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AECRU Contract Number N68711-00-D-0005
Delivery Order DO33

FINAL

INDUSTRIAL WASTE TREATMENT PLANT 360

PART I: AMENDMENT TO THE CLOSURE PLAN

PART II: SAMPLING AND ANALYSIS PLAN

HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, NAVAL AIR STATION, ALAMEDA CALIFORNIA (NOW KNOWN AS ALAMEDA POINT)
ALAMEDA, CALIFORNIA

January 16, 2004

Prepared for

NAVFAC

DEPARTMENT OF THE NAVY
Lou Ocampo, Remedial Project Manager
Southwest Division
Naval Facilities Engineering Command
San Diego, California

Prepared by

TETRA TECH EM INC.
1230 Columbia Street, Suite 1000
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TETRA TECH EM INC.

TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N68711-00-D-0005 Document Control No. DS . A033 . 12932

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Contracting Officer
Naval Facilities Engineering Command
Southwest Division
1230 Columbia Street, Suite 1100
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DATE: 01/16/04
DO: 033
LOCATION:
Alameda Point, Alameda, California

FROM: ______________________
Michael Wanta, Contract Manager

DOCUMENT TITLE AND DATE:
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January 16, 2004
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DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
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5090
Ser 06CA.LO/0043
January 15, 2004

Ms. Wei Wei Chui
Section Chief
Standardized Permits and Corrective Action Branch
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710-2721

Dear Ms. Chui:

Subj: CLOSURE PLAN AND SAMPLING ANALYSIS PLAN FOR INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT EPA ID CA2170023236 NAVAL AIR STATION NOW KNOWN AS ALAMEDA POINT, ALAMEDA, CALIFORNIA

Thank you for the Department of Toxic Substances Control (DTSC) review comments on the draft Amendment to the Closure Plan, and Sampling Analysis Plan for Industrial Waste Treatment Plant (IWTP) 360. We have resolved the review comments through Mr. Dean Wright, the DTSC Project Manager. A copy of the review comments and Navy response is included in the final document.

The Final Amendment to the Closure Plan and Final Sampling Analysis Plan for IWTP 360, Enclosure (1) is forwarded via Federal Express for DTSC approval. The Final Amendment was prepared in accordance with the California Code of Regulations, Title 22, Sections 66265.111, 112, and 197, and DTSC Permit Writer Manual for Closure of Storage and Treatment Facilities.

Please send us your approval to: Commander, Naval Facilities Engineering Command, Southwest Division Attn: Mr. Lou Ocampo. Should you have any questions, please contact Mr. Ocampo at (619) 532-0969 or me at (619) 532-0907.

Sincerely,

THOMAS L. MACCHIARELLA
BRAC Environmental Coordinator
By direction of the Commander

Encl: (1) Final Amendment to the Closure Plan and Sampling Analysis Plan of January 2004

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FINAL

AMENDMENT TO THE CLOSURE PLAN FOR INDUSTRIAL WASTE TREATMENT PLANT 360 HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, NAVAL AIR STATION, ALAMEDA CALIFORNIA (NOW KNOWN AS ALAMEDA POINT)

ALAMEDA, CALIFORNIA

January 16. 2004

Prepared for

DEPARTMENT OF THE NAVY
Lou Ocampo, Remedial Project Manager
Southwest Division
Naval Facilities Engineering Command
San Diego, California

Prepared by

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DS.A033.12932

CONTENTS

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1

2.0 PREVIOUS CLOSURE DOCUMENTS 4

3.0 BACKGROUND 5

3.1 Facility Identification 5
3.2 Facility Location 6
3.2.1 Facility Size 6
3.2.2 Topography 7
3.2.3 Hydrogeologic Conditions 7
3.2.4 Weather and Climactic Conditions 7
3.3 Facility Design 7
3.4 Hazardous Waste Constituents 8
3.5 Estimate and Management of Maximum Inventory 8
3.6 Decontamination Procedures for Equipment, Structures, and Buildings 8

4.0 CONFIRMATION SAMPLING PLAN FOR CONTAINMENT STRUCTURES, TANKS, AND EQUIPMENT 10

5.0 SOIL SAMPLING PLAN 10

5.1 Vicinity of IWTP 360 10
5.1.1 Previous Soil Investigations in Vicinity of IWTP 360 10
5.1.2 Proposed Soil Investigation in Vicinity of IWTP 360 11
5.2 Along Pipelines from Building 360 to IWTP 360 11
5.2.1 Previous Soil Investigations Along Pipelines 11
5.2.2 Proposed Soil Investigation Along Pipelines 12
5.3 Plating Shop Within Building 360 12
5.3.1 Previous Soil Investigation in Plating Shop 12
5.3.2 Proposed Soil Investigation in Plating Shop 13

6.0 GROUNDWATER SAMPLING 13

6.1 Vicinity of IWTP 360 14
6.1.1. Previous Groundwater Investigations in Vicinity of IWTP 360 14
6.1.2 Proposed Groundwater Investigation in Vicinity of IWTP 360 14
6.2 Along Pipelines from Building 360 to IWTP 360 14
6.2.1 Previous Groundwater Investigations Along Pipelines 14
6.2.2 Proposed Groundwater Investigation Along Pipelines 15
6.3 Plating Shop Within Building 360 15

CONTENTS (CONTINUED)

6.3.1 Previous Groundwater Investigations in the Plating Shop 15
6.3.2 Proposed Groundwater Investigation in the Plating Shop 16

7.0 ANALYTICAL TEST METHODS 16

8.0 CLOSURE PERFORMANCE STANDARDS 16

9.0 SOIL REMOVAL AND CLEANUP PROCEDURES 17

10.0 CLOSURE IMPLEMENTATION SCHEDULE 17

11.0 CLOSURE CERTIFICATION REPORT REQUIREMENTS 17

12.0 PERSONAL PROTECTIVE EQUIPMENT AND WORKER HEALTH AND SAFETY 18

13.0 SITE SECURITY 19

14.0 REFERENCES 20

Attachments

A Closure Plan for Industrial Wastewater Treatment Plant, Building 360, Naval Air Station Alameda, November 1995

B DTSC Comments on Certification Report for Closure of IWTP 360 and Navy Responses to Comments

C Background Concentrations in Soil at Alameda Point

D Schedules for Corrective Actions at IWTP 360, Alameda Point, Alameda, California

E Navy Response To Comments Dated October 17, 2003 From The California Department Of Toxic Substances Control (DTSC) On The Review Of Draft Amendment To The Closure Plan And Sampling And Analysis Plan, Industrial Waste Treatment Plant 360, Alameda Point (Formerly Naval Air Station Alameda) Alameda, California.

TABLES

3-1 Major Components at IWTP 360

5-1 Summary of Soil Results in the Vicinity of IWTP 360 in Soil Remaining After Excavation in December 2000

5-2 Summary of Soil Results Along Pipelines from Building 360 to IWTP 360

5-3 Summary of Soil Results in Plating Shop Within Building 360

6-1 Summary of Groundwater Results South of IWTP 360 and Along Pipelines from Building 360 to IWTP 360

6-2 Summary of Groundwater Results in Plating Shop Within Building 360

FIGURES

1-1 Alameda Point Location Map

1-2 Alameda Point and the Location of IWTP 360

3-1 Physical Layout of IWTP 360

3-2 Process Flow Diagram for IWTP 360

3-3 Physical Layout of Plating Shop Within Building 360

5-1 IWTP 360 Site Features, Excavation Area, and Soil Sampling Locations

5-2 Close-up of Sampling Locations in the Vicinity of IWTP 360

5-3 Close-up of Sampling Locations Within Building 360

6-1 IWTP 360 Site Features, Excavation Area, and Groundwater Sampling Locations

ACRONYMS AND ABBREVIATIONS

bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DHS	California Department of Health Services
DTSC	California Environmental Protection Agency Department of Toxic Substances Control
E&E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
HASP	Health and safety plan
IT	International Technology Corporation
IWTP	Industrial waste treatment plant
MCL	Maximum contaminant level
mg/kg	milligrams per kilogram
µg/L	micrograms per liter
NAS	Naval Air Station
Navy	U.S. Department of the Navy
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
Tetra Tech	Tetra Tech EM Inc.

EXECUTIVE SUMMARY

Tetra Tech EM Inc. (Tetra Tech), on behalf of the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Southwest Division, has prepared this closure plan amendment to obtain approval of clean closure for the Resource Conservation and Recovery Act (RCRA) Part A interim status facility (CA2170023236) Industrial Waste Treatment Plant (IWTP) 360 at Alameda Point (formerly Naval Air Station [NAS] Alameda).

IWTP 360 was completely demolished and disposed of offsite in a series of closure activities conducted between 1996 and 2000 pursuant to a 1995 RCRA closure plan (see Attachment A) (Navy 1995). Many of the actual closure activities for IWTP 360 were more extensive than the closure activities specified in the 1995 closure plan, which described decontamination, but not removal, of the tanks and other components of the unit. Following demolition and disposal, a closure certification was submitted in 2001. However, the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) did not approve the certification report for closure of IWTP 360 (DTSC 2002) and requested additional soil and groundwater sampling in the vicinity of the former unit as well as along the waste pipelines that connected the former unit to Building 360. In addition, DTSC requested that the Navy determine whether RCRA-related activities contributed to contamination in the vicinity of the plating shop, an area that was not discussed in the 1995 closure plan, because it is physically separated from IWTP 360. Finally, DTSC and the Navy recognize the need to develop closure performance standards for soil and groundwater and add them to the 1995 closure plan. Cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver were established as the constituents of concern for the additional sampling based on the results of soil samples collected in 1996 and 2000.

It is the Navy's goal to obtain clean closure of IWTP 360 and avoid post-closure are requirements. The purpose of this closure plan amendment is to identify the steps necessary to obtain approval for clean closure for IWTP 360 and to specifically address comments provided by DTSC on the previous certification report for closure of IWTP 360 (refer to Attachment B) (DTSC 2002). This amendment proposes additional sampling of soil and groundwater as well as a set of closure performance standards for both soil and groundwater.

A detailed sampling plan, including specific data quality objectives, is included as a companion document to this amendment to the 1995 closure plan (refer to Part II of this binder). Sample results will be compared to the closure performance standards described in Section 8.0 of this amendment to the closure plan. When closure is completed, the Navy shall submit a certification to DTSC from both the Commanding Officer and an independent, California-registered professional engineer. The closure certification report will state that IWTP 360 has been closed in accordance with this amendment to the closure plan.

The format and content of this amendment covers all elements described in "Permit Writer Manual for Closure of Storage and Treatment Facilities," prepared by DTSC (2001), but this amendment only discusses those elements that have changed or have not been covered in the 1995 closure plan (see Attachment A) (Navy 1995).

1.0 INTRODUCTION

Tetra Tech EM Inc. (Tetra Tech) received Delivery Order 033 from the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Southwest Division, under the Indefinite Quantity Contract for Architectural-Engineering Services to provide CERCLA/RCRA/UST Studies, Contract No. N68711-00-D-0005 to prepare miscellaneous documents including a closure plan amendment for the Resource Conservation and Recovery Act (RCRA) Part A interim status facility Industrial Waste Treatment Plant (IWTP) 360 at Alameda Point (formerly Naval Air Station [NAS] Alameda). Figure 1-1 shows the general location of Alameda Point, and Figure 1-2 shows the location of IWTP 360 within Alameda Point.

IWTP 360 was constructed in 1973 and the Navy submitted a revised RCRA Part A application in July 1987 to add IWTP 360 to the Interim Status Document. The California Environmental Protection Agency Department of Toxic Substances Control (DTSC) approved the Part A revision to include IWTP 360 in October 1987. IWTP 360 was taken out of service in 1994. IWTP 360 was completely demolished and disposed of off site in a series of closure activities conducted between 1996 and 2000 pursuant to a 1995 RCRA closure plan (see Attachment A) (Navy 1995). Many of the actual closure activities for IWTP 360 were more extensive than the closure activities specified in the 1995 closure plan, which described decontamination but not removal of the tanks and other components of the unit. Following demolition and disposal, a closure certification was submitted in 2001. However, DTSC did not approve the certification report for closure of IWTP 360 (DTSC 2002) and requested additional soil and groundwater sampling in the vicinity of the former unit as well as along the waste pipelines that connected the former unit to Building 360. In addition, DTSC requested that the Navy determine whether RCRA-related activities contributed to contamination in the vicinity of the plating shop, an area that was not discussed in the 1995 closure plan, because it is physically separated from IWTP 360. Finally, DTSC and the Navy recognize the need to develop closure performance standards for soil and groundwater and add them to the 1995 closure plan. Cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver were established as the constituents of concern for the additional sampling based on the results of soil samples that had been collected in 1996 and 2000.

The purpose of this closure plan amendment is to identify the steps necessary to obtain approval for clean closure for IWTP 360 and to specifically address comments provided by DTSC on the previous certification report for closure of IWTP 360 (DTSC 2002). This amendment proposes additional sampling of soil and groundwater as well as a set of closure performance standards for both soil and groundwater.

A detailed sampling plan, including specific data quality objectives, is included as a companion document to this amendment to the 1995 closure plan (refer to Part II of this binder). Sample results for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver will be evaluated as described in Section 8.0 of this amendment to the closure plan. When closure is completed, the Navy shall submit a certification to DTSC from both the Commanding Officer and an independent, California-registered professional engineer. The closure certification report will state that IWTP 360 has been closed in accordance with this amendment to the closure plan.

The format and content of this amendment covers all elements described in "Permit Writer Manual for Closure of Storage and Treatment Facilities," (hereinafter referred to as the permit writer manual) prepared by DTSC (2001), but this amendment only discusses those elements that have changed or have not been covered in the "Closure Plan, Industrial Wastewater Treatment Plant, Building 360, NAS Alameda, Alameda, California" (hereinafter referred to as the 1995 closure plan) (see Attachment A) (Navy 1995). The requirements for closure are found in Title 22 *California Code of Regulations* 66265.111, "Closure Performance Standard"; 66265.112, "Closure Plan; Amendment of Plan"; and 66265.197, "Closure and Post-Closure Care."

Section 2.0 of this amendment lists previous closure documents and activities associated with IWTP 360. The chart on the following page provides cross-references between each chapter of the permit writer manual and Sections 3.0 through 13.0 of this amendment. Attachment A presents the 1995 closure plan prepared by the Navy; Attachment B presents the Navy's responses to comments from DTSC on the closure certification report; Attachment C presents the background levels of cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in soil; Attachment D presents the schedule for corrective actions at IWTP 360; and Attachment E presents Navy Responses to DTSC Comments Dated October 17, 2004 on the Draft Amendment to the Closure Plan and Sampling and Analysis Plan for Industrial Waste Treatment Plan 360 (Dated September 11, 2003).

Permit Manual		Closure Plan Amendment	
Chapter Number	**Chapter Title**	**Section Number**	**Section Title**
Chapter 3.1	Facility Identification	3.1 & Attachment A	Facility Identification
Chapter 3.2	Facility Location	3.2 & Attachment A	Facility Location
Chapter 3.3	Facility Design	3.3	Facility Design
Chapter 3.4	Description of Hazardous Waste Constituents	3.4 & Attachment A	Hazardous Waste Constituents
Chapter 3.5	Estimate and Management of Maximum Inventory	3.5 & Attachment A	Estimate and Management of Maximum Inventory
Chapter 3.6	Decontamination Procedures for Equipment, Structures, and Buildings	3.6 & Attachment A	Decontamination Procedures for Equipment, Structures, and Buildings
Chapter 3.7	Confirmation Sampling Plan for Containment Structures, Tanks, and Equipment	4.0 & Attachment A	Confirmation Sampling Plan for Containment Structures, Tanks, and Equipment
Chapter 3.8	Soil Sampling Plan	5.0	Soil Sampling Plan
Chapter 3.9	Analytical Test Methods	7.0	Analytical Test Methods
Chapter 3.10	Groundwater Sampling	6.0	Groundwater Sampling
Chapter 3.11	Closure Performance Standards (Cleanup Levels)	8.0	Closure Performance Standards
Chapter 3.12	Soil Removal/Cleanup Procedures	9.0	Soil Removal/Cleanup Procedures
Chapter 3.13	Closure Cost Estimate	7.2 of Attachment A	(1995 Closure Plan)
Chapter 3.14	Financial Responsibility	8 of Attachment A	(1995 Closure Plan)
Chapter 3.15	Closure Implementation Schedule	10.0	Closure Implementation Schedule
Chapter 3.16	Closure Certification Report Requirements	11.0	Closure Certification Report Requirements
Chapter 3.17	Personal Protective Equipment (Worker Health and Safety)	12.0	Personal Protective Equipment/Worker Health and Safety
Chapter 3.18	Site Security	13.0	Site Security

2.0 PREVIOUS CLOSURE DOCUMENTS

Previous closure plans and related reports for IWTP 360 include the following:

1988 Navy. "Closure Plan for Industrial Wastewater Treatment Plant Building 360." April.

1990 Navy. Cover letter and "Revised Closure Plan for Industrial Wastewater Treatment Plant Building 360." June.

1995 Navy. "Closure Plan, Industrial Wastewater Treatment Plant, Building 360, NAS Alameda, Alameda, California." November. [See Attachment A]

1996 DTSC. "Approval of Closure Plan for Industrial Wastewater Treatment Plant 360." October 30.

1997 Ecology & Environment, Inc. (E&E). "Closure Summary Report, Building 360, Industrial Waste Treatment Plant." September 25.

1998 Navy. "Revised Pages for IWTP 360 Closure Certification [Summary] Report." May 28.

2000 DTSC. "Approval of Field Sampling Investigation Plan for the Building 360 Industrial Wastewater Treatment Plant and Southeast Corner of Building 5." August 25.

2001 International Technology Corporation (IT). "Final Field Sampling Investigation Report, (Addendum to Closure Report, September 25, 1997), Resource Conservation and Recovery Act (RCRA) Permitted Facility, Building 360, IWTP." April 12.

2001 Tetra Tech. "Certification Report for Closure Facility Closure Report Building 360 Industrial Wastewater Treatment Plant." April 16.

2002 DTSC. "Comments on Certification Report for Closure, Facility Closure Report, Building 360 Industrial Waste Treatment Plant, Alameda Point, Alameda, California April 16, 2001 Prepared by Department of the Navy Southwest Division." February 8. [See Attachment B]

2002 Navy. Response to DTSC Geological Services Unit Comments Dated February 7, 2002 on the Closure Certification Report, Building 360." August 1.

The 1995 closure plan specified decontamination but not removal of the tanks and other components, confirmation sampling of the equipment, and cleanup levels for the equipment (see Attachment A) (Navy 1995). After the plan was approved, the aboveground tanks and other aboveground components at IWTP 360 were decontaminated and disposed of off site in 1996 and 1997. These activities are summarized in Section 3.6 of this document. The Navy submitted a closure summary report in 1997 that described the decontamination and demolition activities (E&E 1997). DTSC recommended additional investigation of IWTP 360 based on the findings of the closure summary report.

In 2000, the concrete pad (secondary containment) and underground sumps were removed, and contaminated soil was excavated. The Navy submitted a field sampling investigation report that described those activities (IT 2001b). The soil excavation and sampling results from that report are summarized in Section 3.6 of this document. Subsequently, the Navy submitted a certification closure report (Tetra Tech 2001a); in their comments on that report, DTSC recommended that the Navy conduct additional investigations in the vicinity of IWTP 360 and along the waste pipelines connecting the unit to the plating shop in Building 360 (DTSC 2002) (See Attachment B).

Following DTSC's comments on the certification report, the Navy and DTSC have held a series of meetings discussing the closure of IWTP 360. Based on these meetings, the Navy and DTSC have agreed that the following actions are necessary for clean-closure of IWTP 360:

- In the vicinity of IWTP 360: Determine the lateral extent of soil contamination to the east of IWTP 360, beyond the limits of the soil excavated in December 2000.
- In the vicinity of IWTP 360: Determine whether groundwater is being affected by contaminated soil remaining at depths of 12 to 14 feet below ground surface in the excavation.
- Along the wastewater pipelines from Building 360 to IWTP 360: Determine the extent of soil and groundwater contamination.
- In the plating shop within Building 360: Determine whether RCRA-related activities contributed to soil or groundwater contamination, based on an evaluation of existing soil and groundwater sampling results.

Previous investigations for soil and groundwater at IWTP 360 have shown that cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver are the contaminants of concern for IWTP 360; therefore, the additional investigations proposed in this amendment for closure of IWTP 360 will address only cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in soil and groundwater. Proposed soil and groundwater sampling activities are described in Sections 5.0 and 6.0, respectively.

3.0 BACKGROUND

This section provides the background information about the former IWTP 360 facility: facility identification, location, and design; hazardous waste constituents; management of maximum inventory; and decontamination procedures for equipment, structures, and buildings.

3.1 FACILITY IDENTIFICATION

Facility identification information is summarized below.

Facility Name	NAS Alameda (now called Alameda Point)
Unit Name	IWTP 360
U.S. Environmental Protection Agency (EPA) Identification Number	CA 2170023236
Facility Address	Alameda Point (formerly NAS Alameda) (Code 015) Alameda, CA 94501-5000
Facility Mailing Address	Commanding Officer NAVFAC, Engineering Field Division South West 1220 Pacific Highway San Diego, CA 92132-5190
Facility Contact	Mike McClelland Base Environmental Coordinator 1230 Columbia St., Suite 1100 San Diego, CA 92101-8517 (619) 532-0965
Facility Operator	Not in operation
Closure Plan Preparer	Luciano Ocampo 1230 Columbia St., Suite 1100 San Diego, CA 92101-8517 (619) 532-0969
Nature of Business	NAS Alameda was closed in 1997 and is now called Alameda Point. NAS Alameda, an air station complex, operated and maintained facilities to provide services and materials in support of Naval aviation activities. NAS Alameda berthed and serviced aircraft carriers and other allied and supporting vessels.
Environmental permits	No additional permits are applicable to this amended closure plan.

3.2 FACILITY LOCATION

This section discusses facility size, topography, hydrogeologic conditions, and weather conditions.

3.2.1 Facility Size

The facility size is discussed in Section 2.1 of the 1995 closure plan (see Attachment A) (Navy 1995).

3.2.2 Topography

Alameda Point is located on the western tip of Alameda Island, along the eastern margin of the San Francisco Bay, adjacent to the city of Oakland. The northern portion of Alameda Island was formerly tidelands, marshlands, and sloughs, adjacent to the historical San Antonio Channel, now known as the Oakland Inner Harbor. Most of the land that is now Alameda Point was created by filling the natural tidelands, marshlands, sloughs, and subtidal areas with dredge spoils from the surrounding San Francisco Bay, Seaplane Lagoon, and Oakland Inner Harbor.

The onshore portion of Alameda Point is a 1,734-acre area about 2 miles long from east to west and 1 mile wide from north to south. The land surface is low-lying and nearly flat. Elevations are less than 15 feet (5 meters) above mean sea level.

3.2.3 Hydrogeologic Conditions

The hydrogeologic conditions are discussed in Section 2.3 of the 1995 closure plan (see Attachment A) (Navy 1995).

In general, groundwater in the vicinity of IWTP 360 flows in a west-northwest direction. One basewide monitoring well is located in the area; Well M04-05 is located about 20 feet west of Building 360 and about 20 feet north of the wastewater pipelines running from Building 360 to IWTP 360.

3.2.4 Weather and Climactic Conditions

The prevailing winds of the San Francisco Bay Area are from the west. Records show that winds of gale force or greater have occurred only rarely in the area. Heavy fogs occur on the average of 21 days per year. These fogs impair visibility for navigation at nearby Oakland Airport an average of less than 100 hours per year. Freezing temperatures rarely occur, and snow or icing conditions are rarely encountered. Rainfall averages about 20 inches annually, generally occurring from October to May (E&E 1983).

