragraph 2, line 3. There are no carcinogenic risk ratios calculated for soil. Please correct.**

c. **D-12; paragraph 2. See comment #1.**

d. **D-12; paragraph 3. Explain the reasoning for choosing the contaminants used in the calculations for Tables D-10 and D-11.**

Response:

8a. Section 5.1 has now become Section 8.1.1. This section has been revised to state that the occupational worker exposure scenario (direct exposure to soil) could not be evaluated because no soil data exist for the 0 to 2 feet interval and the area is paved with asphalt, eliminating the exposure pathway. Furthermore, the risk sections have been revised to more clearly explain the risk evaluation.

8b. The discussion of the carcinogenic risk ratio has been removed from the human health risk section.

8c. Figure D-11 (formerly Figure D-10) has been revised to indicate that there is no exposure scenario for ingestion/absorption of soil by occupational workers.

8d. The contaminants used in the calculations for Tables D-11 and D-12 (formerly Figures D-10 and D-11) were chosen based on a constituent-based approach, as outlined in Section 6.0 of the Basewide Petroleum Site Evaluation Methodology Technical Memorandum (TtEMI 1998).

Comment 9:

Section 7.0, Conclusions.

- a. **D-14; paragraph 2. Indicate which Occupational Scenario is being compared, since all scenarios were not calculated (see pg. D-12, paragraph 2).**
- b. **D-15; last paragraph. Correct date (fall 1999). Add to last sentence wording similar to "...and to meet methyl tertiary butyl ether (MTBE) testing requirements."**

Response:

- 9a. The conclusions are now included in Section 10.0. The "no human health risk" paragraph in Section 10.0 has been revised to state that the construction worker scenario was evaluated and the result did not present an unacceptable risk. Risks to occupational workers were not calculated using soil data because there is no complete pathway.
- 9b. The last paragraph has been removed because additional data were collected in August 1999. The data were unavailable for the draft Appendix D report submitted in September 1999.

Comment 10:

Table D-11. Units indicated in table in columns 2 and 3 are for soil, not groundwater. Please correct.

Response:

Former Table D-11 (now Table D-13) has been revised to reflect groundwater concentrations presented in milligrams per liter (mg/L).

Comment 11:

Figure D-10, Exposure Scenario Flowchart. This figure, specifically the receptor characterization, does not correlate with Section 4.0. Please correct.

Response:

Figure D-10 has been revised to indicate that inhalation may be a pathway for the occupational worker scenario. Section 4.0 has now become part of Section 8.0.

COMMENTS BY WILSON DOCTOR:

Comment 1:

Page ES-3. Align "Investigation Conducted" table with "Leak and Contamination" table.

Response:

TtEMI has aligned the "Investigation Conducted" table with the "Leak and Contamination" table.

Comment 2:

Page D-5, Section 2.1. Do not understand "surficial expression". Is "surficial" a word?

Response:

Section 2.1 has now become Section 6.0. "Surficial expression" has been replaced with "plan view."

Comment 3:

Page D-12, second paragraph, first sentence. Missing "be". Should be "could not be evaluated".

Response:

The first sentence in the second paragraph on D-12 has been revised accordingly. However, this section has now become Section 8.1.1.

Comment 4: Page D-12, second paragraph, sixth sentence. Missing “for” should be “Table D-9 presents the Tier 1 soil screening evaluation *for* the construction worker scenario.”

Response: This section, Section 5.1, has now become Section 8.1.1. The sixth sentence of the second paragraph on page D-12 has been revised accordingly.

Comment 5: Page D-12, second paragraph, last sentence. Change “indicting” to “indicating”.

Response: This section has now become Section 8.1.1. TtEMI has revised the sentence to use “indicating.”

Comment 6: Page D-12, third paragraph, first sentence. Do not understand “potentially complete”.

Response: The first sentence in the third paragraph of revised Section 8.1.1. has been revised to state, “...volatile organic compounds (VOCs) released into enclosed-space (building) air is a potential exposure pathway and was evaluated...”

Comment 7: Page D-13, second paragraph, third sentence. Change “references doses” to “reference doses”.

Response: The last sentence in this paragraph has been revised accordingly in Section 8.1.3.

Comment 8: Page D-13, third paragraph, last sentence. Change to “using *this* conservative assumption”.

Response: The last sentence in this paragraph in Section 8.1.3 has been revised accordingly.

Comment 9: Page D-14, Section 7.0, second paragraph, second sentence. Change to “A comparison *of*”

Response: Section 7.0 has now become Section 10.0. TtEMI has revised the sentence accordingly.

Comment 10: Page D-15, second paragraph, first sentence. Change “indicates” to “indicate”.

Response: This sentence is now in Section 10.0. The first sentence in the second paragraph has been revised accordingly.

Comment 11: Page D-15, fourth paragraph, first sentence. Change to “...biodegradation has been observed at several other petroleum sites at MFA; therefore, biodegradation is likely occurring at Tank 58 (PRC 1996b).”

Response: This sentence is now in Section 10.0. As a result of a recent RWQCB comment regarding biodegradation rates at Moffett Federal Airfield, this paragraph has been revised to state biodegradation is most likely occurring at a site based on decreasing concentrations of chemicals of concern (COCs).