3.3 Facility Design

IWTP 360 was located inside a roofed, fenced enclosure west of Building 414. The facility was constructed on a continuously poured concrete slab bordered by a concrete curb with a total secondary containment capacity of 48,000 gallons.

IWTP 360 treated chromium and cyanide wastewater generated from metal plating operations in the plating shop within Building 360. IWTP 360 was constructed in 1973, taken out of service in 1994, and completely demolished by 2000. Table 3-1 lists the tanks and other components that comprised IWTP 360, including their removal dates.

Figure 3-1 shows the general physical layout of the former IWTP 360, and Figure 3-2 shows the process flow diagram for the two waste streams that were treated there. Underground iron and clay piping conveyed wastewater to IWTP 360 from the exterior of Building 360. The pipelines within Building 360, all aboveground pipes, were located under a raised floor.

The original RCRA permit and 1995 closure plan for IWTP 360 did not include the plating shop. However, DTSC requested that the Navy evaluate the soil and groundwater results from the plating shop within Building 360; therefore, this amendment to the 1995 closure plan includes a discussion of the plating shop. Figure 3-3 shows the general physical layout of the former plating shop within Building 360. The plating shop contained three process lines (two chrome process lines and one cyanide process line) with a "wet trench" and "dry trench" running the length of each line. A network of drain lines collected overflow from both ends of each process line. The drain lines emptied into the pipelines that carried wastewater to IWTP 360 (PRC Environmental Management, Inc. [PRC] 1992).

Details of the design features of IWTP 360 are discussed in Section 3.0 of the 1995 closure plan (see Attachment A) (Navy 1995). Section 3 of Attachment A includes:

- Description
- Design capacity
- Ancillary equipment
- Containment systems
- Leak detection and monitoring systems
- Facility layout
- Description of wastes managed in the facility

3.4 HAZARDOUS WASTE CONSTITUENTS

The hazardous waste constituents and the EPA hazardous waste numbers to which those constituents are attributed are discussed in Section 3.8 and Table 3-2 of the 1995 closure plan (see Attachment A) (Navy 1995).

3.5 ESTIMATE AND MANAGEMENT OF MAXIMUM INVENTORY

The maximum inventory is discussed in Section 3.8 and Table 3-2 of the 1995 closure plan (see Attachment A) (Navy 1995). During its operation, IWTP 360 treated an average of 26,400 gallons of plating waste per day (E&E 1997).

3.6 DECONTAMINATION PROCEDURES FOR EQUIPMENT, STRUCTURES, AND BUILDINGS

All tanks, structures, concrete pads, underground sumps, and aboveground piping have been removed from IWTP 360. This section summarizes the decontamination and removal activities that occurred during two time periods after IWTP 360 was taken out of service in 1994:

- September 1996 to February 1997, decontamination and demolition of aboveground tanks and other components (E&E 1997)
- August 2000 to December 2000, demolition of a concrete pad and two underground sumps, and excavation of soil (IT 2001b)

Decontamination with confirmation sampling and demolition of the aboveground components of IWTP 360 was initiated in September 1996 and completed in February 1997 (E&E 1997). Table 3-1 lists the tanks and other components that formerly comprised IWTP 360 and the removal date of each component. After decontamination, all tanks, piping, and equipment inside the secondary containment area within the fenced enclosure for IWTP 360 were transported to the Defense Reutilization and Marketing Office for reuse and/or recycling. The chromium sump (T313) and cyanide sump (T312) were filled with gravel and capped with wet cement at this time.

The concrete pad that formerly served as the floor of the secondary containment system for the aboveground tanks (sodium hydroxide [T310], sulfuric acid [T309], chromium reduction [T305], and the precipitation/flocculation tanks [T306 and T307]) was removed in August 2000. The concrete pad was broken up and disposed of off site at a permitted Class II facility (IT 2001b).

The chromium sump (T313) and cyanide sump (T312) that had been filled in 1997 were removed in December 2000. The sumps were found to extend to depths of 12 feet below ground surface (bgs). Cadmium- and chromium-contaminated soil was excavated from the area around the two sumps to a depth ranging from 10 to 12 feet bgs. The soil removal area was located under the southern end, and south of, the former concrete pad that was the secondary containment for IWTP 360. A sheet pile barrier was installed between the east end of the planned excavation area and Building 414 to maintain the integrity of Building 414 (IT 2001b). The soils excavated below the groundwater table were transported off site to a Class I disposal facility, and the excavation was backfilled with drain rock and clean fill. After the backfilling, the excavation area and adjacent damaged pavement were repaved with asphalt. The soil removal activities are detailed in the final field sampling investigation for IWTP 360 (IT 2001b).

Underground clay pipes connected to the chromium and cyanide sumps (T313 and T312) were removed from their point of connection to the southern extent of the excavation. The clay piping that extended from the southern end of the excavation to the cast iron piping from Building 360 and the iron piping itself were left intact. The length of the underground pipelines left intact is between 200 and 220 feet. The pipelines were flushed before IWTP 360 was taken out of service.

A concrete surface supported by vertical wood timbers resembling remnants of an old pier was observed at the southern end of the excavation and was left in place (IT 2001b). Soil and groundwater sampling has been and will continue to be impeded by this underground structure.

4.0 CONFIRMATION SAMPLING PLAN FOR CONTAINMENT STRUCTURES, TANKS, AND EQUIPMENT

No confirmation sampling is planned for containment structures, tanks, or equipment. All structures, tanks, and equipment in the vicinity of IWTP 360 have been decontaminated (with confirmation sampling) and removed. The sampling and analysis conducted to confirm decontamination were discussed in the closure summary report for Building 360 (E&E 1997).

The underground pipelines from Building 360 to IWTP 360 will be closed in place. The pipelines were flushed before IWTP 360 was closed.

5.0 SOIL SAMPLING PLAN

The sampling requirements for the proposed soil investigation are described in the field sampling plan and quality assurance project plan included in the combined sampling and analysis plan (SAP) in Part II of this binder. The SAP will be submitted to and approved by DTSC before sampling begins. The SAP discusses sampling procedures, decontamination of sampling equipment, analytical methods, quality control samples to be collected, chain-of-custody protocols, sample labeling, and documentation.

Previous soil samples collected in the vicinity of IWTP 360 and along the pipelines from Building 360 contained total cyanide concentrations ranging from nondetect to 2.5 milligrams per kilogram (mg/kg). Total cyanide concentrations in samples collected from the soil under the plating shop within Building 360 ranged from nondetect to 18.6 mg/kg. The EPA Region 9 residential preliminary remediation goal for soil (PRG) for cyanide (free) is 1,200 mg/kg (EPA 2002); therefore, no additional analysis for cyanide is planned.

The following subsections describe the previous and proposed soil investigations in the vicinity of IWTP 360 (Section 5.1), along the pipelines from Building 360 (Section 5.2), and in the plating shop within Building 360 (Section 5.3). Figure 5-1 presents the site features and sampling locations described in these subsections.

5.1 VICINITY OF IWTP 360

This section describes the previous and proposed soil investigations in the vicinity of IWTP 360.

5.1.1 Previous Soil Investigations in Vicinity of IWTP 360

Soil samples were collected in the vicinity of IWTP 360 during three separate investigations (see Figure 5-2):

- In 1995, four samples were collected from two boring locations within Building 414 to depths of 4.5 feet bgs (IT 2001a).

- In 1997, 26 soil samples were collected from seven boring locations (B1 to B7) to depths of about 10 feet bgs; Boring B3 refused at 1 foot bgs (E&E 1997); soil in the vicinity of borings B3 and B4 was excavated in December 2000.
- In 2000, 100 soil samples were collected from 20 boring locations (1 to 20) to depths of 14.6 feet; soil in the vicinity of borings 1 through 7 was excavated in December 2000 (IT 2001b).

The soil samples collected by E&E were analyzed for metals, phenols, chlorinated hydrocarbons, cyanide, and total recoverable petroleum hydrocarbons. With the exception of cadmium and chromium, all analyzed compounds were either not detected or detected at concentrations less than the residential preliminary remediation goals (PRG) (or California-modified PRG, when available) (EPA 2002) or the background levels of metals at Alameda Point. The soil samples collected in 2000 by IT were analyzed only for chromium and cadmium.

The sampling results for cadmium and chromium remaining in soil after the excavation in 2000 are summarized in Table 5-1. All soil with known concentrations of cadmium exceeding the residential PRGs was removed in December 2000; however, soil with known concentrations of total chromium up to 2 times the residential PRG remains at depths greater than 10 feet.

5.1.2 Proposed Soil Investigation in Vicinity of IWTP 360

Additional soil sampling was requested by DTSC to determine the lateral extent of soil contamination to the east of the area excavated in December 2000. One or two soil borings will be advanced to the east of the limits of the soil excavation conducted in December 2000. One boring will be advanced near the east side of Building 414. The second boring will be advanced just to the west of Building 414 and to the east of the former sump locations (if possible based on the space available and tenant activities). At each soil sampling location in the vicinity of the previous excavation area, two depths are proposed: 1.5 to 2.0 feet and 7.5 to 8.0 feet or at the groundwater interface, whichever is shallower. These depths may be modified in the field depending on the location of the groundwater table. Refer to Figure 4 in Part II of this binder for the proposed sampling locations. All samples will be analyzed for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver.

5.2 ALONG PIPELINES FROM BUILDING 360 TO IWTP 360

This section discusses the previous and proposed soil investigations along the waste pipelines from Building 360 to IWTP 360.

5.2.1 Previous Soil Investigations Along Pipelines

Ten soil samples were collected in 2002 along the underground pipelines from Building 360 to IWTP 360 during supplemental remedial investigation data gap sampling for Operable Units 1 and 2 (Tetra Tech 2002). Soil samples were collected during advancement of vacuum extraction sampling at the following three locations: adjacent to Building 360, midway between Building 360 and IWTP 360, and south of the former IWTP sumps (see Figure 5-1 and Table 5-2). Soil samples were collected at 3 feet bgs (depth of wastewater pipeline) and 5 feet bgs (2 feet below the wastewater pipeline). Soil sampling results from the three locations indicated soil concentrations less than residential PRGs for the metals analyzed (cadmium, chromium (total), hexavalent chromium, copper, lead, nickel, and silver).

5.2.2 Proposed Soil Investigation Along Pipelines

Additional soil sampling was requested by DTSC along the length of the pipelines from Building 360 to ITWP 360 to define the extent of contamination. The length of pipelines is about 200 to 220 feet. DTSC recommended collecting samples every 20 to 25 feet; therefore, the soil samples are needed at a total of nine locations along the pipelines. Soil samples were collected from three locations along the pipelines in 2002; therefore, soil samples must be collected from six additional locations.

At each location along the pipeline, soil samples will be collected at 3 feet bgs (depth of wastewater pipeline) and 5 feet bgs (2 feet below the wastewater pipeline). All samples will be analyzed for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver. Refer to Figure 5 in Part II of this binder for the proposed sampling locations.

5.3 Plating Shop Within Building 360

This section discusses previous and proposed soil investigations in the plating shop within Building 360.

5.3.1 Previous Soil Investigation in Plating Shop

The wastewater pipelines from the plating shop in Building 360 run under a raised floor of the building for about 150 feet before exiting the building. The plating shop was not identified previously as a component of the IWTP nor was it included in the previous closure plans. However, the soil under Building 360 in the plating shop has been fully characterized as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site 4 investigations.

Soil samples were collected in the plating shop during three separate investigations:

- 1991, CERCLA Phase 2B investigation (PRC 1992)
- 1994, investigations conducted under Contract Task Order No. 260 for the remedial investigation for CERCLA Sites 4, 5, 8, 10A, 12, and 14 (Tetra Tech 1996)

- 2001 and 2002, data gap sampling conducted in support of the remedial investigation for Operable Units 1 and 2 (Tetra Tech 2002)

Thirty-five samples were collected from 26 locations within the plating shop of Building 360 (see Figure 5-3 and Table 5-3). The 1991 sampling locations (relative to the physical layout of the plating shop) are shown on Figure 3-3. The sampling locations of the 2001 data gap samples relative to the 1991 sampling locations are shown in Figure 5-3. Only chromium (total) concentrations exceeded the residential PRGs in samples from the plating shop, which were analyzed for cadmium, chromium (total), hexavalent chromium, copper, lead, nickel, and silver.

Three sampling locations indicated concentrations of chromium (total) in excess of its residential PRG. These three locations are on the eastern side of the plating shop, close to the "wet trenches" of the easternmost process line (see Figure 3-3). The elevated chromium concentrations detected at these locations probably resulted from leaks in the wet trenches of the plating process line rather than as part of the treatment of waste from the plating shop. The ongoing CERCLA action for Operable Unit 2A, Site 4 at Alameda Point is, therefore, a more appropriate means for addressing these areas of elevated chromium concentrations than this amended closure plan.

5.3.2 Proposed Soil Investigation in Plating Shop

Additional soil sampling within Building 360 will be addressed under the CERCLA program. Sampling within the building is not planned for the closure of IWTP 360 because the building is physically separate from IWTP 360.

6.0 GROUNDWATER SAMPLING

This section describes the previous and proposed groundwater investigations in the vicinity of IWTP 360, along the pipelines from Building 360 to IWTP 360, and in the plating shop within Building 360.

Groundwater samples will be collected from selected locations and analyzed for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in accordance with the SAP (see Part II of this binder), which will be submitted to and approved by DTSC before sampling begins. The SAP discusses decontamination of sampling equipment, quality control samples to be collected, chain-of-custody protocols, sample labeling, and documentation.

Total cyanide was not detected in previous groundwater samples collected along the pipelines from Building 360 to IWTP 360. Results for total cyanide from groundwater samples collected from the basewide monitoring well (M04-05) north of the pipelines and just to the west of Building 360 ranged from 6.7 to 19.8 micrograms per liter (µg/L). California Department of Health Services (DHS) maximum contaminant levels (MCL) in drinking water for cyanide (free) is 150 μg/L (DHS 2003); therefore, the SAP does not include any additional analysis for total cyanide.

6.1 VICINITY OF IWTP 360

This section discusses the previous and proposed groundwater investigations in the vicinity of IWTP 360.

6.1.1. Previous Groundwater Investigations in Vicinity of IWTP 360

Two groundwater grab samples were collected at one location south of the former sumps in 2001 (7 feet bgs and 12 feet bgs) (see Figure 6-1 and Table 6-1). The groundwater samples did not indicate concentrations of cadmium or chromium (total and hexavalent) greater than the California MCLs for drinking water (DHS 2003).

6.1.2 Proposed Groundwater Investigation in Vicinity of IWTP 360

DTSC requested additional groundwater sampling in the vicinity of IWTP 360 to determine whether cadmium and/or chromium concentrations exceed the California MCLs for drinking water (DHS 2003).

Direct-push sampling for groundwater will be performed in the vicinity of IWTP 360 at the following three locations: north, west, and east of the excavation area. Two groundwater samples will be collected in the first water bearing zone at about 7 and 12 feet bgs at each direct-push location. However, limited physical space and tenant activities may prevent sampling at the location that is east of the excavation area. Refer to Figure 4 in Part II of this binder for the proposed sampling locations.

6.2 ALONG PIPELINES FROM BUILDING 360 TO IWTP 360

This section discusses the previous and proposed groundwater sampling along the waste pipelines from Building 360 to IWTP 360.

6.2.1 Previous Groundwater Investigations Along Pipelines

Groundwater samples were collected in 2002 from two locations along the underground pipelines from IWTP 360 to Building 360 (see Figure 6-1 and Table 6-1). The sample results were nondetect or less than California MCLs for the metals analyzed (cadmium, chromium, copper, lead, nickel, and silver). Groundwater sampling results from the basewide monitoring well (M04-05) located north of the pipelines and west of Building 360 indicated concentrations of total chromium that exceed the California MCL of 50 μg/L (DHS 2003); groundwater sample results at this well showed chromium at concentrations ranging from 87 to 105 μg/L.

6.2.2 Proposed Groundwater Investigation Along Pipelines

Additional groundwater sampling was requested by DTSC along the pipelines for the closure of IWTP 360; groundwater samples will be collected at the same locations as the soil samples described in Section 5.2.2. One groundwater sample will be collected at about 5 feet bgs from each location. The samples will be analyzed to determine whether cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver concentrations exceed the California MCLs for drinking water (DHS 2003). Refer to Figure 5 in Part II of this binder for the proposed sampling locations.

6.3 PLATING SHOP WITHIN BUILDING 360

This section discusses the previous and proposed groundwater investigations in the plating shop within Building 360.

6.3.1 Previous Groundwater Investigations in the Plating Shop

Groundwater samples were collected in the plating shop during two separate investigations, the CERCLA Phase 2B investigation in 1991 (PRC 1992) and the data gap sampling in 2001 and 2002 (Tetra Tech 2002) (see Figure 6-1 and Table 6-2).

Nine groundwater samples were collected during the 1991 sampling event. The 1991 sampling locations (relative to the physical layout of the plating shop) are shown on Figure 3-3. The 2001 data gap sampling locations relative to the 1991 sampling locations are shown in Figure 6-1. The 1991 sample results indicated concentrations in excess of the California MCL for cadmium of 5 μg/L in one location (183 μg/L) and for chromium (total) of 50 μg/L in three locations (ranging from 65 to 768 μg/L) (PRC 1992) (DHS 2003).

The 1991 groundwater sampling event yielded hexavalent chromium ranging from 48 to 1,020 μg/L. Because the samples were unfiltered, however, they contained suspended solids, which caused them to overstate the concentration of dissolved hexavalent chromium in the groundwater (Tetra Tech 2001b). The hexavalent chromium data from these samples, therefore, will not be included in the closure assessment for IWTP 360.

Six samples were collected during the data gap investigation in 2001 and analyzed for cadmium and chromium (total and hexavalent). Concentrations of chromium (total) in excess of the MCL of 50 μg/L (1,540 μg/L) were detected at one location, S04-DGS-DP06 (Tetra Tech 2002). The other five groundwater sampling results within the plating area contained chromium (total) ranging from 1.8 to 21 μg/L, which is less than the MCL of 50 μg/L (DHS 2003).

The elevated chromium (total) in groundwater samples collected in 1991 and in 2002 might have resulted from leaks in the wet trenches of the process lines, from leaks in the wastewater pipelines, or from both. Therefore, the ongoing CERCLA action for Operable Unit 2A, Site 4 at

Alameda Point is more appropriate than this amended closure plan for addressing these areas of elevated chromium concentrations.

6.3.2 Proposed Groundwater Investigation in the Plating Shop

Additional groundwater sampling within Building 360 will be addressed under the CERCLA program. Groundwater sampling within the building is not planned for the closure of IWTP 360, because the building is separate from IWTP 360.

7.0 ANALYTICAL TEST METHODS

The media to be sampled are soil and groundwater. The list of target metals consists of cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver. Analytical methods specified in the SAP are in accordance with "Test Methods for Evaluating Solid Waste" (EPA 1996). Selected methods for confirmation sampling are Method 6010B for cadmium, chromium (total), copper, lead, nickel, and silver (total) in soil and groundwater and Method 7196A for hexavalent chromium in soil and in groundwater. Confirmation sampling will be conducted in accordance with the approved SAP (see Part II of this binder), which discusses specific sampling locations, sampling procedures, chain-of-custody protocol, analytical methods, and quality control requirements pursuant to the data quality objectives also included in the SAP.

8.0 CLOSURE PERFORMANCE STANDARDS

This section discusses the soil and groundwater closure performance standards by which acceptable closure status will be evaluated. Results for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in soil will be compared statistically to the Alameda Point background levels as appropriate. The EPA Region 9 PRGs (EPA 2002) and background concentrations for soil results and California MCLs (DHS 2003) for groundwater results will be used as initial screening tools; however, when all data are available, quantitative human health and ecological risk assessments will be completed to make risk management decisions for clean closure.

The general approach to risk assessments will be consistent with Navy policy for conducting risk assessments related to the Installation Restoration Program (Navy 2001) and with the methods and assumptions for assessing risk at Alameda Point. The methods and assumptions will be selected or developed to be consistent with Navy, EPA, and DTSC guidelines for baseline risk assessments.

Background levels determined for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in soil for Alameda Point are included in Attachment C. Background concentrations of naturally occurring metals in soil have been established for Alameda Point using an analytical database constructed during the Alameda Point remedial investigation (Tetra

Tech 2001c). The background data sets were geologically and statistically evaluated to divide the data into three representative background areas. For IWTP 360, the "Blue Background Area," representing the southeastern portion of the installation, is the appropriate data set since IWTP 360 is located in this area.

The PRGs and MCLs for the cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in soil and groundwater are as follows:

Contaminant	EPA Region 9 Residential Preliminary Remediation Goal (mg/kg)	California Maximum Contaminant Level (µg/L)
Cadmium	37	5
Chromium (Total)	210	50
Chromium (Hexavalent)	30	NA
Copper	3,100	1,000 (secondary MCL)
Lead	150	15
Nickel	1,600	100
Silver	390	100 (secondary MCL)

9.0 SOIL REMOVAL AND CLEANUP PROCEDURES

No soil removal or cleanups are anticipated.

10.0 CLOSURE IMPLEMENTATION SCHEDULE

The schedule of activities is included in Attachment D.

11.0 CLOSURE CERTIFICATION REPORT REQUIREMENTS

When closure is completed, the Navy shall submit a closure certification report to DTSC from both the Commanding Officer and an independent, California-registered professional engineer. The closure certification report will state that IWTP 360 has been closed in accordance with the closure plan.

The closure certification report will contain, at a minimum, the following:

1. Certification by an independent registered professional engineer
2. Supervisory personnel description
3. Summary of closure activities

4. Field engineer observation reports
5. Sampling data and analyses
6. Discussion of analytical results
7. Manifests showing disposition of waste generated
8. Modifications and amendments to closure plan (if applicable)
9. Photographs

The closure report will also include the following certification statement, signed by the Commanding Officer:

Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

12.0 PERSONAL PROTECTIVE EQUIPMENT AND WORKER HEALTH AND SAFETY

All personnel will adhere to health and safety practices set forth in a health and safety plan (HASP) to be prepared for the activity. The HASP will be prepared by the contractor as part of the work plan to conduct soil and groundwater sampling. The HASP will address the following, at a minimum:

1. Hazard identification
2. Hazard evaluation
3. Personal protective equipment
4. Environmental monitoring
5. Site work zones
6. Decontamination of workers
7. Emergency procedures
8. Site security

13.0 SITE SECURITY

Site security will be enforced in accordance with the HASP.

14.0 REFERENCES

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N000236.001760
ALAMEDA POINT
SSIC NO. 5090.3

FIGURES

FINAL
INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART 1: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

DATED 16 JANUARY 2004

CITY
HIGHWAY
COUNTY BORDER

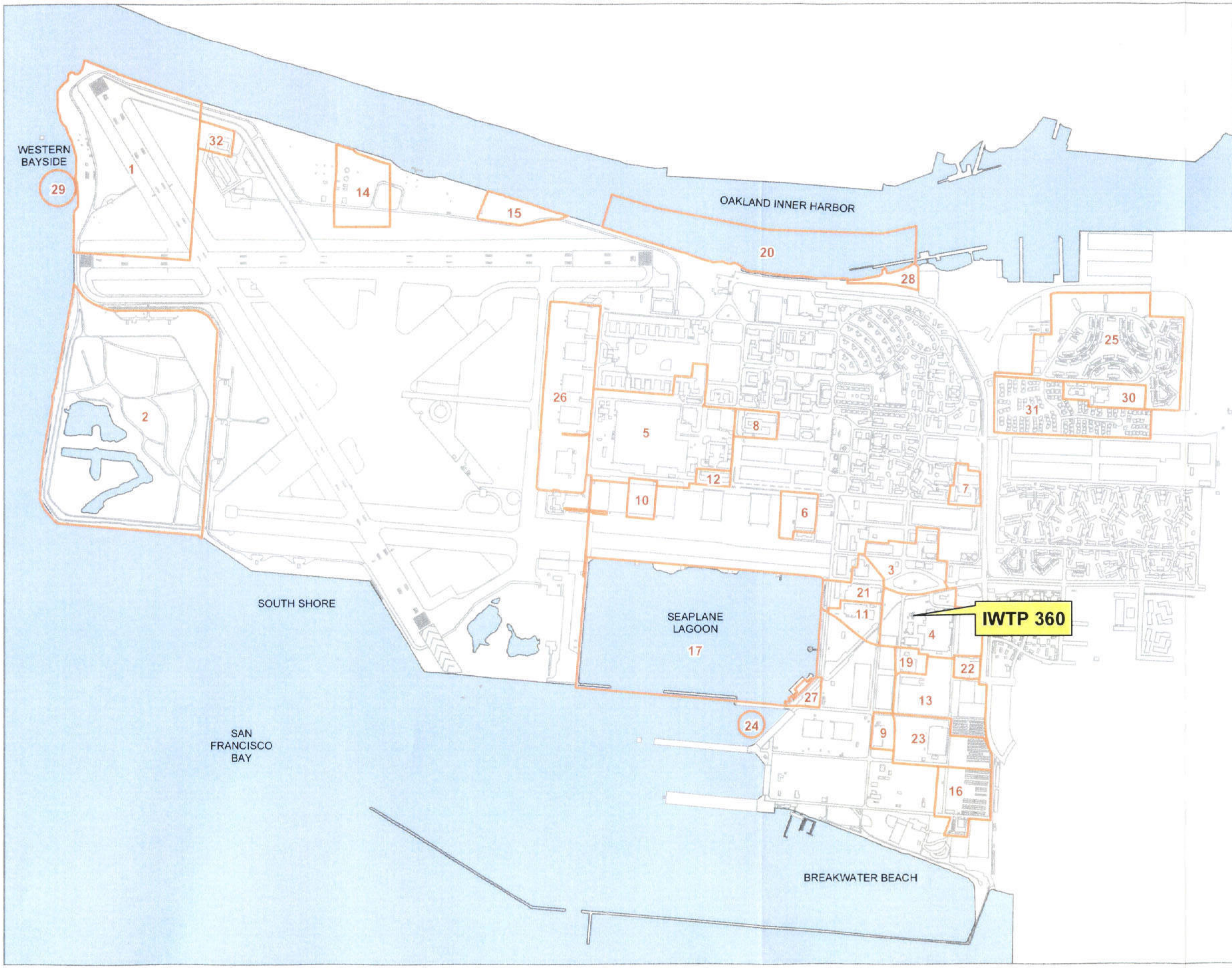
Tetra Tech EM Inc.

Alameda Point
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 1-1
ALAMEDA POINT LOCATION MAP

Amendment To The Closure Plan
Industrial Waste Treatment Plant 360

2003-06-06 U:\almda_sa\do033\iwtp360_closure_plan\mxd\fig01-01_regional_location.mxd TtEMI-SA K. Johnson



CERCLA SITE

BUILDING

LAND COVER

OPEN WATER

Note:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

IWTP = Industrial Waste Treatment Plant

600 0 600 1200 Feet

Tetra Tech EM Inc.

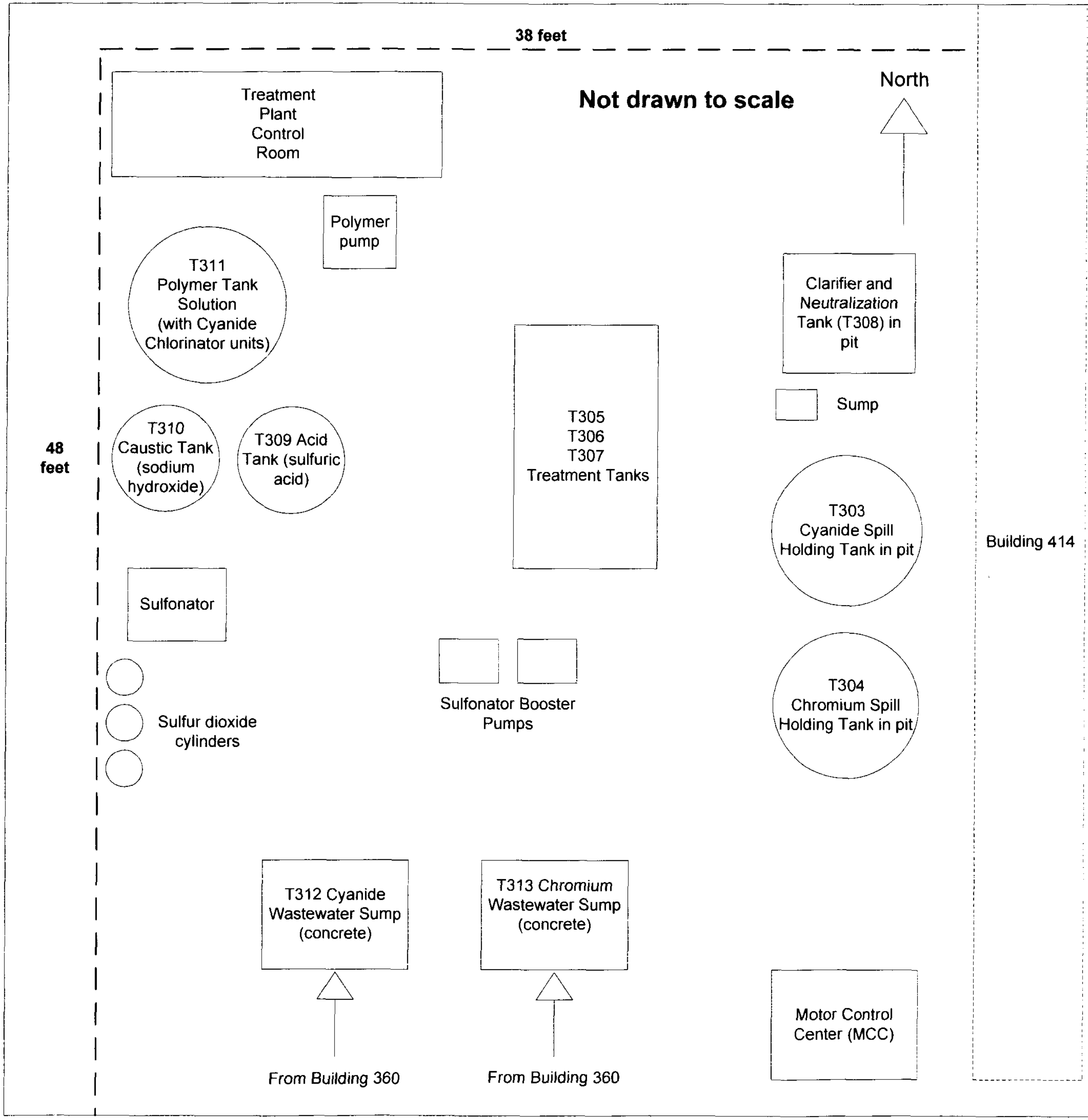
Alameda Point

U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 1-2
ALAMEDA POINT AND THE LOCATION OF IWTP 360

Amendment To The Closure Plan
Industrial Waste Treatment Plant 360

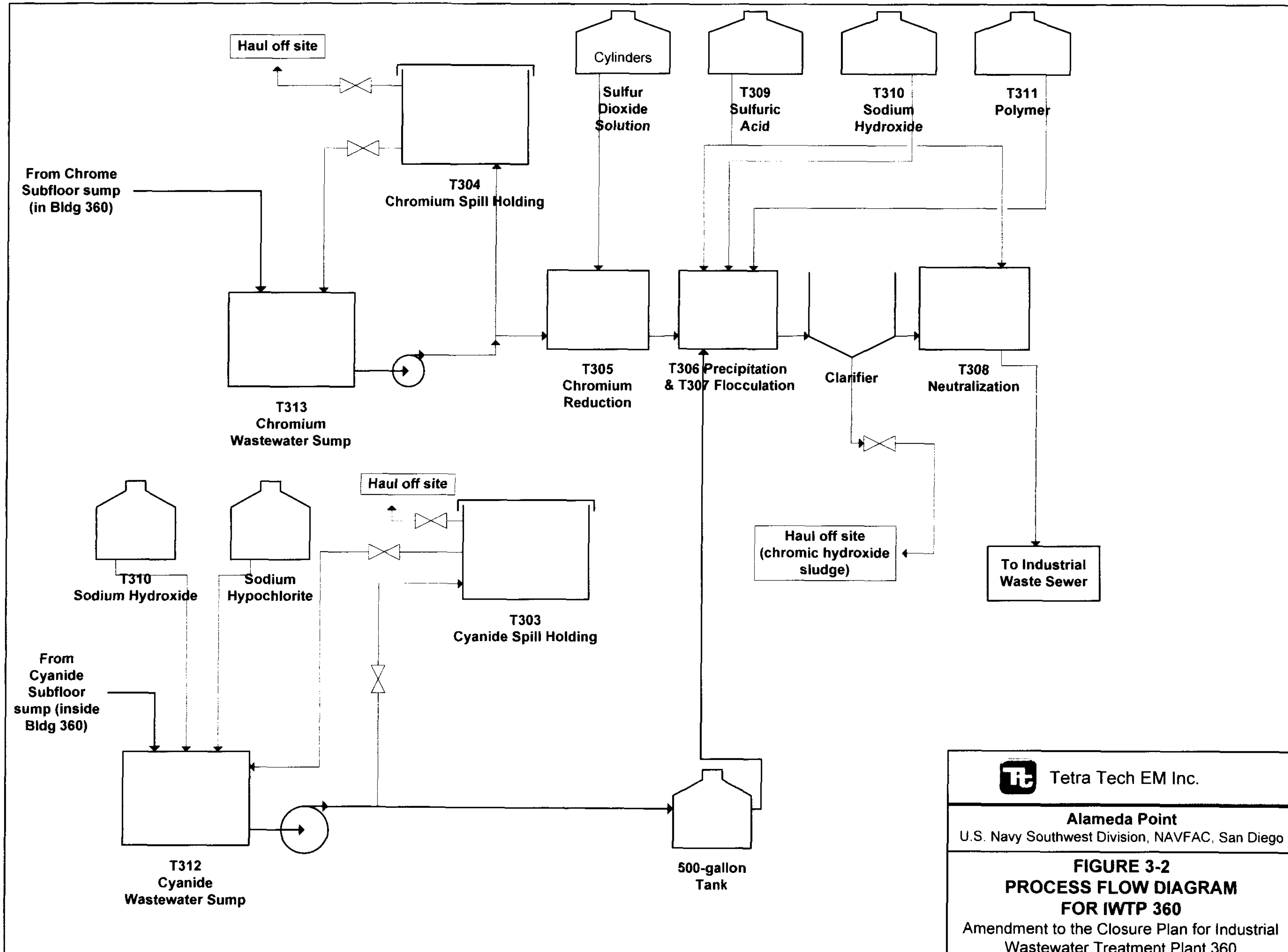
2003-08-21 U:\almda_sa\dc033\iwtp360_closure_plan\mxd\fig01-02_iwtp360_location.mxd TtEM-SA K. Johnson



Tetra Tech EM Inc.

Alameda Point
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 3-1
PHYSICAL LAYOUT OF IWTP 360
Amendment to the Closure Plan for Industrial Wastewater Treatment Plant 360



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Alameda Point
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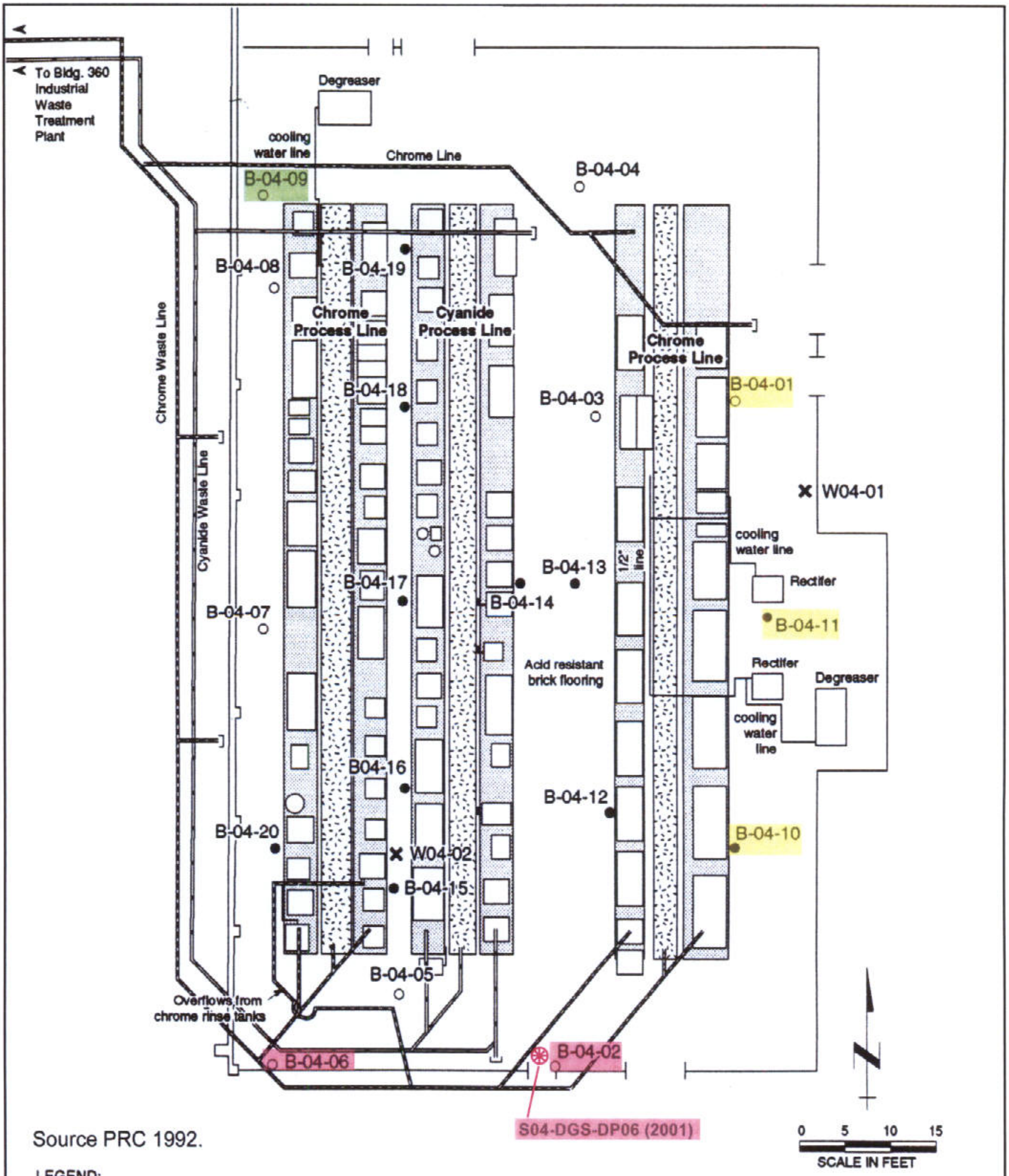
FIGURE 3-2
PROCESS FLOW DIAGRAM
FOR IWTP 360
Amendment to the Closure Plan for Industrial Wastewater Treatment Plant 360



Source PRC 1992.

LEGEND:

- ○ Boring with Groundwater Sample
- ● Boring Location
- ✖ Scrape Sample Location
- □ Vat
- Cadmium in groundwater exceeds MCL
- Chromium in groundwater exceeds MCL
- Chromium in soil exceeds PRG
- ⊣ ⊢ Door
- Wet Trench
- Dry Trench
- Chrome Waste Line
- Cyanide Waste Line

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Alameda Point

U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 3-3

PHYSICAL LAYOUT OF PLATING SHOP WITHIN BUILDING 360

Amendment To The Closure Plan
Industrial Waste Treatment Plant (IWTP) 360

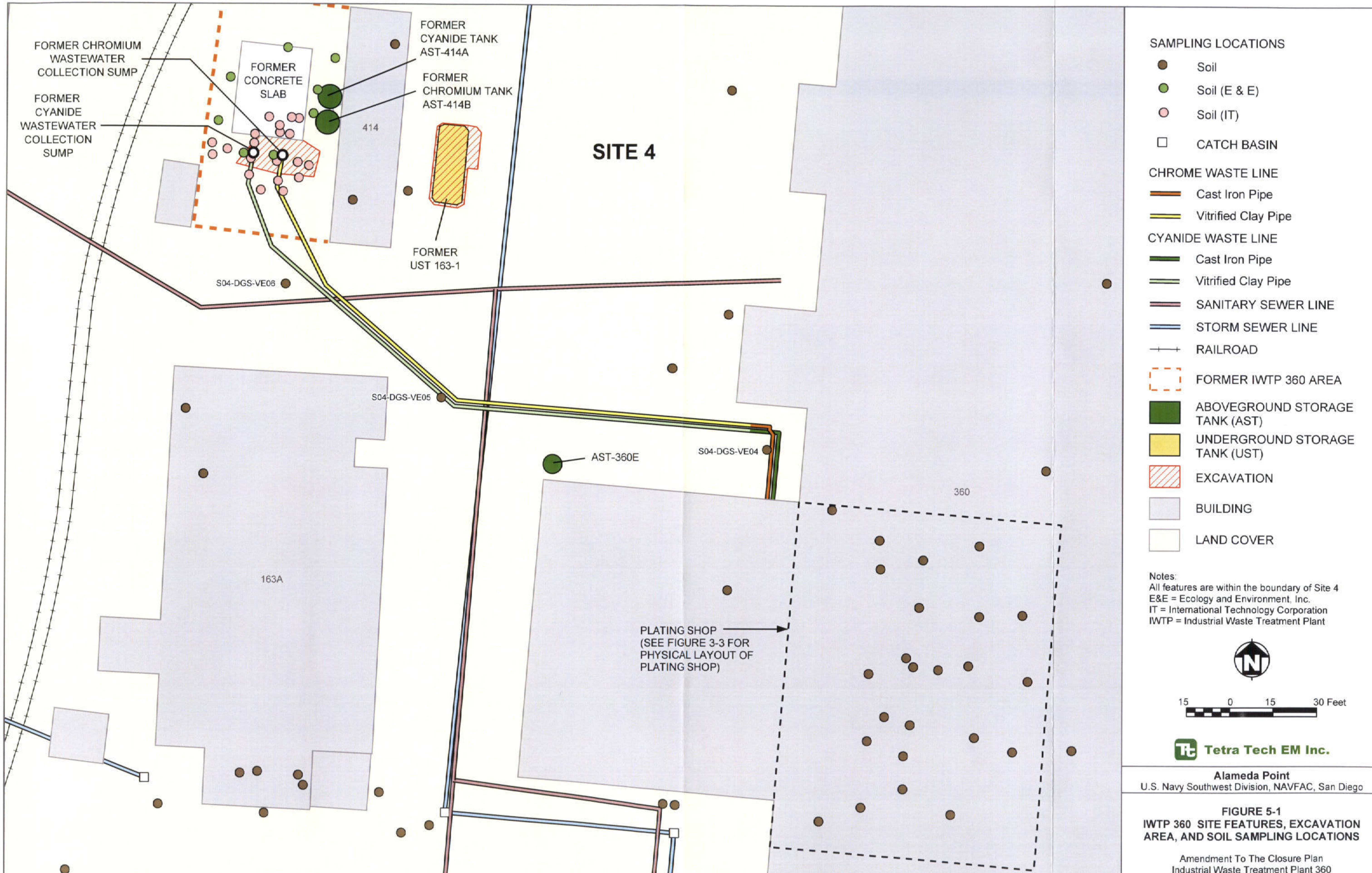

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FIGURE 5-1
IWTP 360 SITE FEATURES, EXCAVATION AREA, AND SOIL SAMPLING LOCATIONS

Amendment To The Closure Plan
Industrial Waste Treatment Plant 360

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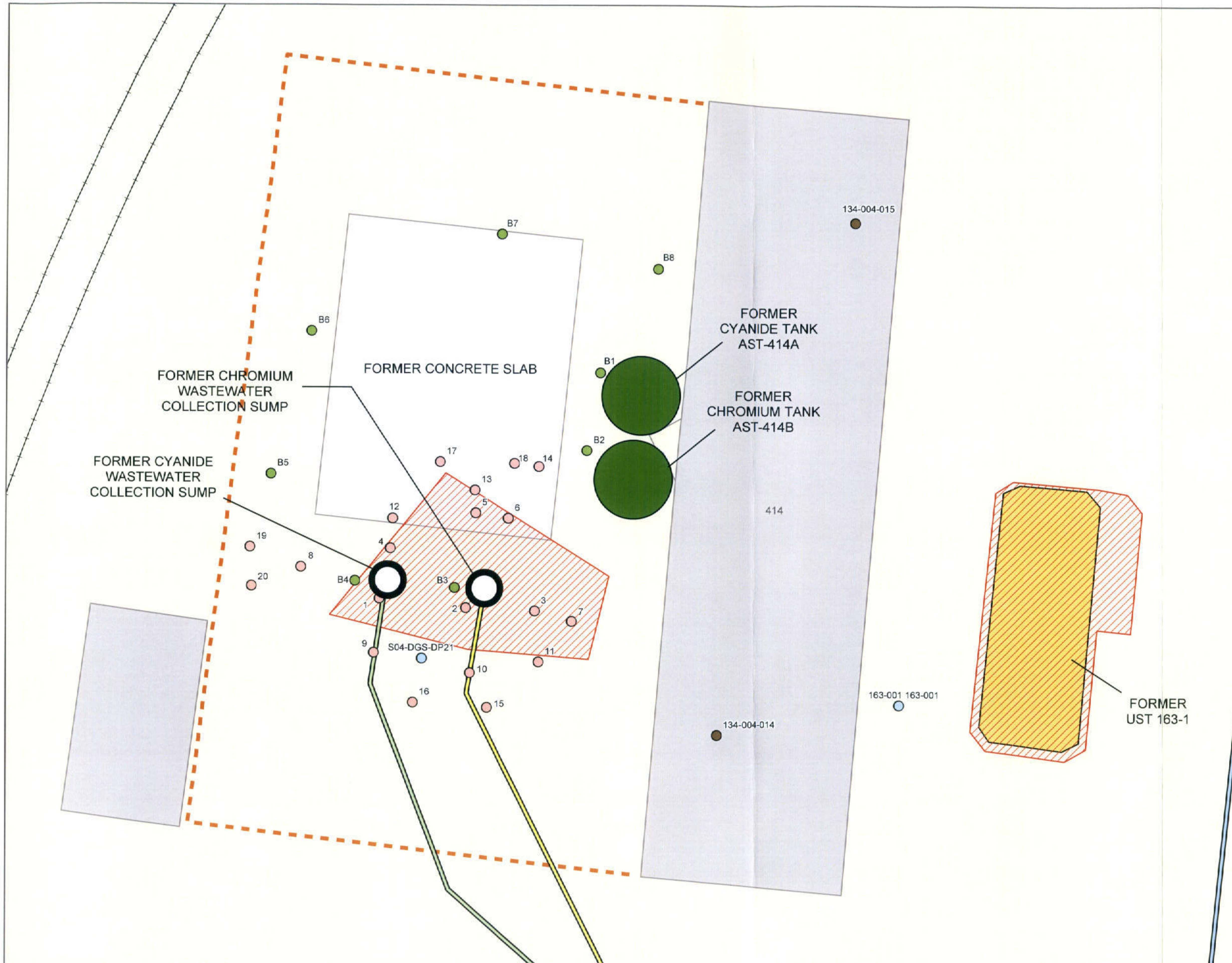

Notes:
All features are within the boundary of Site 4
E&E = Ecology and Environment, Inc.
IT = International Technology Corporation
IWTP = Industrial Waste Treatment Plant

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FIGURE 5-2
CLOSEUP OF SAMPLING LOCATIONS IN THE VICINITY OF IWTP 360