Comment 12: Page D-15, last paragraph, first sentence. "To be performed in fall 1999", it is currently past fall 1999.

Response: TtEMI has revised this appendix using the revised groundwater data for the August 1999 sample from well W58-1. Consequently, this paragraph has been removed from the appendix. The August 1999 data were unavailable in September, when draft Appendix D was submitted for review.

COMMENTS BY DON CHUCK:

Comment 1: Executive Summary, paragraph 3, page ES-1. In the second sentence, several constituents are listed as remaining in the soil after the tank removal. Comparing the list in this sentence to the table for soil contamination in the Tank Checklist, there is no indication of benzene, toluene, or ethylbenzene being present. In the last sentence, TPH-e as diesel is listed as present while the checklist table does not. Please correct.

Response: Data for NPWC soil samples collected from the tank excavation during Tank 58 removal have been added following the text in Table D3. Based on NPWC data, the constituents remaining in soil are gasoline, diesel, ethylbenzene, xylene, JP-5, naphthalene, 2-methylnaphthalene, and motor oil.

Comment 2: Executive Summary, Paragraph 5, Bullet 5, Page ES-2. The first sentence states that the concentrations are stable. In the following statement, it is noted that benzene and TPH-e increased. Also, in the following paragraph, the second sentence states that "the plume stability is uncertain." This bullet needs to be corrected. Additionally, no plume boundaries have been identified for this site.

Response: TtEMI has revised this bullet and subsequent paragraph to reflect the most recent groundwater data collected in August 1999. These data indicate that concentrations of petroleum constituents have decreased from 1995.

Comment 3: Tank 58, Closure Checklist, Page ES-3. The Navy recommends tank closure for this site. However, in the conclusion and recommendations section of this report, a further groundwater sample is recommended to help determine plume stability. Since additional data appears to be needed to make a final conclusion, the closure recommendation appears to be premature.

Response: TtEMI collected an additional groundwater sample from well W58-1 in August 1999. The analytical results from this sample demonstrate that concentrations of petroleum constituents have decreased. The only detection of petroleum constituents was TPH-e as diesel at 200 micrograms per liter ($\mu\text{g/L}$).

Comment 4: Tank 58, Closure Checklist, Page ES-6. In the summary table, closure is recommended. See Comment 3.

Response: Please refer to the response to comment 3.

Comment 5: Section 1.1, Paragraph 1, 2nd Sentence, Page D-1. Remove the portion of the sentence “the tanks...associated with.” The sentence seems rather clumsy as written.

Response: TtEMI revised this sentence of Section 2.1 accordingly.

Comment 6: Section 2.0, 1st Sentence, Page D-5. Remove this sentence entirely. It has already been stated before that Tank 58 is the only tank to be covered by this report.

Response: The first sentence in former Section 2.0, currently Section 6.0, has been removed.

Comment 7: Section 2.1, 2nd Paragraph, 5th Sentence, Page D-5. Change “surficial expression” to “plan view.”

Response: TtEMI revised this section, currently Section 6.0, accordingly.

Comment 8: Section 2.1, 3rd Paragraph, 2nd Sentence, Page D-6. It appears from review of Figure D-6 that the groundwater flow direction in the vicinity of Tank 58 is 5° to the east, not west.

Response: TtEMI revised this sentence and the groundwater flow arrow to indicate groundwater flows 5 degrees east of north. This figure is now Figure D-7.

Comment 9: Section 3.2, Page D-7. The heading for this section should be changed since there is no free product at this site as stated in Section 3.0. In the second sentence, it is stated that petroleum constituents could be leached into the groundwater through storm events. Since the area around Tank 58 is covered by asphalt pavement, how likely is this to occur? If not likely, remove sentence. The sentence following the table on page D-8 (“Free...Section 2.2) should be removed. It has already been noted that free product is absent from this site. Add to the next sentence, add that contamination may have also been the result of leaking pipes and tank overfill. Contamination could have also come from the oil/water separator associated with Tank 58.

Response: This section title is no longer used because the entire document format has been revised at the request of the Navy and RQWCB.

Comment 10: Section 3.3, Paragraph 6, Last Sentence, Page D-9. Change “Site 15” to “Tank 58”.

Response: TtEMI changed all references from Site 15 to Tank 58 in the appendix except for the first sentence in Section 2.1, “Site Background.”

Comment 11: Section 3.5, Page D-10. In the sentence at the top of page D-11, it is stated that TPH-e as diesel appears to increase with precipitation. Rainfall data should be provided to back this conclusion up. September, where the greatest increase is seen, is not normally a “wet” month at Moffett. The rainy season generally doesn’t start until October. Provide justification for this conclusion or remove the sentence.

Response: All references to increasing concentrations of petroleum constituents with rainfall have been removed from the document.

Comment 12: Section 4.0, 5th and 6th Sentence, Page D-11. References to Site 15 should be removed, since it has already been stated earlier that this report is only dealing with Tank 58. It is unclear as to what is being stated in the sixth sentence. Tank 58 was the source of contamination for soil and groundwater at this site. The sixth sentence implies that there are additional sources of contamination in the subsurface. Please clarify these sentences. In the last sentence, change "Site 15" to "Tank 58".

Response: Please refer to the response to comment 10 on changing "Site 15" to "Tank 58 area."