Amendment To The Closure Plan
Industrial Waste Treatment Plant 360

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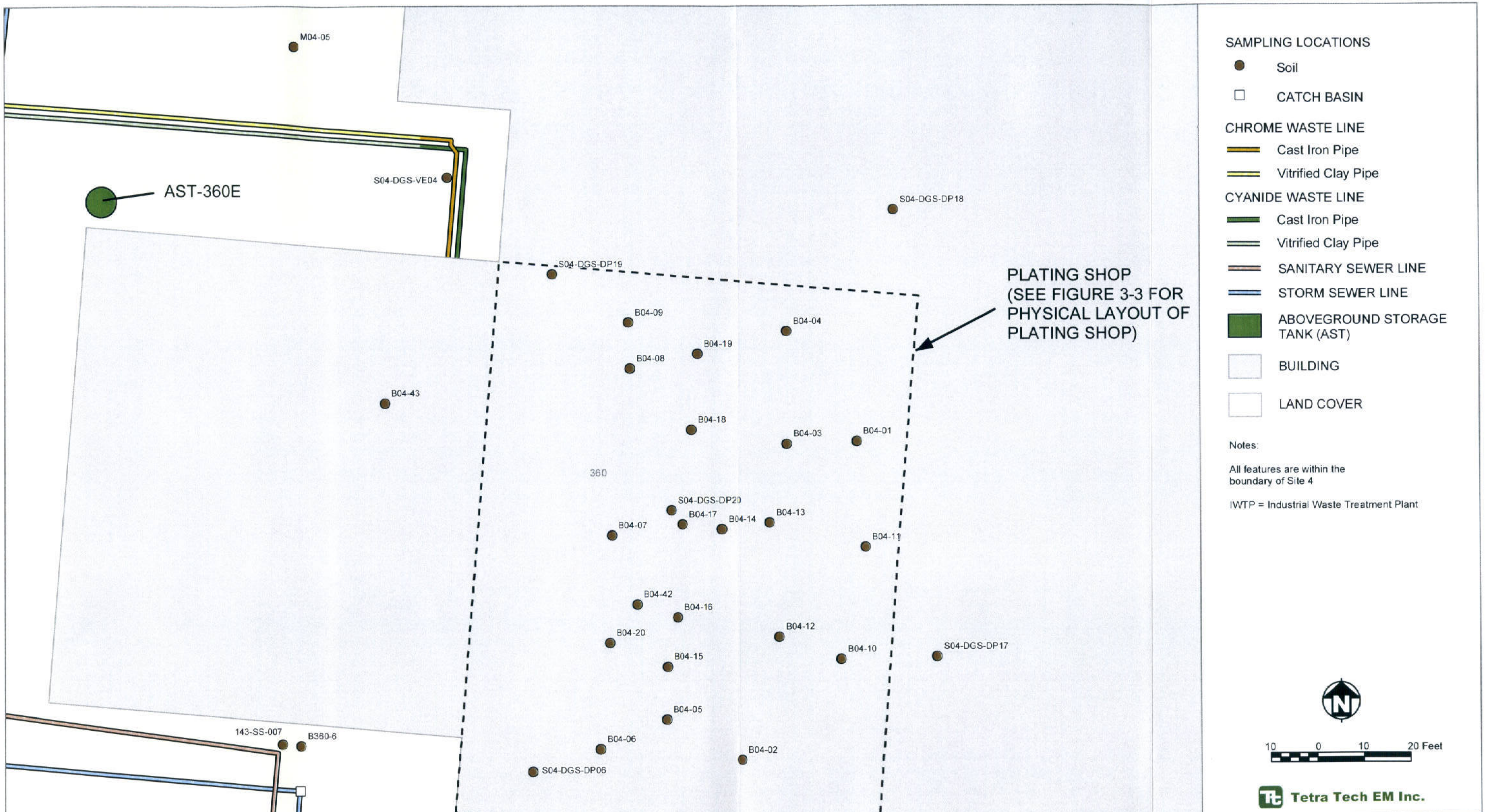

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FIGURE 5-3
CLOSEUP OF SAMPLING LOCATIONS WITHIN BUILDING 360

Amendment To The Closure Plan
Industrial Waste Treatment Plant 360

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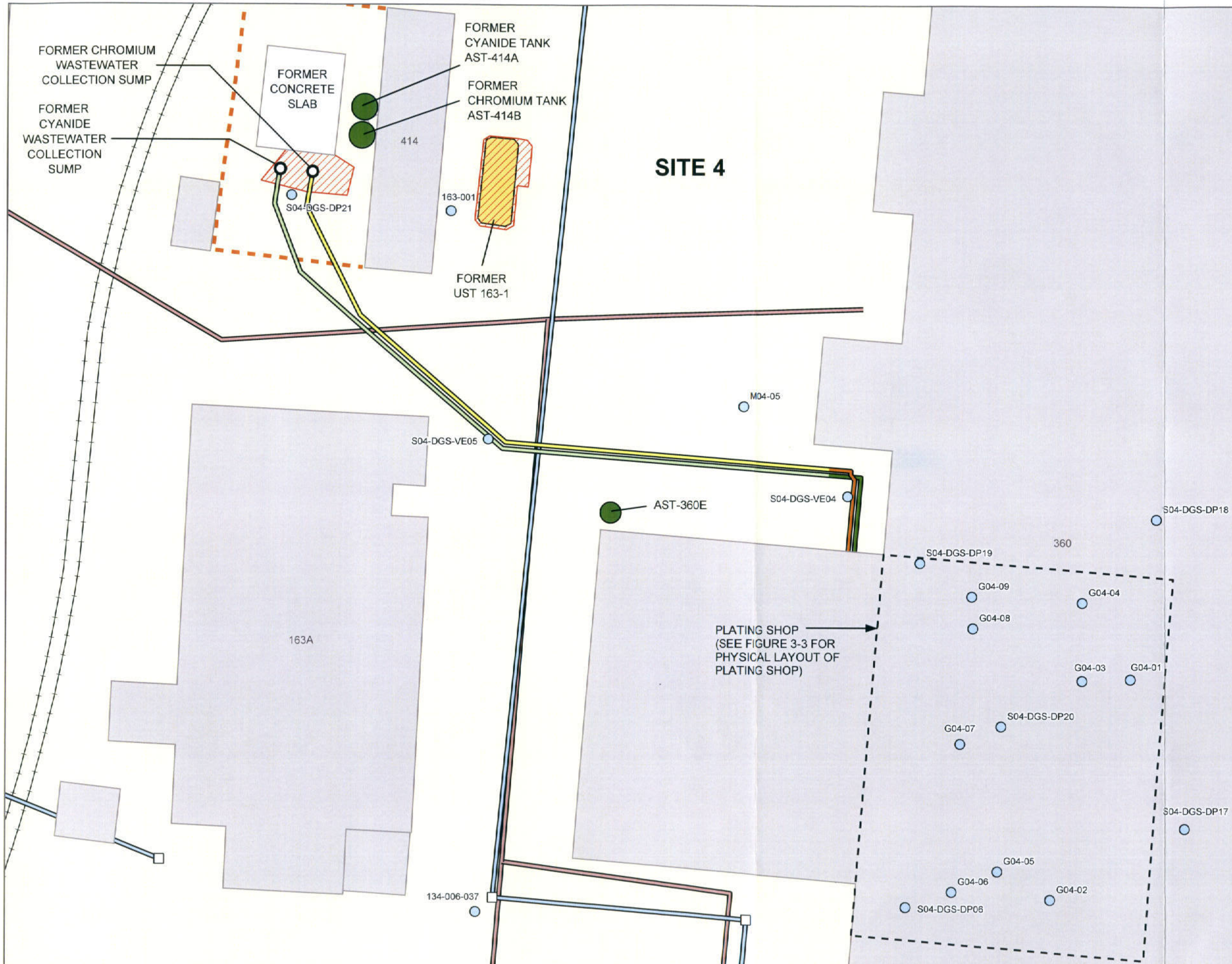

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U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 6-1
IWTP 360 SITE FEATURES, EXCAVATION AREA, AND GROUNDWATER SAMPLING LOCATIONS

Amendment To The Closure Plan
Industrial Waste Treatment Plant 360

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TABLES

FINAL
INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART 1: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

DATED 16 JANUARY 2004

TABLE 3-1: Major Components of IWTP 360

Identification	Construction	Material Stored	Capacity (gallons)	Status
Plating Waste Sump	Concrete	Wastewater	190	
Cyanide Spill Holding (T303)	Steel	Cyanide wastewater	5,300	Tank removed in January 1997; tank pit filled with concrete in February 1997
Chromium Spill Holding (T304)	Fiberglass	Chromium wastewater	5,300	Tank removed in January 1997; tank pit filled with concrete in February 1997
Chromium reduction (T305)	Steel	Wastewater (pH 2.5)	510	Tank removed in January 1997
Rapid Mix; Precipitation Tank (T306)	Steel	Wastewater (pH 11.5)	510	Tank removed in January 1997
Rapid Mix; Flocculation Tank (T307)	Steel	Wastewater (pH 11.5)	510	Tank removed in January 1997
Clarifier	Steel	Wastewater (pH 11.5)	2,950	Tank removed before 1995 closure plan; tank pit filled February 1997
Neutralization (T308)	Steel	Wastewater (pH 11.5)	380	Tank removed before 1995 closure plan
Sulfuric Acid (93%) Supply (T309)	Steel	93% Sulfuric acid	100	Tank removed December 1996
Sodium Hydroxide Supply (T310)	Steel	Sodium hydroxide	400	Tank removed December 1996
Polymer Supply (T311)	Stainless steel	Polymer solution	535	Tank removed December 1996
Cyanide wastewater Sump (T312)	Concrete	Cyanide wastewater	1,450	Filled with gravel and capped with concrete in February 1997; removed in December 2000
Chromium Wastewater Sump (T313)	Concrete	Chromium wastewater	1,450	Filled with gravel and capped with concrete in February 1997; removed in December 2000

(((

Table 5-1: Summary of Soil Results in the Vicinity of IWTP 360 in Soil Remaining After Excavation in December 2000

Location Relative to Excavated Soil	Sampling Date	Sampling Location	Depths (feet bgs)	Range of Cadmium Results (mg/kg) (PRG = 37 mg/kg)	Range of Chromium Results (mg/kg) (PRG = 210 mg/kg)
South of excavation	8/24/2000	9	6.0 to 14.3	0.02(U) to 1	31.3 to 58.4
	8/24/2000	10	6.0 to 14.3	0.02(U) to 0.018(U)	27.7 to 71
	8/24/2000	11	6.0 to 6.3	2	68.6
	8/24/2000	15	6.0 to 14.3	0.02(U) to 0.55	24.7 to 112
	8/24/2000	16	6.0 to 14.3	0.02(U) to 0.66	25.6 to 56.7
West/northwest of excavation	8/24/2000	8	5.7 to 14.0	0.02(U) to 0.06	25.7 to 44.9
	8/24/2000	12	7.0 to 14.3	0.02(U)	30.7 to 58.2
	8/24/2000	19	6.0 to 14.3	0.02(U) to 0.03(U)	11.6 to 39.6
	8/24/2000	20	6.0 to 14.3	0.02(U) to 0.03(U)	10.2 to 86.1
North/northeast of excavation	8/24/2000	13	6.3 to 14.6	0.02(U)	42.2 to 132
	8/24/2000	14	6.3 to 14.3	0.02(U) to 3.1	22 to 53.1
	8/24/2000	17	6.3 to 14.6	0.02(U) to 0.53(B)	18 to 48
	8/24/2000	18	6.5 to 14.3	0.02(U) to 0.48(B)	7.51 to 43.8
North of excavation	7/1/1997	B2, B5, B6, B7, B8	1 to 10	ND	14 to 35
East of Excavation (inside Building 414)	4/4/1995	134-044-014	3 to 4.5	0.07 (U) to 0.15	26.5 to 34.6
	4/11/1995	134-044-015	2.5 to 3	0.13	28
Within excavation	8/24/2000	1	10.0 to 14.0	0.02(U) to 0.25(B)	43.7 to 124
	8/24/2000	2	10.0 to 14.0	0.11(B) to 1.9	39.5 to 243
	8/24/2000	3	13.7 to 14.0	1.3	306
	8/24/2000	4	10.7 to 14.0	1.1 to 5.9	346 to 422
	8/24/2000	5	10.0 to 14.3	0.02(U) to 0.21(B)	43.8 to 122
	8/24/2000	6	10.0 to 14.3	0.02(U)	43.9 to 230
	8/24/2000	7	11.7 to 14.0	0.02(U)	50.8 to 51.5

Notes:

B = Compound detected in an associated blank as well as the sample
bgs = Below ground surface
IWTP = Industrial wastewater treatment plant
mg/kg = Milligrams per kilogram
ND = Not detected
PRG = Residential Preliminary Remediation Goals (U.S. Environmental Protection Agency 2002)
U = Compound was analyzed for but not detected above the concentration listed.
Value (shaded) = Concentration exceeds PRG

Soil at Sampling Locations B3, B4, and 1 through 7 was removed to a depth of 10 to 12 feet.

Table 5-2: Summary of Soil Results Along Pipelines from Building 360 to IWTP 360

Location	Sampling Date	Sampling Location	Depths (feet bgs)	Range of Cyanide Results (mg/kg) (PRG = 1,200 mg/kg)	Range of Cadmium Results (mg/kg) (PRG = 37 mg/kg)	Range of Chromium Results (mg/kg) (PRG = 210 mg/kg)	Range of Hexavalent Chromium Results (mg/kg) (PRG = 30 mg/kg)	Range of Copper Results (mg/kg) (PRG = 3,100 mg/kg)	Range of Lead Results (mg/kg) (Cal-modified PRG = 150 mg/kg)	Range of Nickel Results (mg/kg) (PRG = 1,600 mg/kg)	Range of Silver Results (mg/kg) (PRG = 390 mg/kg)
Adjacent to Building 360	4/26/2002	S04-DGS-VE04	3 to 5.5	2.2(U)	0.34(J) to 1.5	32 to 33.6	0.056(U)	13.1 to 38.0	5.4 to 7.5	33 to 47	1.4(J) to 2.7
Midway between Building 360 and IWTP 360	4/26/2002	S04-DGS-VE05	3 to 5.5	2.3(U) to 3.0	0.48(J) to 7.8	53.5 to 98.6	0.057(U) to 0.13	16.4 to 62.6	72.1 to 90.1	11.0 to 36.0	1.6(J) to 10.0
South and adjacent to former sumps at IWTP 360	4/26/2002	S04-DGS-VE06	3 to 3.5	2.5	31.6	38.1	1.2	8.3	8.3	165	3.3

Notes:
bgs = Below ground surface
Cal-modified = PRG modified by California EPA
J = Estimated concentration value
IWTP = Industrial wastewater treatment plant
mg/kg = Milligrams per kilogram
PRG = Residential Preliminary Remediation Goals (U.S. Environmental Protection Agency 2002)
U = Compound was analyzed for but not detected above the concentration listed.
Value (shaded) = Concentration exceeds PRG

Table 5-3: Summary of Soil Results In Plating Shop Within Building 360

Point Name	Sampling Date	Cadmium (mg/kg) (PRG = 37 mg/kg)	Chromium (Total) (mg/kg) (PRG = 210 mg/kg)	Chromium (Hexavalent) (mg/kg) PRG = 30 mg/kg)	Copper (mg/kg) (PRG = 3,100 mg/kg)	Lead (mg/kg) (Cal-modified PRG = 150 mg/kg)	Nickel (mg/kg) (PRG = 1,600 mg/kg)	Silver (PRG = 390 mg/kg)
B04-01	9/5/1991	6.89	333 J	2.29 J	54.3	68.5	144	2.12
B04-02	9/5/1991	0.446	45.6 J	0.667 J	11.5	6.81 J	158	1.79
B04-03	9/5/1991	0.987	44.8 J	0.194 J	19.1	3.38 J	41.8	9.76
B04-04	9/5/1991	0.949	161 J	0.117 J	17.3	46.7	53.6	1.57
B04-05	9/5/1991	4.91	194 J	0.361 J	13.2	5.46 J	692	2.79
B04-06	9/5/1991	1.55	53.6 J	0.341 J	8.28	3.48 J	62.4	2.69
B04-07	9/5/1991	2.3	34 J	0.189 J	9.38	4.74 J	55.4	1.01
B04-08	9/5/1991	0.306 U	31.2 J	0.21 J	5.42	4.12 J	25.6	0.795
B04-09	9/5/1991	38.1	192 J	0.085 J	29.6	33.4	107	10.3
B04-10	9/5/1991	2.29	1060 J	0.981 J	99.6	28	102	1.62
B04-11	9/5/1991	0.867	936 J	0.861 J	33.2	15.3 J	47.4	1.44
B04-11	9/5/1991	1.02	1250 J	28.6 J	33	12.4 J	52.5	1.58
B04-12	9/5/1991	0.319 U	51.4 J	7.81 J	28.3	10.2 J	37.1	7.31
B04-13	9/5/1991	0.299 U	64.9 J	0.949 J	18.8	5.06 J	28.9	7.86
B04-14	9/5/1991	0.774	31.5 J	0.657 J	22.3	2.15 J	42.6	3.84
B04-15	9/5/1991	0.314 U	32.4 J	0.39 J	10	6.27 J	30.9	1.33
B04-16	9/5/1991	5.67	24.8 J	0.107 J	13	8.76 J	87.3	70.5
B04-17	9/5/1991	0.314 U	24 J	1.45 J	33.8	2.28 J	40.2	2.12
B04-18	9/5/1991	1.79	27.1 J	0.501 J	34.7	6.82 J	159	1.68
B04-19	9/5/1991	11.4	57.8 J	2.64 J	21.1	28.2	50.1	15
B04-20	9/5/1991	0.369	33.5 J	2.22 J	14.3	4.12 J	29.1	1.88
B04-42	4/1/1994	5.9	134 J	0	33.5 J	10.8	90 J	15.1
B04-42	4/1/1994	4.3	70.5 J	0	19.7 J	8.7	53.6 J	1.1
B04-42	4/1/1994	1.5	157 J	0	14.3 J	9.1	115 J	0.5 U
B04-43	9/1/1994	0.68 J	52.9	NA	16	34.4 J	34.4	3
B04-43	9/1/1994	0.52 J	56.3	NA	21.8	15.5 J	37.8	2.8

Table 5-3: Summary of Soil Results In Plating Shop Within Building 360

Point Name	Sampling Date	Cadmium (mg/kg) (PRG = 37 mg/kg)	Chromium (Total) (mg/kg) (PRG = 210 mg/kg)	Chromium (Hexavalent) (mg/kg) PRG = 30 mg/kg)	Copper (mg/kg) (PRG = 3,100 mg/kg)	Lead (mg/kg) (Cal-modified PRG = 150 mg/kg)	Nickel (mg/kg) (PRG = 1,600 mg/kg)	Silver (PRG = 390 mg/kg)
B04-43	9/5/1991	0.15 J	55.5	NA	11.5	7.4 J	39.6	0.21 U
S04-DGS-DP06	4/27/2002	0.078 U	118	1.1	NA	NA	NA	NA
S04-DGS-DP06	4/27/2002	0.046 U	91.3	0.06 U	NA	NA	NA	NA
S04-DGS-DP17	6/20/2001	0.1 U	39	0.054 U	NA	NA	NA	NA
S04-DGS-DP17	6/20/2001	0.17 U	30.2	0.057 U	NA	NA	NA	NA
S04-DGS-DP19	6/19/2001	6.3	49.5	0.2	NA	NA	NA	NA
S04-DGS-DP19	6/19/2001	0.23 U	29.1	0.06 U	NA	NA	NA	NA
S04-DGS-DP20	6/19/2001	1	191	0.22	NA	NA	NA	NA
S04-DGS-DP20	6/19/2001	1.1	94.1	0.058 U	NA	NA	NA	NA

Notes:
Cal-modified = PRG modified by California
IWTP = Industrial wastewater treatment plant
J = Estimated concentration value
mg/kg = Milligrams per kilogram
NA = Not analyzed
PRG = Residential Preliminary Remediation Goals (U.S. Environmental Protection Agency 2002)
U = Compound was analyzed for but not detected above the concentration listed.
Value (shaded) = Concentration exceeds PRG

Table 6-1: Summary of Groundwater Results South of IWTP 360 and Along Pipelines from Building 360 to IWTP 360

Location	Point Name	Sampling Date	Cadmium (ug/L) (MCL = 5 µg/L)	Chromium (Total) (ug/L) (MCL = 50 µg/L)	Chromium (Hexavalent) (ug/L) No MCL published	Copper (ug/L) (MCL-sec = 1,000 µg/L)	Lead (ug/L) (MCL = 15 µg/L)	Nickel (ug/L) (MCL = 100 µg/L)	Silver (ug/L) (MCL-sec = 100 µg/L)
South of IWTP 360 (3 feet south of excavation)	S04-DGS-DP21	7/9/2001	0.25 U	1.3 U	10 U	NA	NA	NA	NA
	S04-DGS-DP21	7/9/2001	0.27 J	26.6	10 U	NA	NA	NA	NA
Along pipeline (close to Bldg 360)	S04-DGS-VE04	4/26/2002	0.4 UJ	1 UJ	10 UJ	3.5 UJ	0.71 J	3.6 J	0.25 U
Along pipeline (midway between Bldg and IWTP)	S04-DGS-VE05	4/26/2002	0.37 UJ	1.2 UJ	10 UJ	5.3 UJ	2.6 J	6.7 J	0.25 U
Monitoring well - north of pipeline (40 feet)	M04-05	6/21/2002	0.076 U	87	NA	4.5 J	3 U	3.2 J	5 U
	M04-05	8/4/1998	0.3 U	105	NA	5.7 UJ	1.1 U	5.6 UJ	0.7 U

Notes:
Bldg = Building
IWTP = Industrial Wastewater Treatment Plant
J = Estimated concentration value
MCL = Maximum Contaminant Level (California Department of Health Services 2003)
MCL-sec = Secondary MCL
NA = Not analyzed
µg/L = Microgram per liter
U = Compound was analyzed for but not detected above the concentration listed.
Value shaded = Concentration exceeds MCL

Table 6-2: Summary of Groundwater Results In Plating Shop Within Building 360

Point Name	Sampling Date	Cadmium (ug/L) (MCL = 5 µg/L)	Chromium - Total (ug/L) (MCL = 50 µg/L)	Chromium - Hexavalent (µg/L) No MCL Published
G04-01	9/9/1991	3 U	5.7 U	100 U*
G04-02	9/9/1991	3 U	70	1020 J*
G04-02	9/9/1991	3 U	65	82.5 J*
G04-03	9/9/1991	3 U	5.7 U	200 U*
G04-04	9/6/1991	3 U	5.7 U	48.5 J*
G04-05	9/9/1991	3 U	28.5	200 U*
G04-06	9/9/1991	3 U	768	493 J*
G04-07	9/10/1991	4.3	5.7 U	400 U*
G04-08	9/10/1991	3 U	33.7	660 J*
G04-09	9/9/1991	183	131	147 J*
S04-DGS-DP06	4/27/2002	0.22 UJ	1540	190 J
S04-DGS-DP17	6/20/2001	0.25 U	1.8 J	10 U
S04-DGS-DP18	6/19/2001	0.25 U	3.8 J	10 U
S04-DGS-DP19	6/19/2001	0.38 J	8.4	10 U
S04-DGS-DP20	6/19/2001	3.4	21	10 U
S04-DGS-DP21	6/19/2001	0.25 U	1.3 UJ	10 UJ

Notes:
IWTP = Industrial Wastewater Treatment Plant
J = Estimated concentration value
MCL = Maximum Contaminant Level (California Department of Health Services 2003)
NA = Not analyzed
µg/L = Microgram per liter
U = Compound was analyzed for but not detected above the concentration listed.
Value shaded = Concentration exceeds MCL

* Groundwater samples collected from point name beginning with G04 were unfiltered for hexavalent chromium analysis

ATTACHMENT A

CLOSURE PLAN, INDUSTRIAL WASTEWATER TREATMENT PLANT, BUILDING 360, NAS ALAMEDA, NOVEMBER 1995

FROM ... 5-16-00

CLOSURE PLAN

INDUSTRIAL WASTEWATER TREATMENT PLANT
BUILDING 360, NAS ALAMEDA
ALAMEDA, CALIFORNIA

November 7, 1995

Prepared in Support of:

Contract to Provide Environmental Support Services
to the U.S. Navy Public Works Center
San Francisco Bay
Contract No. N68378-95-D-4929
Delivery Order No. 0003

TABLE OF CONTENTS

Section		Page
1.	INTRODUCTION	1-1
	1.1 FACILITY IDENTIFICATION	1-1
	1.1.1 Facility Name	1-1
	1.1.2 EPA Identification Number	1-1
	1.1.3 Facility Address	1-1
	1.1.4 Facility Mailing Address	1-2
	1.1.5 Facility Contact	1-2
	1.1.6 Facility Operator	1-2
	1.1.7 Closure Plan Preparer	1-2
	1.1.8 Nature of Business	1-2
	1.1.9 Environmental Permits	1-2
	1.1.10 Certification	1-3
2.	FACILITY INFORMATION	2-1
	2.1 FACILITY SIZE	2-1
	2.2 FACILITY MAPS	2-1
	2.3 HYDROGEOLOGIC CONDITIONS	2-1
	2.4 WEATHER AND CLIMATIC CONDITIONS	2-5
3.	FACILITY DESIGN	3-1
	3.1 DESCRIPTION	3-1
	3.2 DESIGN CAPACITY	3-1
	3.3 ANCILLARY EQUIPMENT	3-1
	3.4 CONTAINMENT SYSTEMS	3-2
	3.5 LEAK DETECTION/MONITORING SYSTEMS	3-2
	3.6 FACILITY LAYOUT	3-2
	3.7 DESCRIPTION OF WASTES	3-2

TABLE OF CONTENTS (cont.)

Section		Page
3.8	HAZARDOUS WASTE CONSTITUENTS AND MAXIMUM INVENTORY	3-5
3.9	WASTES GENERATED DURING CLOSURE	3-5
3.10	MANAGEMENT OF HAZARDOUS WASTES	3-8
3.11	LAND DISPOSAL RESTRICTIONS	3-8
3.12	CHANGES IN MAXIMUM INVENTORY	3-8
4.	DECONTAMINATION PROCEDURES	4-1
4.1	CONTAMINATED EQUIPMENT, STRUCTURES, AND BUILDINGS	4-1
4.2 ~~4.1~~	DECONTAMINATION PROCEDURES	4-1
5.	CONFIRMATION SAMPLING	5-1
5.1	OBJECTIVE	5-1
5.2	SAMPLE TYPES	5-1
5.3	NUMBER AND LOCATIONS OF SAMPLES	5-1
5.4	FIELD SAMPLING METHODS	5-2
5.4.1	Water Samples	5-2
5.4.2	Wipe Samples	5-2
5.4.3	Chip/Core Samples	5-2
5.4.4	Soil Samples	5-2
5.4.5	Groundwater Samples	5-3
5.5	QUALITY CONTROL SAMPLES	5-3
5.6	DECONTAMINATION OF SAMPLING EQUIPMENT	5-3
5.7	CHAIN-OF-CUSTODY PROCEDURES	5-3
5.8	SAMPLE LABELING, PACKAGING/PRESERVATION, AND SHIPPING	5-4
5.9	DOCUMENTATION	5-5
5.10	ANALYTICAL TEST METHODS	5-6

TABLE OF CONTENTS (cont.)

Section		Page
6.	CLOSURE PERFORMANCE STANDARDS & CLEANUP PROCEDURES	6-1
	6.1 SOIL CLEANUP LEVELS	6-1
	6.2 EQUIPMENT, STRUCTURES, AND BUILDING CLEANUP LEVELS	6-1
	6.3 REMOVAL/CLEANUP PROCEDURES	6-1
7.	CLOSURE IMPLEMENTATION SCHEDULE/COST ESTIMATE	7-1
	7.1 SCHEDULE	7-1
	7.2 COST ESTIMATE	7-1
8.	FINANCIAL RESPONSIBILITY	8-1
9.	CLOSURE CERTIFICATION REPORT	9-1
10.	WORKER HEALTH AND SAFETY	10-1
	10.1 HAZARD IDENTIFICATION	10-2
	10.1.1 Chemical Hazard Assessment	10-2
	10.1.2 Physical Hazard Assessment	10-3
	10.1.2.1 Demolition Activity Physical Hazards	10-4
	10.1.2.2 Safe Use of Demolition and Removal Equipment	10-4
	10.1.2.3 Material Handling	10-6
	10.1.2.4 Confined Space Entry	10-7
	10.2 HAZARD EVALUATION	10-7
	10.3 PERSONAL PROTECTIVE EQUIPMENT	10-8
	10.4 ENVIRONMENTAL MONITORING	10-14
	10.5 SITE WORK ZONES	10-17
	10.5.1 Exclusion Zone	10-18
	10.5.2 Contamination Reduction Zone	10-19
	10.5.3 Support Zone	10-19
	10.6 DECONTAMINATION OF WORKERS	10-20
	10.7 EMERGENCY PROCEDURES	10-23

LIST OF ILLUSTRATIONS

Figure		Page
2-1	SITE LOCATION MAP	2-2
2-2	FACILITY LOCATION MAP	2-3
3-1	FACILITY LAYOUT	3-3
3-2	PROCESS SCHEMATIC	3-6
7-1	CLOSURE PLAN IMPLEMENTATION SCHEDULE	7-2

LIST OF TABLES

Table		Page
2-1	GEOLOGIC UNITS BENEATH NAS ALAMEDA	2-4
3-1	TANK INFORMATION, Building 360 IWTP	3-4
3-2	MANAGED HAZARDOUS WASTES, Building 360 IWTP	3-7
3-3	DISCHARGE LIMITATIONS, Building 360 IWTP	3-9
4-1	EQUIPMENT TO BE DECONTAMINATED, Building 360 IWTP	4-2
7-1	CLOSURE COST ESTIMATE, Building 360 IWTP	7-3
10-1	DEMOLITION ACTIVITY PHYSICAL HAZARDS, Building 360 IWTP	10-5
10-2	HAZARDS ASSOCIATED WITH WASTEWATER CONSTITUENTS AND TREATMENT CHEMICALS, Building 360 IWTP	10-9
10-3	SUGGESTED AIR MONITORING PLAN, Building 360 IWTP	10-16

1. INTRODUCTION

This document outlines the procedures to be employed to permanently close and demolish the Building 360 Industrial Wastewater Treatment Plant (IWTP) at the Alameda Naval Air Station (NAS Alameda) in Alameda, California. The following documents were reviewed in the preparation of this Closure Plan:

- *Operation Plan, Industrial Waste Treatment Plant, Building 360,* Naval Air Station, Alameda California, Department of the Navy, Western Division, Naval Facilities Engineering Program, April 1988.

- *Permit Writer Instructions for Closure of Storage and Treatment Facilities,* Department of Toxic Substances Control, June 14, 1993.

- *Geohydrology and Groundwater — Quality Overview, East Bay Plain Area, Alameda County, California,* Alameda County Flood Control and Water Conservation District, June 1988.

1.1 FACILITY IDENTIFICATION

1.1.1 Facility Name:

Naval Air Station, Alameda
Building 360 Industrial Wastewater Treatment Plant (IWTP)

1.1.2 EPA Identification Number

CA2170023236

1.1.3 Facility Address

Commanding Officer
Naval Air Station (Code 015)
Alameda, CA 94501-5000

1.1.4 Facility Mailing Address

Commanding Officer
Naval Air Station (Code 015)
Alameda, CA 94501-5000

1.1.5 Facility Contact

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Oakland, CA 94623-1003
(510) 302-5485

1.1.6 Facility Operator

Navy Public Works Center, San Francisco Bay
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(510) 302-5415

1.1.7 Closure Plan Preparer

Mr. Steven M. Morin, Environmental Engineer
Ecology and Environment, Inc.
160 Spear Street, Suite 1400
San Francisco, CA 94105
(415) 777-2811

1.1.8 Nature of Business

NAS Alameda is a major Naval air station complex which maintains and operates facilities to provide services and materials in support of Naval aviation activities. NAS Alameda berths and services aircraft carriers and other allied and supporting vessels. The major tenant is the Naval Aviation Depot whose primary mission is to overhaul aircraft.

1.1.9 Environmental Permits

Wastewater Discharge Permit No. 773-95511
East Bay Municipal Utility District

RCRA Hazardous Waste Permit No. CA2170023236

Air Emissions Permit No. PL-114
Bay Area Air Quality Management District

1.1.10 Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Name Date

2. FACILITY INFORMATION

2.1 FACILITY SIZE

NAS Alameda currently occupies approximately 2,720 acres of land, water, and airspace easements. The IWTP at Building 360 covers an area of approximately 1,800 square feet (37.5 ft. x 47.5 ft.).

2.2 FACILITY MAPS

NAS Alameda is located on a coastal island on the east side of San Francisco Bay. The Building 360 IWTP is located in the southeast section of NAS Alameda, approximately 3,000 feet north and 1,250 feet east of San Francisco Bay (Figure 2-1). There are no drinking water wells within ¼-mile of the facility. The IWTP facility at Building 360 is at 37° 46' 40" north latitude and 122° 17' 35" west longitude. The IWTP location, with respect to Building 360, is presented in Figure 2-2.

2.3 HYDROGEOLOGIC CONDITIONS

NAS Alameda is five feet above sea level and is constructed on dredged bay mud fill underlain by Merritt sand, to a depth of approximately 55 feet below sea level, and older alluvium, to a depth of approximately 725 feet below sea level. The alluvium is underlain by undivided bedrock. Table 2-1 describes these geologic units in more detail. Depth to groundwater is relatively uniform across the base but varies from 2 to 8 feet below ground surface at NAS Alameda due to tidal influences.

N00236.001760
ALAMEDA POINT
SSIC NO. 5090.3

ATTACHMENT A – CLOSURE PLAN, INDUSTRIAL WASTEWATER TREATMENT PLANT, BUILDING 360

FIGURE 2-1 – SITE LOCATION
PAGE 2-2

FINAL INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART I: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

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ATTACHMENT A – CLOSURE PLAN, INDUSTRIAL WASTEWATER TREATMENT PLANT, BUILDING 360

FIGURE 2-2 – FACILITY LOCATION MAP
PAGE 2-3

FINAL INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART I: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

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Table 2-1

GEOLOGIC UNITS BENEATH NAS ALAMEDA

Geologic Unit	Thickness	General Character	Water-bearing Properties
Bay mud	Ranges from 1 foot to 120 feet beneath the bay	Unconsolidated, dark plastic clay and silty clay rich in organic material. Some lenses of silt and sand.	Low permeability. Water saturated; mostly with salt water. Yields small quantity of groundwater to wells.
Merritt sand	A maximum of about 65 feet	Loose, well sorted, fine to medium grained sand; silty, clayey, with lenses of sandy clay and clay.	Permeable. Permeability decreases with depth as deposit becomes more consolidated. Yields small quantities of groundwater to wells.
Older Alluvium	A maximum of about 1100 feet	Layers of poorly consolidated to unconsolidated clay, silt, sand, and gravel.	Permeable, but water yielding ability varies throughout area. Yields large to small quantities of water to wells.
Undivided bedrock	Probably more than 10,000 feet	Mostly consolidated or highly compacted sandstone, shale, and chert some volcanic rock, serpentine, and conglomerates.	Low permeability. Locally yields small quantities of water to wells from fractures, and the sandstone and conglomerate units.

Source: *Geohydrology and Groundwater — Quality Overview, East Bay Plain Area, Alameda County, California*

2.4 WEATHER AND CLIMATIC CONDITIONS

The *Geohydrology and Groundwater — Quality Overview* report referenced in Section 1 describes the climate of Alameda County as Mediterranean with winter rains and summer dryness. The winter rains derive from frontal storms formed in the North Pacific Ocean. Most of the rainfall occurs during the months of November through March. The rainfall pattern displays a north to south trend with greater amounts of rain to the north. The average annual precipitation at NAS Alameda is approximately 16 inches.

3. FACILITY DESIGN

3.1 DESCRIPTION

The IWTP at Building 360 occupies an area of approximately 1,800 square feet which includes the following:

- Instrument/Control Equipment: 125 sq. ft.
- Waste/Chemical Storage: 250 sq.ft.
- Waste Treatment/Processing: 1,425 sq. ft.

3.2 DESIGN CAPACITY

The Building 360 IWTP was constructed in 1973 and was taken out of service in 1994. During its operable lifetime, the IWTP treated an average of 26,500 gallons per day.

3.3 ANCILLARY EQUIPMENT

The Building 360 IWTP contains the following ancillary equipment:

- Operator Shelter/Control Room;
- Motor Control Center;
- Two Emergency Spill Collection Tanks (one for chromium, one for cyanide);
- Miscellaneous Pumps (transfer, process, and chemical); and
- Miscellaneous Underground and Aboveground Piping.

3.4 CONTAINMENT SYSTEMS

The entire IWTP was constructed on a continuously-poured concrete slab. The slab is bordered by a concrete spill containment curb having a total secondary containment capacity of 48,000 gallons.

3.5 LEAK DETECTION/MONITORING SYSTEMS

The Building 360 IWTP did not have any leak detection or leak monitoring systems.

3.6 FACILITY LAYOUT

The layout of the Building 360 IWTP is presented in Figure 3-1. Table 3-1 provides information concerning the tanks at the Building 360 IWTP.

3.7 DESCRIPTION OF WASTES

During its operation, the IWTP treated two different waste streams (i.e., cyanide and chromium) generated from metal plating operations in Building 360.

The cyanide wastewater consisted mainly of rinsewater containing cyanide, silver, nickel, lead, and copper. The cyanide wastewater was treated using sodium hydroxide to raise the pH to over 10 and sodium hypochlorite to break the cyanide down into carbon dioxide and nitrogen. The effluent from the cyanide treatment process was discharged into the precipitation unit where it was commingled with the chromium treatment effluent for the removal of heavy metals.

The chromium wastewater consisted primarily of rinsewater containing hexavalent and trivalent chromium, cadmium, nickel, and surfactants. In this treatment process, the chromium was reduced from hexavalent (Cr^{+6}) to trivalent (Cr^{+3}) through the introduction of

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SSIC NO. 5090.3

ATTACHMENT A – CLOSURE PLAN, INDUSTRIAL WASTEWATER TREATMENT PLANT, BUILDING 360

FIGURE 3-1 – FACILITY LAYOUT
PAGE 3-3

FINAL INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART I: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

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Table 3-1

TANK INFORMATION
Building 360 Industrial Wastewater Plant

Tank No.	Description/ Purpose	Contents	Capacity (gal.)	Material of Construction	Lining
	Plating waste sump	Wastewater	190	Concrete	None
T303	Cyanide spill holding	Cyanide wastewater	5,300	Steel	Coal tar epoxy
T304	Chromium spill holding	Chromium wastewater	5,300	Fiberglass	Hetron 197
T305	Chromium reduction	Wastewater (pH 2.5)	510	Steel	Coal tar epoxy
T306	Rapid mix	Wastewater (pH 11.5)	510	Steel	Coal tar epoxy
T307	Rapid mix	Wastewater (pH 11.5)	510	Steel	Coal tar epoxy
	Clarifier (removed)	Wastewater (pH 11.5)	2,950	Steel	Coal tar epoxy
T308	Neutralization (removed)	Wastewater (pH 11.5)	380	Steel	Coal tar epoxy
T309	Sulfuric acid	93% Sulfuric acid	100	Steel	None
T310	Sodium hydroxide	Sodium hydroxide	400	Steel	None
T311	Polymer	Polymer solution	535	Stainless Steel	None
T312	Cyanide wastewater sump	Cyanide wastewater	1,450	Concrete	None
T313	Chromium wastewater sump	Chromium wastewater	1,450	Concrete	None

Source: *Operation Plan, Industrial Waste Treatment Plant, Building 360,* Naval Air Station, Alameda California, Department of the Navy, Western Division, Naval Facilities Engineering Program, April 1988.

sulfuric acid, to lower the pH to approximately 2.5, and sulfur dioxide to reduce the valence state of the chromium.

The two treatment effluents were then combined as the streams entered the precipitation tank where the pH was raised to approximately 8.5 using sodium hydroxide. A polymer was also added to aid in the precipitation of metal hydroxides and sulfides. This combined stream then flowed into a clarifier where the precipitate was allowed to settle out and the effluent flowed to the industrial waste sewer following adjustment of the pH to approximately 7.0. The sludge that accumulated in the bottom of the clarifier was periodically pumped out and disposed offsite by an outside contractor. Figure 3-2 presents a schematic of the treatment process. Following the shutdown of this treatment facility, the clarifier/neutralization tank was removed for use at another permitted treatment facility at NAS Alameda.

3.8 HAZARDOUS WASTE CONSTITUENTS AND MAXIMUM INVENTORY

The types, quantities, and maximum inventory of hazardous wastes that were typically handled at the Building 360 IWTP are presented in Table 3-2. The maximum inventory is a function of the capacity of the tank containing the material and the typical concentration.

3.9 WASTES GENERATED DURING CLOSURE

The Building 360 IWTP has been out of operation since 1994 and all of the tanks, pumps, and piping have been emptied of all liquids. Wastes that are anticipated to be generated during closure include wash/rinse water from the flushing and decontamination of the tanks, pumps, and piping; personal protective garments worn during decontamination procedures; and investigation derived waste (e.g., cuttings from soil borings, decontamination water, etc.). Also, the tanks, pumps, and piping could be included as a generated waste if decontamination is not achieved; however, this is not anticipated.

ATTACHMENT A – CLOSURE PLAN, INDUSTRIAL WASTEWATER TREATMENT PLANT, BUILDING 360

FIGURE 3-2 – PROCESS SCHEMATIC
PAGE 3-6

FINAL INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART I: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

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Table 3-2

MANAGED HAZARDOUS WASTES
Building 360 Industrial Wastewater Treatment Plant

Waste Material	EPA Hazardous Waste Number	California Waste Code	Typical Concentration (mg/l)	Physical State	Estimated Annual Quantity (lbs.)	Maximum Inventory	
						Gallons	Pounds
Chromium (total)	D007	132	41.000	Liquid	2357.00	11,610	6.460
Chromium+6	D007	132	0.900	Liquid	52.00	6,750	0.140
Silver	D011	132	0.020	Liquid	1.20	11,100	0.003
Copper	N/A	132	0.100	Liquid	5.70	11,100	0.020
Lead	D008	132	0.025	Liquid	1.40	11,100	0.004
Nickel	N/A	132	0.890	Liquid	51.00	18,360	0.140
Cyanide	F007	131	1.200	Liquid	69.00	6,750	0.190
Cadmium	D006	132	0.180	Liquid	10.30	11,610	0.030
Surfactants	N/A	561	0.300	Liquid	17.25	11,610	0.050
Metal Hydroxide Sludge	F006	171	N/A	Liquid	142,000.00	N/A	389.000

Source: *Operation Plan, Industrial Waste Treatment Plant, Building 360,* Naval Air Station, Alameda California, Department of the Navy, Western Division, Naval Facilities Engineering Program, April 1988.

3.10 MANAGEMENT OF HAZARDOUS WASTES

As previously mentioned, the Building 360 IWTP has been out of operation since 1994 and all of the tanks, pumps, and piping are currently empty. The wastewater generated during decontamination procedures will be sampled and analyzed for the parameters indicated in Table 3-3; if the analytical results meet all of the discharge limitations presented in this table, the wash/rinsewater will be discharged to the Industrial Waste Sewer; if the analytical results do not meet the discharge limitations, the wash/rinsewater will be transported to the Building 5 IWTP for treatment. All disposable personal protective equipment will deconned to the fullest extent possible and triple-bagged for disposal with the municipal trash. It is anticipated that all of the equipment (i.e., tanks, pumps, and piping) at the IWTP will be successfully decontaminated and will be disposed of offsite.

3.11 LAND DISPOSAL RESTRICTIONS

Treatment of all wash/rinsewater not meeting the discharge limitations specified in Table 3-3 will be performed at another permitted industrial wastewater treatment plant at NAS Alameda. Any solids generated during the decontamination procedure will also be brought to this treatment facility for dewatering and ultimately disposed offsite. These solids will comply with all land disposal restrictions.

3.12 CHANGES IN MAXIMUM INVENTORY

The Building 360 IWTP has been out of operation since 1994 and is to be demolished in 1996. Consequently, a change in the maximum inventory of hazardous wastes is not anticipated.

Table 3-3

DISCHARGE LIMITATIONS
Building 360 Industrial Wastewater Treatment Plant

Parameter	Analytical Method (SW-846)	Maximum Concentration
Arsenic	6010	2 mg/l
Cadmium	6010	0.69 mg/l
Chlorinated Hydrocarbons	EPA 612	0.5 mg/l
Chromium (total)	6010	2 mg/l
Copper	6010	3.38 mg/l
Cyanide	9010	1.2 mg/l
Iron	6010	100 mg/l
Lead	6010	0.69 mg/l
Mercury	7470	0.05 mg/l
Nickel	6010	3.98 mg/l
Oil and Grease	9070	250 mg/l
pH	pH Meter	> 5.5
Phenolic Compounds	9065	100 mg/l
Silver	6010	0.43 mg/l
Temperature	Thermometer	< 150 °F
Zinc	6010	2.61 mg/l

Source: *Operation Plan, Industrial Waste Treatment Plant, Building 360,* Naval Air Station, Alameda California, Department of the Navy, Western Division, Naval Facilities Engineering Program, April 1988.

4. DECONTAMINATION PROCEDURES

4.1 CONTAMINATED EQUIPMENT, STRUCTURES, AND BUILDINGS

The equipment, structures, and buildings to be decontaminated during the closure and demolition of the Building 360 IWTP are listed in Table 4-1.

4.2 DECONTAMINATION PROCEDURES

As stated previously, the Building 360 IWTP has been out of operation since 1994 and all of the tanks, pumps, and piping are currently empty. The first step in the decontamination procedure will be the removal of all solids and sludges remaining in the tanks. These solids will be transported to another of NAS Alameda's permitted treatment facilities for subsequent shipment to an off-site, licensed disposal facility. In addition, treatment process chemicals will be either salvaged for use in another of NAS Alameda's treatment facilities or, if unsalvageable, disposed of off-site at a licensed disposal facility.

Following removal of the solids, sludges, and process chemicals, the interior of all tanks, pumps, and piping will be flushed using clean water. If necessary, the interior walls of the tanks may also be hydroblasted to remove contaminants that have adhered to the walls of the tanks. Flushing and cleaning of the treatment system will begin at the head of the process and proceed systematically through the treatment plant to the Chromium Reduction/Precipitation tanks. The exterior of the tanks, pumps, piping, and concrete pads and sumps will also be hydroblasted and the resulting water will be collected for disposal in the industrial sewer or for further treatment if analytical results indicate that it exceeds the discharge limits.

Table 4-1 EQUIPMENT TO BE DECONTAMINATED Building 360 Industrial Wastewater Treatment Plant	
Equipment Number	Description
— Tanks —	
—	Plating Waste Sump (concrete; 190 gal.)
T303	Cyanide Spill Holding Tank (steel; 5,300 gal.)
T304	Chromium Spill Holding Tank (fiberglass; 5,300 gal.)
T305	Chromium Reduction Tank (steel; 510 gal.)
T306	Rapid Mix Tank (steel; 510 gal.)
T307	Rapid Mix Tank (steel; 510 gal.)
T309	Sulfuric Acid Supply Tank (steel; 100 gal.)
T310	Sodium Hydroxide Supply Tank (steel; 400 gal.)
T311	Polymer Supply Tank (stainless steel; 535 gal.)
T312	Cyanide Wastewater Sump (concrete; 1,450 gal.)
T313	Chromium Wastewater Sump (concrete; 1,450 gal.)
— Pumps —	
P301	Cyanide Wastewater Pump (submersible)
P302	Cyanide Wastewater Pump (submersible)
P303	Wastewater Pump (submersible)
P304	Wastewater Pump (submersible)
P305	Polymer Supply Pump (positive displacement)
P306	Polymer Supply Pump (positive displacement)
P307	Wastewater Pump (turbine — 15 gpm)
P308	Wastewater Pump (turbine — 15 gpm)

Table 4-1 (cont.)

EQUIPMENT TO BE DECONTAMINATED
Building 360 Industrial Wastewater Treatment Plant

Equipment Number	Description
	— Piping —
—	2" Cast Iron Wastewater Pipe from P303 & P304 to T305
—	2" FRP Chrome Spill Pipe from P303 & P304 to T304
—	3" FRP Chrome Spill Pipe from T304 to T313
—	2"/8" Cast Iron Wastewater Pipe from P301 & P302 to Industrial Sewer
—	2" Cast Iron Cyanide Spill Pipe from P301 & P302 to T303
—	3" Cast Iron Cyanide Spill Pipe from T303 to T312
—	2"/8" Cast Iron Wastewater Pipe from T308 to Industrial Sewer
—	½" PVC Polymer Supply Pipe from T311 to T307
—	½" Black Steel Acid Supply Pipe from T309 to T305
—	½" Black Steel Sodium Hydroxide Supply Pipe from T310 to T307
—	1½" PVC Sulfur Dioxide Supply Pipe to T305
	— Miscellaneous —
—	Instrument/Control Building
—	Motor Control Center
—	Concrete Pads (including secondary containment curbs)
—	Concrete Sumps
—	Valves

Source: *Operation Plan, Industrial Waste Treatment Plant, Building 360,* Naval Air Station, Alameda California, Department of the Navy, Western Division, Naval Facilities Engineering Program, April 1988.

5. CONFIRMATION SAMPLING

5.1 OBJECTIVE

The objective of confirmation sampling of the equipment and structures at the Building 360 IWTP is to verify that decontamination has been thorough and complete, and to aid in determining the final disposition of the equipment and rubble.

5.2 SAMPLE TYPES

Four types of samples are anticipated during the closure of the Building 360 IWTP including:

- Water samples from collected wash/rinse water;
- Wipe samples from metallic and plastic surfaces;
- Chip or core samples from pads and other concrete surfaces; and
- Soil samples from beneath concrete pad.

5.3 NUMBER AND LOCATIONS OF SAMPLES

One water sample will be collected from each batch of wash/rinse water — the results from these analyses will also be used to determine the effectiveness of decontamination of equipment where wipe samples are not possible (e.g., the inside of small diameter pipes and pumps). Two wipe samples will be collected from each storage and process tank including one from one of an interior wall and one from the floor of the tank. Samples of the concrete pad will be collected at a rate of one for every 300 square feet (i.e., a total of six) with a bias toward areas where contamination occurred or was most likely to have occurred (e.g., beneath or adjacent to the process and storage tanks). Also, one chip sample will be collected from each concrete tank or sump.

5.4 FIELD SAMPLING METHODS

5.4.1 Water Samples

Grab samples will be collected from the wash/rinse water immediately after the wash/rinse operations are complete. The sample will be collected by dipping the sample container(s) into the water from the top of the tank.

5.4.2 Wipe Samples

To collect a wipe sample, a template having an area of 100 square centimeters (cm^2) will be held against the surface of the object being sampled. An absorbent material (e.g., sterile gauze pad) soaked on an appropriate solvent, will then be wiped over the entire 100 cm^2 area of the template. The absorbent material will them be immediately placed in a sample container (e.g., clean glass jar).

5.4.3 Chip/Core Samples

Chip samples will be obtained from concrete surfaces such as the interior walls of concrete tanks or sumps. A hammer and chisel will be used to collect a sample of the concrete in an area measuring approximately ten centimeters by ten centimeters by 1 inch thick. The sample will then be placed in a clean sample container. The concrete pad will be sampled by coring. The top one inch of the core will be broken off and submitted to the lab for analysis.

5.4.4 Soil Samples

At each concrete boring location, three soil samples will be collected. The first will be collected from the top six inches of the soil surface, the second from the 18 to 24 inches below the soil surface, and the third from 36 to 42 inches below the soil surface. Additional soil samples will be collected if obvious discoloration, odor, or unusual soil texture is encountered. The soil samples will be collected using a hollow stem auger with a 2-inch diameter split spoon sampler. Boring equipment (e.g., auger flights) will be decontaminated between each borehole and sampling equipment (e.g., split spoon) will be decontaminated between each sample. Soil properties will be recorded.

5.4.5 Groundwater Samples

Groundwater sampling and analysis is not planned for the Building 360 IWTP which is included in the NAS Alameda Installation Restoration Program (IRP). The IRP is a long-term base-wide program that addresses areas of contamination at NAS Alameda. The IRP is overseen by a number of regulatory agencies including the Department of Toxic Substances Control (DTSC). Any groundwater contamination or extensive soil contamination beneath the Building 360 IWTP will be addressed in the IRP. This closure plan addresses only the equipment, structures, and shallow soils at the Building 360 IWTP.

5.5 QUALITY CONTROL SAMPLES

Quality control samples (i.e., duplicates, replicates, or co-located) will be collected at a rate of 10% for each matrix sampled. Where less than ten samples of a given matrix are collected, one quality control sample will be collected.

5.6 DECONTAMINATION OF SAMPLING EQUIPMENT

Any non-disposable sampling equipment that is used for the collection of samples will be decontaminated between each sampling location by the following method: tap water rinse to remove gross contamination; Alconox wash; tap water rinse; deionized water rinse. The item(s) will then either be allowed to air dry or will be dried using a clean cloth or paper towels.

5.7 CHAIN-OF-CUSTODY PROCEDURES

Chain-of-custody (C-O-C) procedures will follow standard Environmental Protection Agency protocol. The primary objective of the C-O-C procedures is to provide an accurate record that can be used to trace the possession and handling of samples from collection through completion of analyses to storage and final disposition. The samples will be handled by as few people as possible. The person collecting the sample will be responsible for the care and custody of the samples until they are transferred to another person.

Custody seals will be placed over the caps of individual sample containers. Custody seals will also be placed over the outside of the shipping container(s) at points where attempts at tempering with the samples would be noted; strapping tape will be placed over the seals to ensure that they are not broken accidently during shipment. Upon receipt by the laboratory, the sample custodian will check to make sure that the seals are intact.

The C-O-C record will be fully completed in triplicate and the original copy will accompany the samples at all times. When transferring samples from one person to another, the individuals relinquishing and receiving them will sign, date, and record the time on the C-O-C record.

5.8 SAMPLE LABELING, PACKAGING/PRESERVATION, AND SHIPPING

Immediately after collection, sample labels or tags will be attached or affixed to the sample container. Sample information will be entered on the label using waterproof ink. To minimize the handling of sample containers, the labels will be filled out prior to sample collection and will have the following information:

- Date of collection;
- Sample number;
- Project number;
- Analysis required;
- Preservation, if required; and
- pH (for water samples and blanks).

For protection, the sample label will be covered with mylar tape after the container is capped.

Sample containers will be packaged carefully to avoid breakage or contamination and will be shipped to the laboratory at appropriate temperatures. The following sample packaging requirements will be followed:

- Individual sample containers will be wrapped in cushioning material and placed in sealable plastic bags to minimize the potential for contamination;
- The shipping container(s) will be partially filled with inert packing materials to protect the sample containers during shipment;
- The sample containers will be placed in the shipping container in such a way so as not to touch one another;
- Wet ice, double-packaged in sealable plastic bags, will be used to keep the samples cool during shipment; the ice will not be used as a substitute for packing materials. A temperature blank (one 40 ml vial filled with tap water) will also be included in the cooler and its temperature will be measured and recorded by the laboratory upon receipt.
- The remaining void space in the shipping container will be filled with inert packing materials.
- Two copies of the C-O-C form will be placed in a plastic bag which will be taped to the inside of the shipping container lid; custody seals will be affixed to the shipping container.

The samples will be preserved as required by the analytical method to be performed.

All samples will be shipped to the laboratory by next day air freight on the day that they are collected.

5.9 DOCUMENTATION

A daily logbook will be maintained on-site by the field personnel which will provide sufficient data to reconstruct the events that occurred during the IWTP closure. All daily logs will be kept in a bound waterproof logbook containing sequentially numbered pages. All entries will be made in waterproof ink and dated. Pages will not be removed for any reason. If corrections are necessary, the person making the correction will draw a single line through the original entry (so that the original is still legible) and the correct entry will be entered alongside the stricken entry. The person making the correction will then initial and date the correction. The daily log will include a complete summary of the day's activities including:

- Name (signature) of person making the entry;
- Names of team members on-site;
- Weather conditions (temperature, approximate wind direction and speed, etc.);
- Level of Personal Protective Equipment (PPE) employed, changes in PPE (if required), and reason(s) for changes;
- Documentation of sample collections including location and depth, date and time, personnel collecting samples, type of sample, sample matrix, and preservative used (in any);
- Brand, model number, and serial number of on-site monitoring equipment;
- On-site measurement data (e.g., pH, temperature, PID readings, explosimeter/ oxygen meter readings, etc.);
- Field observations and remarks, with sketches (as necessary);
- Log of photographs;
- Unusual circumstances or difficulties; and
- Initials of person making the entry.

5.10 ANALYTICAL TEST METHODS

All samples will be analyzed by a laboratory certified by the state of California using the analytical methods for the parameters listed in Table 3-3.

6. CLOSURE PERFORMANCE STANDARDS & CLEANUP PROCEDURES

6.1 SOIL CLEANUP LEVELS

Cleanup levels are not proposed at this time for contaminated soils at the Building 360 IWTP. Soil sampling results will be reviewed and if contamination beneath the pad is found to be extensive and widespread, it will be addressed in the NAS Alameda IRP as previously mentioned. If soil contamination is found to be minor and localized, remedial measures will be prepared and presented to DTSC for their concurrence.

6.2 EQUIPMENT, STRUCTURES, AND BUILDING CLEANUP LEVELS

The equipment, structures, and buildings at the Building 360 IWTP will be considered non-hazardous if the analysis of the wipe samples indicate non-detect for the parameters listed in Table 3-3. Equipment, structures, and buildings that cannot be sufficiently decontaminated will be regarded at hazardous waste and will be disposed offsite as such.

6.3 REMOVAL/CLEANUP PROCEDURES

Procedures for the excavation and disposal of contaminated soil are not proposed at this time. If extensive soil contamination is encountered, removal/cleanup procedures will be addressed in the NAS Alameda IRP as previously mentioned. If soil contamination is found to be minor and localized, remedial measures will be prepared and presented to DTSC for their concurrence.

7. CLOSURE IMPLEMENTATION SCHEDULE/COST ESTIMATE

7.1 SCHEDULE

The proposed schedule for the closure of the Building 360 IWTP is presented in Figure 7-1.

7.2 COST ESTIMATE

The cost estimate for the closure of the Building 360 IWTP is presented in Table 7-1.

ATTACHMENT A – CLOSURE PLAN, INDUSTRIAL WASTEWATER TREATMENT PLANT, BUILDING 360

FIGURE 7-1 – CLOSURE PLAN IMPLEMENTATION SCHEDULE, PAGE 7-2

FINAL INDUSTRIAL WASTE TREATMENT PLANT 360, HAZARDOUS WASTE FACILITY PERMIT CA 2170023236, PART I: AMENDMENT TO THE CLOSURE PLAN, PART II: SAMPLING AND ANALYSIS PLAN

THE ABOVE IDENTIFIED FIGURE IS NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY SOUTHWEST DIVISION TO LOCATE THIS FIGURE. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
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1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

Table 7-1

CLOSURE COST ESTIMATE
Building 360 Industrial Wastewater Treatment Plant

Item	Costs ($)		
	Materials	Labor	Total
Prepare Closure Plan, Work Plan, and Summary Report	200	5,854	6,054
Prepare Health & Safety Plan and Job Hazard Analysis	50	2,680	2,730
Prepare Job Plan Including Site Visits	0	2,342	2,342
Mob/Demob Decontamination Trailer	100	9,835	9,935
Scrape/Remove Solid Residue and Flush Tanks, Piping, Sumps, and Pumps	4,620	22,479	27,099
Air Quality Testing of Tanks Prior To and During Removal	0	1,172	1,172
Pump and Dispose of ~12,000 Gallons of Contaminated Liquid and 12 Drums	29,000	0	29,000
Collect and Analyze Water and Wipe Samples	33,000	2,810	35,810
Disconnect, Remove, & Cap All Piping and Remove Pumps	200	7,376	7,576
Inert Tanks Prior to Removing Using Dry Ice	340	1,581	1,921
Disconnect and Remove All Electrical Service, Equipment, and Lighting	205	8,196	8,401
Disconnect and Demolish Utilities	116	4,683	4,799
Demolish Buildings, Platforms, and Fence Enclosure; Burn Tank Foundations Free; Cut Large Tanks into Acceptable Sizes	200	14,225	14,425
Rental: 30' JLG	1,125	0	1,125
Remove Structural Members and Load Components Onto Truck for Disposal	0	6,615	6,615
Rental: Forklift	600	0	600
Transport Salvageable Items to DRMO; Transport Non-Salvageable Items to Landfill	1,800	2,107	3,907
Rental: Truck-Mounted Crane (20-30 Ton)	3,600	0	3,600
Rental: Two Pickup Trucks	2,800	0	2,800
Subcontracting: HSA Drilling, Soil Sample Collection and Analysis	13,500	0	13,500
Locate/Mark Underground Utilities	0	505	505

Table 7-1 (cont.)

CLOSURE COST ESTIMATE
Building 360 Industrial Wastewater Treatment Plant

Item	Costs ($)		
	Materials	Labor	Total
Set-up/Maintain Barricades; Provide Dust Control	213	5,971	6,184
7½-Ton Tractor Truck	80	0	80
Lowbed Trailer	24	0	24
Mob/Demob Equipment	100	527	627
5-Ton Dump Truck	300	0	300
Backhoe	780	0	780
Load, Transport, and Dispose Concrete Rubble	2,700	1,733	4,433
Break 1' Reinforced Concrete Pavement (Backhoe-Mounted Hydraulic Hammer)	200	5,760	5,960
Saw Cut Asphalt	400	1,405	1,805
Break, Load, Transport, and Dispose 3" Asphaltic Concrete	2,016	4,215	6,231
Prepare Asphaltic Concrete Patch	0	7,265	7,265
Install 4" Asphaltic Concrete Patch	6,265	10,063	16,328
5-Ton Dump Truck	160	0	160
Roller Vibratory Compactor	416	0	416
Pick-up & Deliver Asphalt	0	937	937
Update As-Built Drawings	0	2,342	2,342
Total	**105,110**	**132,678**	**237,788**

Source: *Operation Plan, Industrial Waste Treatment Plant, Building 360,* Naval Air Station, Alameda California, Department of the Navy, Western Division, Naval Facilities Engineering Program, April 1988.

8. FINANCIAL RESPONSIBILITY

NAS Alameda is a federal facility and is therefore exempt from the financial responsibility requirements.

9. CLOSURE CERTIFICATION REPORT

Following completion of the closure of the Building 360 IWTP, a Closure Certification report will be prepared describing the actual closure activities and will submitted to DTSC for review. This report will contain, at a minimum, the following:

- Certification by an independent registered professional engineer;
- Supervisory personnel description;
- Summary of closure activities;
- Field Engineer observation reports;
- Sampling data and analyses including sampling locations, soil boring logs, chain-of-custody, analytical results, etc.;
- Discussion of analytical results;
- Manifests showing disposition of wastes;
- Modifications and amendments to Closure Plan (if applicable); and
- Photographs.

10. WORKER HEALTH AND SAFETY

California regulations contained in 8 CCR 5192 require that a site safety plan be prepared for post-emergency response operations at hazardous waste site, which are applicable to closure actions. Closure actions at sites that contain or contained hazardous waste are within the scope of state and federal Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations.

A site safety plan will be prepared prior to closure implementation to address all on-site closure activities. The following health and safety guidelines outline the basic requirements and protocols that will be included in the preparation of this site-specific Health and Safety Plan.

The site safety plan will address the following seven areas:

- Hazard identification;
- Hazard evaluation;
- Personal protective equipment;
- Environmental monitoring;
- Site work zones;
- Decontamination of workers; and
- Emergency procedures.

Each of these areas is discussed in more detail below in the following subsections.

10.1 HAZARD IDENTIFICATION

10.1.1 Chemical Hazard Assessment

The Building 360 IWTP presents certain potential chemical hazards due to the presence of residual amounts of plating shop wastewater residues in IWTP sumps, tanks, and piping and the presence of treatment chemicals formerly used at the IWTP. According to the Operations Plan, the Building 360 IWTP handled two different waste streams: chromium wastewater from the Building 360 Plating Shop that contained hexavalent and trivalent chromium, cadmium, nickel, and surfactants; and cyanide wastewater from the Building 360 Plating Shop containing cyanide, silver, nickel, lead, and copper. The IWTP treated these wastewater using sulfuric acid, sulfur dioxide, sodium hydroxide, sodium hypochlorite, and a polymer to aid in precipitation of the metals.

Potential chemical hazards associated with demolition of the Building 360 IWTP include the following:

- skin and eye contact with corrosive residual plating wastewater during flushing operations, decontamination, removal, and demolition of the IWTP;
- skin and eye contact with IWTP treatment chemicals during material handling;
- inhalation of acid mists or fumes and dust containing heavy metal particulates during decontamination of equipment with high-pressure sprayers and demolition and removal of equipment;
- inhalation of hydrogen cyanide gases;
- incidental ingestion of sludges, residual wastewater, and wash/rinse water;
- mixing of incompatible chemicals/wastes during handling of residual wastewater or treatment chemicals which may result in the generation of toxic fumes, cause an explosion, or produce an exothermic reaction.

The IWTP sumps, tanks, and piping will be flushed with water to remove residual wastewater and metals. This wastewater will then be treated prior to disposal. This method should reduce the possibility of contact with heavy metals and cyanide in the wastewater that could occur during decontamination, demolition, and removal. However, low points in the piping system, and tank and sump bottoms may still contain residual sludges and wastewaters.

Decontamination of tanks and sumps with high-pressure sprayers could also result in the dislodging of scale or sludge and the production of mists containing heavy metals, corrosives, or cyanide compound particulates. Thus, both skin and eye contact or inhalation of mists or dust containing these particulates are a concern.

10.1.2 Physical Hazard Assessment

Potential physical hazards associated with Building 360 IWTP demolition include:

- slips, trips, and falls;
- lifting and material handling hazards;
- electric shock;
- fire;
- mechanical and heavy equipment hazards; and
- temperature stress.

Trip and fall hazards could exist due to work in and around open treatment vats, storage tanks, and excavated areas. Lifting and material handling hazards could exist during the removal of residual sludge, leftover treatment chemicals, and treatment plant equipment. Electrical hazards could exist around electrical equipment, and subsurface and overhead electrical supply lines. These hazards can be avoided by identifying all surface, subsurface, and overhead electrical equipment and supply lines and ensuring that power is completely off and that contact is avoided. Fire hazards could exist anytime there are ignition sources (sparks, heat, flame) around flammable vapors or through the mixing of incompatible materials. The use of such heavy equipment such as backhoes, bulldozers, excavators, forklifts, or cranes and other site equipment such as concrete saws and acetylene torches will also pose certain physical hazards. Temperature stress is always a potential concern when personnel are working in impervious protective gear and temperatures exceed 70 °F.

Each of these physical hazards should be considered during development of the SSP and safe operating procedures. The following section discusses these physical hazards associated with key closure and demolition activities.

10.1.2.1 Demolition Activity Physical Hazards

The tasks associated with Building 360 IWTP demolition can be grouped into five major categories: system flushing, excavation, equipment and material decontamination, equipment and material removal, and confined space entry. Table 10-1 provides a summary of demolition activity physical hazards which breaks the response activity categories up into potential tasks, hazards, and recommended controls. Many required tasks performed during demolition can be hazardous. Safety must be emphasized, and all personnel must know how to protect themselves, their co-workers, and the equipment they operate. The key to safety in the field is an ability to recognize situations that may produce hazardous conditions, and to plan ahead to avoid or mitigate these conditions.

10.1.2.2 Safe Use of Demolition and Removal Equipment

Heavy mechanical equipment can pose some of the most serious physical hazards at a demolition site. Potential hazards include electrical shock, fire, overhead concerns, foundation stability, physical contact with machinery, and production of large amounts of particulates. Good maintenance of equipment and proper use of hand tools should be performed to minimize the potential for personal injury and equipment loss. Good site planning should segregate heavy equipment operations from physical obstacles, other heavy equipment, and personnel.

All equipment used for demolition operations must be properly grounded. Lock-out/tag-out procedures in conformance with 29 CFR 1910.147 should be used where warranted for procedures performed on equipment capable of storing energy such as capacitors, transformers, generators, etc. All site personnel should be trained on the location of kill switches and should ensure that all emergency shut-offs on equipment are working properly. Backhoe and crane operations need to be planned to avoid overhead utility lines.

Table 10-1

DEMOLITION ACTIVITY PHYSICAL HAZARDS
Building 360 Industrial Wastewater Treatment Plant

Tasks	Potential Hazards	Recommended Controls
System Flushing	Contact with wastewater, splash, slips, trips, falls, temperature stress	Wear prescribed PPE, eliminate ignition sources, stay alert, position to minimize wastewater contact, monitor for temperature stress, conduct air monitoring, use buddy system, ensure proper decontamination.
Excavation With hand tools With heavy machinery	Contact with wastewater and contaminated soil, slope stability, jagged metal edges, vehicle accidents, electric shock, slips, trips, falls, lifting hazards, overhead hazards, sparking, temperature stress	Air monitoring, wear prescribed PPE, eliminate ignition sources, ensure proper grounding and bonding of electrical and transfer equipment, use ground fault circuit interrupters, stay alert, use proper lifting techniques, segregation of heavy equipment operations, watch for temperature stress, use buddy system, ensure proper decontamination.
Equipment and Material Decontamination High pressure spray washing of Tanks, Sumps, Piping	Contact with contaminated residue/soil, splash, slips, trips, falls, inhalation of mists, lifting/material handling hazards, temperature stress, noise	Air monitoring, wear prescribed PPE, use proper lifting techniques, stay alert, watch for temperature stress, monitor direction of spray washing, wear hearing protection if necessary and eye protection, use buddy system, ensure proper decontamination.
Equipment and Material Removal and Disposal Tanks Sumps Piping Treatment Chemicals Residual Wastewater	Contact with treatment chemicals or residual wastewater, lifting/material handling hazards, sparking, heavy equipment hazards, slips, trips, falls, mixing of incompatible, spills, temperature stress, noise	Air monitoring, watch for residues on surfaces and avoid contact, use proper material handling techniques, wear prescribed PPE, stay alert, wear eye protection and hearing protection if necessary, segregation of heavy equipment operations, use buddy system, ensure proper decontamination, ensure proper segregation and staging of chemicals/waste, proper decontamination of equipment.
Confined Space Entry	Low oxygen levels, organic vapors, explosive vapors, direct contact with wastewater residue, slips, trips, falls, slope stability	Avoid if possible; prepare specific confined space entry safety plan including proper ingress and egress procedures; air monitoring, ensure proper slope stability, wear appropriate PPE and respiratory protection.

Heavy equipment can produce sparks when removing steel-lined tanks, piping, and other equipment and provide an ignition source if flammable vapors are present. Cutting with acetylene torches, if used, can also create fire and explosion hazards. Identification of flammable material and monitoring for flammable vapors should be conducted prior to demolition activities that may be capable of producing sparks. Non-sparking tools should be used whenever possible when working around flammable vapors.

In addition to overhead electric lines, planning of demolition activities needs to take into account any obstructing physical structures when using heavy machinery. Personnel also need to be aware of potential overhead hazards from the machinery itself, and hard hats should be worn at all times.

Removal of in-ground tanks, piping, and other structures and excavation of large amounts of soil can compromise foundation stability. Stability concerns for machinery, personnel, and neighboring structures need to be considered prior to large-scale removals.A primary cause of physical injury at demolition sites is inadvertent physical contact with machinery. Slips, trips, and falls in proximity to machinery or while operating hand-held machinery, particularly in slippery or muddy conditions, is a significant concern. Site work planning should take into account potential for vehicular accidents and establish clear walkways, vehicle corridors, and emergency egress routes accordingly.

Use of backhoes, concrete saws, and other equipment can result in the production of large amounts of particulates. Given that residual wastewater, sludge, and/or contaminated sludges or soil may be present in certain parts of the Building 360 IWTP, dust could contain hazardous particulates. Therefore, efforts should be made to reduce the production of dust due to heavy machinery and site operations to reduce potential respiratory concerns.

10.1.2.3 Material Handling

Proper rigging and lifting techniques should be practiced when handling heavy hand tools and removing treatment plant equipment or materials by hand. Material handling equipment should be used whenever possible to minimize the potential for lifting injuries and to expedite demolition activities. Since accidents occur frequently during handling, drums and other containers should only be moved if necessary. Drum and container handling equipment should be used whenever possible. Before anything is moved, the most appropriate moving sequence should first. Given the possible presence of incompatible wastes and chemicals, avoidance of spills and proper staging procedures are particularly crucial at this site.

The treatment chemicals also pose contact and inhalation concerns and care should be taken so as not to splash or spill these materials when handling leftover chemical containers and IWTP tanks that contain treatment chemicals.

Given the presence of certain incompatible materials, for example cyanide and acids or sulfuric acid and chromic acid and organics, care should be taken during staging of sludges, treatment chemicals, and residual wastewater prior to removal to avoid spills, mixing, or storage in close proximity of any incompatibles. There is also a potential that contaminated soil may be present and spills of certain materials into these soils could have the potential to react depending on the hazardous materials present. All staging should be done on impervious surfaces or material to avoid such spills.

10.1.2.4 Confined Space Entry

The Building 360 IWTP contains treatment tanks and sumps, and some below grade excavation could be required. Confined space and below grade operations raise the following special concerns: low oxygen levels; organic vapors; flammable vapors; direct contact with residual waste; and slope stability. Confined space entry should be avoided if demolition and removal activities can be conducted without such entry. A separate site-specific confined space entry safety plan should be prepared if entrance to a confined space is planned. Monitoring for oxygen concentration, hydrogen cyanide, hydrogen sulfide, organic vapor, and lower explosive limit airborne levels should be conducted prior to and during entry.

10.2 HAZARD EVALUATION

The heavy metals likely to be present in Building 360 IWTP residual wastewater pose certain inhalation, ingestion, and skin and eye contact hazards which are summarized in Table 10-2.

In addition, there are also inhalation, ingestion, and skin and eye contact hazards associated with the treatment chemicals. Table 10-2 provides information on the constituents, properties, and hazardous characteristics for the metals found in the wastewater and for the various treatment chemicals. Any chemicals other than those presented here that are thought to be present at the Building 360 IWTP should also be profiled in the site-specific safety plan.

Performing regular air monitoring (see Section 10.4), wearing the appropriate personal protective equipment (see Section 10.5), following proper decontamination procedures (see Section 10.6), and minimizing contact with wastewater residue, treatment chemicals, and contaminated surface areas during decontamination, removal, and demolition activities should minimize the exposures and subsequent toxic hazards.

10.3 PERSONAL PROTECTIVE EQUIPMENT

All site personnel should wear equipment to protect the body against contact with known or suspected chemicals or physical agents. EPA has divided protective equipment into four categories based on the degree of protection provided:

- Level A: Should be worn when the highest level of respiratory, skin, and eye protection is needed. Level A ensemble consists of a pressure-demand air supply respirator, fully encapsulated chemical-resistant suit, inner and outer chemical resistant gloves, chemical-resistant safety boots, and hard hat.

- Level B: Should be worn when the highest level of respiratory protection needed, but a lesser degree of skin protection required. Level B consists of pressure-demand air supply respirator, splash suit or disposable chemical-resistant coveralls, inner and outer chemical resistant gloves, chemical-resistant safety boots, and hard hat.

- Level C: Should be worn when the requirements for using an air-purifying respirator are met, and lesser degree of skin protection required. Disposable chemical-resistant coveralls, inner and outer gloves, safety boots, and hard hat may still be worn.

- Level D: Should be worn only where there are no respiratory or skin hazards. This level provides minimal protection from chemical hazards. Level D consists of a standard work uniform of coveralls, gloves, safety shoes or boots, hard hat, and goggles or safety glasses. It is advisable to wear disposable coveralls for additional protection and to minimize decontamination procedures.

Table 10-2

HAZARDS ASSOCIATED WITH WASTEWATER CONSTITUENTS AND TREATMENT CHEMICALS
Building 360 Industrial Wastewater Treatment Plant

Compound	Appearance/Odor/ Incompatibilities	Physical/Chemical Properties	Exposure Pathways	Exposure Units	Exposure Symptoms
Cadmium dust	Metal: silver-white, blue-tinged, lustrous Odorless Incompatible with strong oxidizing agents	Boiling point: 1409 °F Vapor Pressure: 0 mm Solubility in H_2O: Insoluble Specific Gravity: 8.65 at 77 °F Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion	PEL = 0.2 mg/m^3 [8 hr. TWA] PEL = 0.6 mg/m^3 (C)	Pulmonary edema, dyspnea, cough, chest tight, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia
Chromium	Blue-white to Steel-gray, lustrous, brittle, hard solid Incompatible with strong oxidizing agents	Boiling point: >4788 °F Vapor Pressure: 0 mm Solubility in H_2O: Insoluble Specific Gravity: 7.14 Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion	PEL = 1 mg/m^3 [8 hr. TWA]	Histologic fibrosis of lungs
Trivalent chromium compounds (Cr^{+3})	Depends on specific compound Incompatible with water	Depends on specific compound	Ingestion Skin or eye contact	PEL = 0.5 mg/m^3 [8 hr. TWA]	Sensitization dermatitis
Hexavalent chromium compounds (Cr^{+6})	Depends on specific compound; Chromic acid is incompatible with combustible, organic or other readily oxidizable material (paper, wood, sulfur, aluminum, plastics, etc.)	Depends on specific compound	Inhalation Ingestion Skin or eye contact	PEL = 0.1 mg/m^3 (C) as CrO_3	Respiratory system irritation; nasal septum perforation; liver, kidney damage; leucytosis, leukopenia, monocytosis, eosinophilia; eye injury, conjunctivitis; skin ulcer; sensitization dermatitis

Table 10-2

HAZARDS ASSOCIATED WITH WASTEWATER CONSTITUENTS AND TREATMENT CHEMICALS
Building 360 Industrial Wastewater Treatment Plant

Compound	Appearance/Odor/ Incompatibilities	Physical/Chemical Properties	Exposure Pathways	Exposure Units	Exposure Symptoms
Copper dusts and mists	Metal: reddish, lustrous, malleable Odorless solid Incompatible with oxidizers, alkalis, sodium azide, acetylene	Boiling Point: 4703 °F Vapor Pressure: 0 mm Solubility in H_2O: Insoluble Specific Gravity: 8.94 (metal) Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion Skin or eye contact	PEL = 1 mg/m³ [8 hr. TWA]	Irritation of nasal mucous membrane, pharynx; nasal perforation; eye irritation; metallic taste; dermatitis
Cyanide compounds (as CN)	Appearance depends on specific compound Odor: Almonds Incompatible with strong oxidizers such as acids, acid salts, chlorates, and nitrates	Depends on specific compound	Inhalation Skin Absorption Ingestion Skin or Eye Contact	PEL = 5 mg/m³ (4.7 ppm) [8 hr. TWA]	Irritation of eyes and skin; gasping; slow respiration, headaches, confusion, nausea, vomiting, asphyxia, death
Lead	Metal: heavy ductile soft gray solid Incompatible with strong oxidizers, hydrogen peroxide, acids	Boiling Point: 3164 °F Vapor Pressure: 0 mm Solubility in H_2O: Insoluble Specific Gravity: 11.34 (metal) Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion Skin or eye contact	PEL = 0.05 mg/m³ [8 hr. TWA]	Weakness, lassitude, insomnia, facial pallor; anorexia, weight loss, malnutrition, constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist, ankles; encephalopathy; nephropathy; irritation of eyes; hypotension
Nickel metal and nickel compounds	Metal: lustrous, silvery solid Incompatible with strong acids, sulfur, selenium, wood & other combustibles, nickel nitrate	Boiling Point: 5139 °F Vapor Pressure: 0 mm Solubility in H_2O: Insoluble Specific Gravity: 8.90 Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion Skin and eye contact	PEL = 0.1 mg/m³ (soluble compounds) PEL = 1 mg/m³ (metal and insoluble compounds) [both 8 hr. TWA]	Headache, vertigo; nausea, vomiting, epigastric pain, substernal pain; cough, hyperpnea; cyanosis; weakness; leukocytosis; pneumonitis; delirium; convulsion

Table 10-2

HAZARDS ASSOCIATED WITH WASTEWATER CONSTITUENTS AND TREATMENT CHEMICALS
Building 360 Industrial Wastewater Treatment Plant

Compound	Appearance/Odor/ Incompatibilities	Physical/Chemical Properties	Exposure Pathways	Exposure Units	Exposure Symptoms
Silver (metal dust and soluble compounds as Ag)	Metal: White, lustrous solid Incompatible with acetylene, ammonia, hydrogen peroxide, bromoazide, chlorine trifluoride, ethylene-imine, oxalic acid, tartaric acid	Boiling Point: 3632 °F Vapor Pressure: 0 mm Solubility in H_2O: Insoluble Specific Gravity: 10.49 (metal) Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion Skin and eye contact	PEL = 0.01 mg/m³ [8 hr. TWA]	Blue-gray eyes, nasal septum, throat, skin; irritated skin, ulceration; gastrointestinal disturbance
Hydrogen cyanide	Colorless or pale blue liquid or gas with bitter, almond-like odor Incompatible with amines, oxidizers, acids, sodium hydroxide, calcium hydroxide, sodium carbonate, water, caustics, ammonia	Boiling Point: 78 °F Vapor Pressure: 630 mm Solubility in H_2O: Miscible Specific Gravity: 1.00 Liquid at 67 °F Flash Point: 0 °F LEL: 5.6% UEL: 40.0%	Inhalation Skin Absorption Ingestion Skin and eye contact	PEL = 4.7 ppm (5 mg/m³) [skin] ST	Asphyxia and death at high levels; weakness, headache, confusion; nausea, vomiting, increase rate and depth of respiration or respiration slow and gasping
Sulfuric acid (H_2SO_4)	Colorless to dark brown, oily, odorless liquid Incompatible with organic materials, chlorates, carbides, fulminates, water, powdered metals (reacts violently with water with evolution of heat)	Boiling Point: 554 °F Vapor Pressure: 1 mm at 295°F Solubility in H_2O: Miscible Specific Gravity: 1.84 (96-98% acid) Flash Point: NA LEL: NA UEL: NA	Inhalation Ingestion Skin or eye contact	PEL = 1 mg/m³ [8 hr. TWA]	Eye, nose, throat irritation; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; tracheobronchitis; skin, eye burns; dermatitis

Source: U.S. Dept. of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards, 1994; American Conference of Government Industrial, Hygienist (ACGIH), Guide to Occupational Exposure Values, 1994

Key:
PEL = OSHA Permissible Exposure Limit
TWA = Time-Weighted Average for 8 hr (PEL)
ST = Short-Term Exposure Limit (15 minute Time weighted average)
C = Ceiling; not to be exceeded at any time
LEL = Lower Explosive Limit
UEL = Upper Explosive Limit

The level of protection selected should be based on:

- The type and airborne concentrations of chemicals present and their toxicity; and
- The possibility of exposure to harmful substances by inhalation, ingestion, and/or skin or eye absorption/contact.

For inhalation of toxic chemicals and skin absorption, air monitoring action levels should be established for all airborne contaminants of concern (see Table 10-2). These action levels should be conservatively set so as to warrant evacuation from the hot zone and/or upgrades of respiratory and/or dermal protection prior to potential exposure of site personnel to contaminants above the determined exposure limits for the site. Action levels are based on the site exposure limits and the protective factor of different respiratory and dermal protection gear. For example, if the PEL for sulfuric acid is 1 mg/m^3 and the protective factor of a particular brand of air-purifying respirator (APR) with the appropriate cartridge for sulfuric acid is 50, then this APR could be used in environments with up to 50 mg/m^3 of sulfuric acid vapors. In practice, action levels should be made based on a conservative approach toward both the PELs and PFs of respiratory equipment so as to have an added level of safety. A conservative approach to setting the action level for a particular chemical for upgrading from Level D (no respiratory protection) to Level C (generally involving use of a full-face APR) is to set the level at the PEL for a contaminant of concern and then divide by 2. In cases where concentrations are unknown and particularly acute risks may exist, then action levels should be set much more conservatively than 50% of the PEL. Action levels also need to take into account the effectiveness and availability of cartridges for APRs. For example, there are no cartridges for hydrogen cyanide, and upgrades in respiratory protection generally involve using a Level B self-contained breathing apparatus (SCBA).

Unless otherwise indicated by air monitoring, the initial fieldwork activities at the demolition site should normally be conducted in the suggested modified level D protective equipment and clothing noted below. Level D protective equipment should be upgraded when splash or contact risks warrant the use of non-permeable protective gear such as Saranax, and/or eye splash protection. Level B or Level C protective gear should be utilized during particular demolition activities where air monitoring action levels may be triggered.

The suggested types of clothing that should be worn and equipment that should be used for the modified level D protection include:

Modified Level D

- Cotton underclothes;
- Hooded Tyvek coveralls or Saranax (for corrosives) as appropriate regarding splash concerns;
- Chemically resistant (nitrile or neoprene) safety toe and shank boots that meet or exceed ANSI Z41.4-1967/75. Leather safety toe and shank boots may be required by the SSO if the sites contain nails or other sharp objects that are likely to puncture the thin neoprene cover of the chemical resistant boots;
- One pair of nitrile or neoprene boot covers to be worn over chemically resistant boots. Two pairs of boot covers should be worn over leather safety boots;
- Pair of nitrile surgical inner gloves;
- Nitrile rubber (NBR) outer gloves;
- Hard hat, with face-shield if splash concerns exist;
- A full-face air-purifying respirator (OSHA/NIOSH approved) with appropriate cartridges (e.g., organic vapor, acid gas, HEPA/dust, etc.) should be carried and used if needed; and
- Boots or boot covers should have a good tread to minimize falls when walking on contaminated surfaces.

Ambient air monitoring should be conducted regularly at the demolition site to establish total airborne vapor or gas concentrations. The frequency of air monitoring is dependent on the type of work being performed at the time and may range from every 20 to 30 minutes to every two hours. The level of protection worn on-site should be constantly accessed by the SSO to determine if an upgrade is required. Changes in conditions that would require a change in the level of protection worn would include:

- An increase or decrease in the chemical concentrations present on-site;
- Discovery of new contaminants;
- A change in weather conditions, wind speed, and/or wind direction;

- A change in the type of work being performed; and
- Chemical cartridge break through or chemical penetration, degradation, or permeation of protective clothing.

10.4 ENVIRONMENTAL MONITORING

Ambient air monitoring should be conducted regularly at each demolition site to determine the presence and/or concentrations of airborne contaminants. The air monitoring data should be used to determine changes in the level of protection.

Although the likelihood of the production of hydrogen cyanide during the demolition is negligible, given the acute hazards posed by hydrogen cyanide, real-time air monitoring for hydrogen cyanide and cyanide compounds should be conducted during demolition activities that concern the cyanide wastestream.

Based on the information provided in the Building 360 IWTP Operations Plan, and the likely demolition activities, air monitoring should be done for the following at a minimum:

- dust (particulates);
- hydrogen cyanide and other cyanide compounds;
- organic vapors;
- lower explosive limit (LEL); and
- oxygen levels in the event of confined space entry.

Site-specific information may warrant monitoring for additional concerns.

Ambient air monitoring equipment should be calibrated daily or operational checks should be performed as required by the manufacturer. The SSO should include all ambient air monitoring data (background levels, breathing zone samples, etc.) in the site safety log. Background concentrations or readings should be established away from each site for dust, hydrogen cyanide and cyanide compounds, organic vapors, LEL, and oxygen.

Table 10-3 provides a summary of the potential air contaminants that should be monitored, the contaminants' physical state, suggested monitoring instruments and frequency, and exposure limits or concentration limits. This air sampling checklist can help to design a site-specific air monitoring plan.

The SSO should monitor the site prior to each major removal or decontamination procedure. A random aerosol monitor should be used to monitor dust levels. A toxic gas monitor like a Monitox should be used to monitor the presence and level of hydrogen cyanide. Short-term Draeger tubes can be used to monitor various other cyanide compounds. A combustible gas indicator (CGI) should be used to determine the oxygen level and the presence of combustible gases. An organic vapor monitor (OVM) should be used to determine the presence of organic vapors. Monitoring should continue during demolition operations.

Exposure limits should be determined for each potential air contaminant of concern. These limits will help determine the action levels for upgrading personal protective gear. Exposure limits are based on the toxicity of chemical contaminants for inhalation or absorption exposure. The chemical hazards assessment portion of the site safety plan should identify the OSHA Permissible Exposure Limits (PEL)s for all contaminants of concern. PELs, as identified in Table 10-1, are usually either 8-hour time-weighted averages (TWA), 15-minute short-term (ST) time-weighted averages, or ceiling (C) limits. A conservative approach is to use 1/2 of the appropriate PEL as the exposure limit.

Exposure limits for flammable or explosive vapors are based on ignitability. For oxygen levels exposure limits are based on the level necessary to sustain life. Flammable vapors and oxygen levels have standard action levels that are listed in Table 10-3.

The determination of an exposure limit for heavy-metal particulates is somewhat more complex. Dusts, fumes, or mists that are produced during demolition from high-pressure spraying, metal cutting, or heavy equipment operation could contain certain levels of heavy metals or cyanide constituents in dislodged sludge, scale, or contaminated soil in the Building 360 IWTP system or in the general area. Random aerosol monitors such as the MIE Miniram only indicate total particulate levels and not specific contaminant concentrations. However, if a sample of residual wastewater scale or dust can be collected and analyzed, then the laboratory data can be used to calculate a total dust exposure limit. This sample, or series of

Table 10-3

SUGGESTED AIR MONITORING PLAN
Building 360 Industrial Wastewater Treatment Plant

Potential Air Concern	Type of Air Contaminant	Monitoring Instrument	Monitoring Frequency	Personnel Exposure Limit*	Purpose
Heavy Metals	Particulates	Random Aerosol Monitor (RAM)	During activities that give rise to mists of dusts in contaminated areas	Depends on contaminant levels in dust; determined on site-specific basis	Assess exposures, verify respiratory protection
Hydrogen cyanide	Gas	Toxic gas monitor (HCN Monitox)	During entry and work on the cyanide wastewater stream	PEL = 4.7 ppm	Assess exposures, verify respiratory protection
Cyanide compounds	Vapors	Detector tube (Draegers)	During entry and work in the site	PEL = 4.7 ppm	Assess exposures, verify respiratory protection
Solvents/Oil	Organic Vapors	Organic Vapor Monitor with FID	Regularly	If organic vapors are known base on compound	Assess exposures, verify respiratory protection
Flammable vapors (LEL)	Flammable vapors	Explosimeter (CGI)[1]	During entry into the site	Acceptable if < 10% LEL Reassess if >10%LEL and <20% LEL Evacuate if > 20% LEL	Detect flammable vapor concentrations
O_2 deficiency	Gas	Oxygen monitor	During entry into the site	>19.5% < 23% acceptable < 19.5% > 23% evacuate	Ensure adequate oxygen in air

* Personnel exposure limits should be set at a level lower than the PEL. One common approach is to set the level at 1/2 the PEL for 8 hr TWA PELs. Site exposure limits for compounds with only a ST or C PEL should be set at an even smaller fraction of the PEL.

[1] The CGI can be poisoned by leaded gasoline and give erroneous readings. The percent oxygen must be in the "normal range" (20.9%) for the explosimeter to read accurately.

samples, should be representative of the most contaminated area where particulates may be produced during demolition. Laboratory data will indicate the percent of contaminants in the sample(s). A total dust exposure limit for each contaminant can be then be established based on the following equation:

[PEL of compound/2]/(portion of compound in dust) = Dust exposure limit (mg/m^3)

When multiple contaminants are present, then a total dust exposure limit can established by choosing the lowest dust exposure limit derived for individual contaminants. The following example shows this process:

Assume the representative dust sample contains:
1% cadmium, 6% chromium, 0.5% lead, and 5% nickel

PELs for these metals are as follows:
Cd: 0.1 mg/m^3
Cr(total): 1.0 mg/m^3
Pb: 0.05 mg/m^3
Ni: 0.1 mg/m^3

Dust exposure limits based on individual metals are as follows:
Cd: 5 mg/m^3
Cr(total): 8.3 mg/m^3
Pb: 5 mg/m^3
Ni: 1 mg/m^3

Total dust exposure limit = 1 mg/m3 (based on the lowest individually-derived dust exposure limit)

10.5 SITE WORK ZONES

Although a site containing hazardous materials may be divided into as many zones as necessary to ensure minimal employee exposure to hazardous substances, the three most commonly identified zones are the Exclusion Zone, the Contamination Reduction Zone, and the Support Zone. These zones are established based on the type of operations that will occur within each zone, the degree of hazard within each zone, and the areas of the site that should be avoided by unauthorized personnel or unprotected employees. Specifically, the purpose of establishing work zones is to:

- Reduce the accidental spread of hazardous substances by workers or equipment from contaminated areas to non-contaminated areas;
- Confine work activities to the appropriate areas to minimize the possibility of accidental exposure; and
- Facilitate the location and evacuation of personnel in the event of an emergency.

Movement of personnel and equipment between these zones should be minimized and restricted to specific access control points. These three zones are discussed on more detail in the following subsections.

10.5.1 Exclusion Zone

The Exclusion Zone encompasses the area where contamination is either known to occur or is suspected of being present and the greatest potential for exposure exists. The outer boundary of the Exclusion Zone is called the Hotline which separates the area of known or suspected contamination from the rest of the site. The Hotline should be established based on the following factors:

- The presence of hazardous substances, discoloration, or any drainage, leachate, or spilled material;
- The provision of sufficient space to protect personnel outside the Exclusion Zone from potential fire or explosion;
- Allowing an adequate area in which to conduct site operations; and
- Reducing the potential for contaminant migration.

The Hotline should be physically secured and/or clearly marked (e.g., using barricades, chains, ropes, banner tape, etc.). Access to the Exclusion Zone should be restricted by establishing Access Control Points, typically located upwind of the Exclusion Zone, which are used to regulate the flow of personnel and equipment into and out of the area of contamination. All persons who enter the Exclusion Zone must wear the appropriate level of PPE.

10.5.2 Contamination Reduction Zone

The transition are between the Exclusion Zone and the Support Zone is called the Contamination Reduction Zone (CRZ) and is designated as the area in which decontamination procedures occur. The purpose of the CRZ is to minimize the possibility that the Support Zone will become contaminated or affected by the site hazards.

The CRZ is typically established outside the area of contamination. Access Control Points should be established for both personnel and heavy equipment. The CRZ should contain an appropriate number of decontamination stations (see Subsection 10.6) necessary to address the contaminants found in the Exclusion Zone.

The boundary between the CRZ and the Support Zone is called the Contamination Control Line and separates the non-contaminated areas from those areas used to decontaminate workers and equipment (i.e., partially contaminated areas). A secondary purpose for the Contamination Control Line is to establish the area where workers entering the CRZ are wearing the proper PPE and that workers exiting the CRZ have removed all potentially contaminated PPE.

10.5.3 Support Zone

The Support Zone is the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The command post, medical station, equipment and supply center, field laboratory, and any other administrative and support functions are typically located in the Support Zone.

The location of the Support Zone is typically dictated by the constraints of the site itself. However, the Support Zone must be located in a non-contaminated area which is known to be free of elevated concentrations of hazardous substances. The Support Zone should also be located upwind, based on the prevailing wind direction, from the Exclusion Zone and far enough from the Exclusion Zone that it would not be affected by fire or explosion in the Exclusion Zone. Also, line-of-site contact with all activities in the Exclusion Zone should be maintained, and accessibility to support services (e.g., power, access roads, telephones, shelter, and water) should be maximized.

10.6 DECONTAMINATION OF WORKERS

Demolition site workers should normally go through a Personal Decontamination Station (PDS) at the completion of work, which consists of several cleaning and rinsing stations as well as clothing and equipment removal stations. Contaminated clothing and equipment should not be taken offsite. The decontamination protocol initially assumes that personnel or equipment working in the exclusion zone are contaminated until instrumentation reading or visual observation indicates differently. The contamination reduction zone should be large enough to handle personnel and equipment.

The following decontamination procedure should be followed whenever exiting the exclusion zone.

Station 1 - Segregated Equipment Drop. Deposit equipment used on site (hand tools). Segregate at the equipment to reduce the possibility of cross contamination. In the case of warm weather, a rest station for personnel may be set up within this station.

Station 2 - Boot Cover and Glove Wash. Scrub outer boot covers and gloves with a trisodium phosphate solution (or Alconox solution).

Station 3 - Boot Cover and Glove Rinse. Rinse off decontamination solution from Station 2 with water.

Station 4 - Tape Removal. Remove tape from boots and gloves and deposit in a plastic bag.

Station 5 - Boot Cover Removal. Remove boot covers and deposit in a plastic bag.

Station 6 - Outer Glove Removal. Remove outer gloves and deposit in a plastic bag.

Station 7 - Protective Coverall Removal. Remove protective coverall, carefully turning inside-out, and deposit in a plastic bag.

Station 8 - Respirator Removal. Wipe the respirator exterior with a paper towel and disinfectant solution or baby wipe; remove and deposit it in a plastic bag. Avoid touching the faceshield. Respirators should be washed in a sanitizing solution (or equivalent), rinsed with potable water, and allowed to dry at the end of each day.

Station 9 - Inner Glove Removal. Remove inner gloves and deposit in a plastic bag. Wash hands, face, and any other potentially contaminated areas with a water/mild soap solution followed by a potable water rinse. Shower as soon as possible upon completing site activities.

All equipment that has come in contact with contaminated soil or water should be properly decontaminated in the contamination reduction zone prior to leaving the site. Equipment can include such items as tools. Equipment decontamination procedures should consist of the following:

- Remove packed debris with a scrub brush and water;
- Scrub all potentially contaminated surfaces with a trisodium phosphate soap solution;
- Allow cleaned item to air dry;
- Scan cleaned surfaces with an organic vapor monitor (OVM) to detect the presence of organic vapors and a monitox to detect HCN; and
- Repeat the steps above if any readings above background are detected.

Air monitoring equipment such as the OVM and CGI should be wrapped in plastic, except for sampling inlets and sealed with duct tape prior to use on site. Air monitoring equipment decontamination should consist of removing the plastic and tape and wiping the unit with dampened paper towel, if necessary.

The decontamination of vehicles and large pieces of equipment, such as pumps, may be performed on a wash pad constructed so that cleaning solutions and wash water can be recycled or collected for proper disposal. A raised graveled area lined with polyethylene can be used. Steam cleaning or pressure sprayers with detergent are the decontamination methods of choice for large equipment and vehicles.

A quick walk-through of decontamination procedures at the personnel decontamination station should be conducted before workers go into the exclusion zone. For personnel utilizing airsupplying respirators, this should help ensure that sufficient time is allotted to proceed through the decontamination line.

The overall goals of a successful SSP are: (1) to reduce the possibility of exposure of field and off-site personnel to any contaminants; (2) to reduce the possibility of physical injury; and (3) to prevent contaminant transport from the site by personnel or equipment. While chemical and physical hazards are discussed in greater detail in previous subsections of these guidelines, many risks can be reduced by following standard safe operating procedures for hazardous waste sites. The following are some general safe work practices that should integrated into the SSP, implemented by SSO, and followed by all personnel on site:

- No personnel should be permitted access to the site unless they have proof of passing the required medical examination and have been trained in compliance with 8 CCR 5192, have the proper protective equipment, and have signed an acknowledgement sheet stating that they have read and understand the site safety plan (SSP) and will follow it.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the site.

- Hands and face must be thoroughly washed upon leaving the site.

- Daily safety and health inspections should be conducted by the site safety officer (SSO) to verify operations are being performed in accordance with OSHA regulations and PWC requirements.

- Confined and/or enclosed spaces should not be entered under any circumstances or without an approved confined-space entry procedure.

- Facial hair that interferes with face-to-facepiece fit of a respirator should not be permitted.

- Contact lenses should not be worn on-site.

- Contact with contaminated or potentially contaminated surfaces should be avoided. Whenever possible, employees must not walk through puddles, mud, or any discolored ground surface, kneel on the ground, or lean, sit, or place equipment on drums, containers, vehicles, or the ground.

- No uncovered street clothes should be worn on the site.

- Personnel in the exclusion zone should use the buddy system.

- Visual contact must be maintained between team members on site at all times.

- All personnel should know the route to the hospital, egress routes, and be aware of any special medical conditions of their team members.

- Team members should observe the contractors and subcontractors and the condition of their equipment at all times and report immediately to the SSO any safety-related issues that are unresolved.

- All contractor or subcontractor personnel should notify the SSO of any unsafe acts or conditions noted on site.

- All accidents and/or injuries should be reported to the SSO.

- The SSO should conduct daily safety meetings to discuss planned work for the day, level of protection required, air monitoring requirements, decontamination procedures, and other health and safety matters as necessary. All personnel should sign an On-Site Safety Meeting Form.

- Lighters or matches should not be brought into the contamination reduction and/or the exclusion zones.

- An accident prevention plan should be developed and implemented.

This is only a partial list, and the SSO should supplement this list based on specific site knowledge as appropriate.

10.7 EMERGENCY PROCEDURES

As part of the site health and safety plan, an emergency response and contingency plan should be developed as specified in 29 CFR 1910.120(l) which should address, at a minimum, the following:

- Pre-emergency planning and procedures for reporting incidents to appropriate regulatory agencies for potential chemical exposures, personal injuries, fires/explosions, and environmental spills and releases;

- Personnel roles, lines of authority, training, and communications;

- Posted instructions and a list of emergency contacts including: physician/nearby medical facility; fire and police departments, ambulance service; federal/state/local environmental agencies; Certified Industrial Hygienist; and contracting officer;

- Emergency recognition and prevention;

- Site topography, layout, and prevailing weather conditions;
- Criteria and procedures for site evacuation (i.e., emergency alerting procedures/ employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, and site security and control);
- Specific procedures for decontamination and medical treatment of injured personnel;
- Map and detailed route description to the nearest medical facility;
- Criteria for initiating the community alert system, if applicable; and
- Critique of emergency response and follow-up.

The demolition crew should be prepared for any emergency situations that may arise during the closure of the Building 360 IWTP. The following supplies, at a minimum, should be readily available for on-site use:

- First Aid equipment and supplies;
- Emergency eyewash and shower station(s) approved by the American National Standards Institute (ANSI) standard Z-358.1;
- Emergency-use respiratory equipment sufficient to protect field personnel in worst-case conditions;
- Spill control material and equipment; and
- At least two 10-pound capacity Type ABC fire extinguishers.

ATTACHMENT B
DTSC'S COMMENTS ON CERTIFICATION REPORT FOR CLOSURE, FACILITY CLOSURE REPORT, BUILDING 360 INDUSTRIAL WASTE TREATMENT PLANT AND NAVY RESPONSES TO COMMENTS

References

DTSC. 2002. "Comments on Certification Report for Closure, Facility Closure Report, Building 360 Industrial Waste Treatment Plant, Alameda Point, Alameda, California April 16, 2001 Prepared by Department of the Navy Southwest Division." February 8.

Navy. 2002. Response to DTSC Geological Services Unit Comments Dated February 7, 2002 on the Closure Certification Report, Building 360." August 1.

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
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5090
Ser 06CA.SE/0787
August 1, 2002

Mr. Glenn Brown
California Environmental Protection Agency
Department of Toxic Substances Control
Northern California Region
Standardized Permits and Corrective Action Branch
700 Heinz Avenue, Suite 200
Berkeley, CA 94710-2721

SUBJECT: DEPARTMENT OF TOXIC SUBSTANCES CONTROL LETTER DATED FEBRUARY 8, 2002

Dear Mr. Brown:

This correspondence is in response to your letter of February 8, 2002 in which you provided comments on the Certification Report for Closure, Facility Closure Report, Building 360 Industrial Waste Treatment Plant (IWTP) dated April 16, 2001 (Certification Report). Your letter forwarded a memorandum from Department of Toxic Substances Control (DTSC) Geological Services Unit (GSU) that provided comments on the Certification Report. We appreciate the opportunity to review the comments from GSU. The Navy's response to GSU's comments are set forth in Attachment A.

The goal is to close out the permit for the IWTP, which has included decontaminating the equipment (listed in Table 4-1 of the Closure Plan) and disposing of it offsite, and collecting confirmation samples. The confirmation samples included the decontamination rinse water, concrete chip samples from the inside of concrete sumps and the concrete pad, and soil samples, as specified in the Closure Plan. In addition, the sumps and concrete pad were removed, and subsurface soil was excavated.

In 1990, the Navy prepared a Closure Plan (a revision to the original 1988 closure plan) in anticipation of transferring Building 360 wastewater for treatment to the Building 32 IWTP. However, Building 360 IWTP was not taken out of service until 1994. Therefore, the Navy prepared a Closure Plan, dated November 7, 1995 and a Field Work Plan, dated February 7, 1996, to implement the closure decontamination activities and specify, in detail, the sampling to be conducted. The 1995 Closure Plan specified that rinse water samples, tank wipe samples, concrete chip samples, concrete pad core samples, and soil samples at concrete pad core locations be collected. The 1995 Closure Plan stated that groundwater sampling and extensive soil sampling would be addressed in the Installation Restoration Program (IRP). The Field Work Plan specified that wipe samples from tanks and concrete chip samples from the sumps and the concrete pad would be collected, and that subsurface soil and groundwater samples would not be collected due to the location of the site above an IRP site. DTSC issued a letter dated October 30, 1996 to the Navy approving the 1995 Closure Plan (see Attachment B). The Navy indicated in an April 16, 1997 memorandum from Public Works to the Commanding Officer that the cleanup of Building 360 IWTP was complete (see Attachment C) and issued a Closure Summary Report, dated September 25, 1997. The Closure Summary Report detailed the decommissioning activities that took place, including the decontamination, demolition, and removal of all above ground tanks, equipment and piping, and collection and analysis of samples, which included: concrete chip, liquid, and sludge samples from the sumps; subsurface soil samples at seven locations; and rinse water. Wipe samples from the tanks were not collected because the tanks were triple rinsed, dismantled, and removed for recycling. Concrete pad chip samples were not collected at that time, but were later collected preceding follow-on pre-removal soil sampling activities. Soil samples showed elevated concentrations of cadmium and chromium above the California-modified residential Preliminary Remediation Goals. These concentrations were located adjacent to the cyanide and chromium sumps.

DTSC issued a letter on March 13, 1998 to the Navy stating they reviewed the Closure Summary Report, and Building 360 IWTP could not be administratively closed because metals concentrations in the soil samples were above background levels and requested the Navy perform one or more additional steps listed in the letter (see Attachment D). Following receipt of this letter, the Navy prepared a Field Sampling Investigation Plan, dated August 10, 2000, which was approved by DTSC in a letter, dated August 25, 2000 (see Attachment E). DTSC also indicated in a facsimile that the confirmation sampling locations were acceptable (see Attachment F). The Field Sampling Investigation Plan was prepared to further investigate the extent of cadmium and chromium contamination in the soil near the cadmium and chromium sumps in order to design the excavation of the metals impacted soil.

After subsurface soil samples in the vicinity of the concrete pad and sumps were collected, the Navy held a meeting with DTSC on October 10, 2000 to review the soil sampling data and define the extent of the soil excavation to satisfy the Resource Conservation and Recovery Act (RCRA) close out requirements for Building 360 IWTP (see Attachment G). Based on the decisions at the meeting defining the extent of soil removal, the Navy removed the concrete pad and sumps and completed the soil excavation in March 2001 to the agreed limits from the October 10, 2000 meeting. The Navy issued the Final Field Sampling Investigation Report (Addendum to Closure Summary Report) dated April 12, 2001, and the third party Certification Report for Closure, Facility Closure Report, Building 360 IWTP (Certification Report) dated April 16, 2001. The Final Field Sampling Investigation Report included the soil sample results, showed the excavation boundaries, and reported the results of the concrete chip samples collected from the concrete pad. DTSC provided comments on the

Certification Report by electronic mail, and the Navy prepared written responses that were further clarified with DTSC (the comments and responses were documented in meeting minutes) on June 20, 2001 and August 23, 2001 (see Attachment H).

The Navy finds that closure of Building 360 IWTP was conducted in accordance with the 1995 Closure Plan, in conjunction with the subsequent Field Work Plan and the Field Sampling Investigation Plan, with a few exceptions for analytical parameters as explained in the Certification Report and the attached response to GSU comments. Therefore, the Navy requests DTSC approve the RCRA closure of Building 360 IWTP. As explained further in our response to GSU comments, the Navy will continue to address groundwater and soil contamination associated with Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Site 4 as part of the Navy's IRP at Alameda Point, the former Alameda Naval Air Station. If you have any questions please call me at (510) 749-5952.

Sincerely,

STEVE EDDE
Alameda Point Environmental Liaison

Attachments:

A. Navy Response to DTSC GSU Comments dated 7 Feb 02
B. DTSC Letter, Approval of Closure Plan for IWTP 360 dated 30 Oct 96
C. Navy memorandum, Closure of IWTP Building 360, dated 16 Apr 97
D. DTSC Letter, Comments on Building 360 IWTP Closure Summary Report dated 13 Mar 98
E. DTSC Letter, Approval of Field Sampling Investigation Plan for the Building 360 IWTP and Southeast Corner of Building 5, dated 25 Aug 00
F. Facsimile transmittal, Pre-confirmation Sampling, dated 08 Aug 00
G. Navy transmittal, Meeting Minutes for October 10, 2000, dated 25 Oct 00
H. Navy transmittal, Meeting Minutes for August 23, 2001 including DTSC comments and Navy responses, dated 30 Nov 01

Copy to:
Mr. Dan Murphy
Ms. Marcia Liao

(A)

RESPONSE TO DEPARTMENT OF TOXIC SUBSTANCES CONTROL, GEOLOGICAL SERVICES UNIT COMMENTS DATED 7 FEB 02 ON THE CLOSURE CERTIFICATION REPORT, BUILDING 360 (CA2170023236), ALAMEDA POINT, ALAMEDA, CALIFORNIA, PROJECT No. 25045/200004-33 MPC/46

RESPONSE TO DTSC MEMORANDUM COMMENTS

General Comment:[1] In 1997 a total of eight borings were drilled (B1 through B8) at various locations within 360 IWTP. Results were presented in the Closure Summary Report. Borings were advanced to a depth of approximately 10 feet bgs. Boring B1 was abandoned because of refusal at one-foot bgs. The following is a summary of actual soil sampling and analysis compared to the required sampling and analysis in the approved Closure Plan. The Closure Plan required that three soil samples from each boring be analyzed for the following parameters.

- Arsenic
- Cadmium
- Chlorinated Hydrocarbons
- Chromium (total)
- Copper
- Cyanide
- Iron
- Lead
- Mercury
- Nickel
- Oil and Grease
- pH
- Phenolic Compounds
- Silver
- Temperature
- Zinc

In addition, quality control samples described in Section 5.5 of the Closure Plan required collection and analysis of soil samples at a rate of ten percent 10% for each matrix sampled.

A total of twenty-six (26) soil samples were collected from seven boreholes and twenty (20) samples were analyzed for the following parameters.

- Title 22 Metals
- Total Phenol
- Semi Volatile Organic Compounds by EPA Method 8260
- Cyanide
- Total Recoverable Petroleum Hydrocarbons

[1] This unnumbered comment appeared on page 3 of the above-mentioned memorandum.

Response: While the comment is not entirely clear, the Navy believes the comment indicates the Navy did not comply with requirements in the 1995 Closure Plan for the number of soil samples analyzed at each soil boring and the parameters analyzed. It is true that the Navy did not submit three samples at one of the locations, B3, collected in 1997 due to refusal, as discussed in the Closure Summary Report. The 1995 Closure Plan specified that three samples would be collected at each soil boring location. The Navy collected soil samples at seven locations and reported results for 21 soil samples (three samples each at five locations, four samples at one location, and two samples at one location).

It is true that the parameters analyzed on the soil samples do differ from the 1995 Closure Plan for the following three parameters: oil and grease, pH, and temperature. This difference is discussed in further detail in the response to Comment 2 below.

As a point of clarification, the Title 22 Metals plus iron were reported and include all the metals listed in the 1995 Closure Plan. Also, the above comment incorrectly states that soil samples were analyzed for semivolatile organic compounds using Environmental Protection Agency (EPA) Method 8260. The soil samples were analyzed for chlorinated hydrocarbons using EPA Method 8260 (volatile organic compounds, which includes chlorinated hydrocarbon compounds as well as other types of compounds).

Comment 1: Three soil samples were not submitted for laboratory analysis from boring B3 as required by the Closure Plan. Only two (2) soil samples (B3-6 and B3-10) were submitted for laboratory analysis from boring B3. No further action is recommended regarding this issue.

Response: That is correct. Two samples were collected at boring B3 in 1997 due to refusal at 1 foot below ground surface (bgs) (see Closure Summary Report page 4-5). In addition, the Navy performed additional sampling near the former boring B3 in 2001 and conducted a soil excavation in the area of the sumps.

Comment 2: Soil samples submitted for laboratory analysis from all borings were not analyzed for the following parameters, as required by Section 5.10 of the approved Closure Plan.

- Oil and Grease
- pH
- Chlorinated Hydrocarbons
- Temperature

Future studies should include these parameters.

Response: The parameters analyzed for the soil samples do differ from the 1995 Closure Plan for the following three parameters: oil and grease, pH, and temperature. The February 7, 1996 Field Work Plan did not specify collection of soil samples; however, they were collected and analyzed for all other parameters listed in the Closure Plan. Chlorinated hydrocarbons were analyzed on the soil samples using

EPA Method 8260 (see Closure Summary Report, page 4-5). If appropriate, future studies will include these parameters.

Although not in strict compliance with the Closure Plan, the omission of the parameters temperature and oil and grease for those initial soil samples is not considered significant for the following reasons. The parameters set forth in Table 3-3 of the Closure Plan were appropriate for testing rinse water to meet the East Bay Mud permit requirements for discharge and were not as appropriate for soil samples. The Closure Plan does not adequately address the appropriate parameters for soil samples because the objective of the plan was to verify that decontamination of the equipment and structures was complete and to determine the final disposition of the equipment and rubble (see Closure Plan, page 5-1). The Closure Plan was not written to address procedures for testing extensive subsurface soil, excavation of soil and soil cleanup levels (see Closure Plan, page 6-1), or landfill disposal parameters for testing excavated soil.

Although the Navy did not analyze for oil and grease, the Navy did analyze for total recoverable petroleum hydrocarbons (TRPH) because petroleum contamination would be of more interest at the site than oil and grease due to the former presence of underground storage tank (UST) 163-1 nearby, and the proximity to the location of the former refinery (pre-Navy activities). In analyzing TRPH, the Navy used the total TRPH method that is similar to the oil and grease method. The oil and grease method is a measure of biodegradable animal greases and vegetable oils along with some non-biodegradable mineral oils, while the TRPH method is a measure of the mineral oils.

Comment 3: Duplicate quality control samples were not submitted and analyzed by the laboratory as specified in Section 5.5 of the Closure Plan. Based on the 26 soil samples submitted for laboratory analysis, three duplicate soil samples were required to be submitted for laboratory analysis.

Future sampling should include quality control samples.

Response: The Navy agrees that future sampling should include quality control samples. It is the Navy's practice to include quality control samples in their investigations.

Twenty-one soil samples were submitted to the laboratory for analysis, which should have included two blind field duplicates of the soil samples, according to the Closure Plan. There is no explanation provided in the Closure Summary Report regarding this omission. However, the analytical laboratory did analyze duplicate soil samples from these soil boring samples and reported the quality control results for metals, cyanide, total recoverable petroleum hydrocarbons, and phenols. The laboratory also analyzed matrix spike duplicate samples from the soil borings for the volatile organic compound analysis. Please see the quality control reports in the Subsurface Soil Sampling section of Appendix F of the Closure Summary Report. In addition, the Navy submitted the following additional quality control samples: equipment rinsate samples and trip blanks.

Comment 4. The chromium wastewater consisted primarily of Cr^{+6}, Cr^{+3}, Cd, N and surfactants. During the treatment process chromium was reduced from Cr^{+6} to

Cr^{+3} by introducing sulfuric acid to lower the pH to approximately 2.5 and sulfur dioxide to reduce the valence state of the chromium. However, sampling and analysis of soil and groundwater for Cr^{+6} was not specified in the Closure Plan. Elevated levels of Cr were detected in deeper subsurface soil samples (i.e. 260 milligrams per kilogram (mg/kg), Boring B3 at a depth of 10 feet bgs) adjacent to the chromium tank. However, the base of the tank was located approximately 12 feet bgs. Groundwater was also encountered at approximately 6 feet bgs. Collection and analysis of soil samples at deeper depths near the base of the tank and collection of groundwater samples would have provided a more complete evaluation of subsurface conditions.

Response: The Navy agrees that collection of deeper soil samples and groundwater samples in 1997 would have provided a more complete evaluation of subsurface conditions. Based on DTSC's review of the Closure Summary Report and their letter dated March 13, 1998, the Navy collected additional soil samples in the vicinity of boring B3 by sampling 20 borings around the sumps in a concentrated fashion at 2-foot depth intervals from 6 to 14 feet bgs, as presented in Table 2 in the Final Field Sampling Investigation Report and on Figures 2, 4, 5, and 6.

The Navy is also currently investigating the groundwater under the Comprehensive Environmental Response Compensation Liability Act (CERCLA) program for Site 4. Monitoring well M04-05 (located west of Building 360) is included in the basewide groundwater monitoring plan.

In 2001, two groundwater grab samples were collected in the location of the former sumps (7 and 12 feet bgs, respectively) and were analyzed for total chromium and hexavalent chromium. Hexavalent chromium was not detected in either sample and total chromium was detected at 0.0266 milligrams per liter (mg/L) in the sample collected at 12 feet bgs; this concentration is below the total chromium Maximum Contaminant Level (MCL) of 50 mg/L. These results will be published in a Supplemental Data Gap Sampling Report for Operable Unit (OU)-1 and OU-2 scheduled for Spring 2002.

Comment 5: Based on the results of soil sampling and analysis conducted in 1997, IT conducted an additional investigation at 360 IWTP in August 2000 to determine the extent of chromium and cadmium impacted soil. Twenty direct-push sampling locations were advanced around the two tanks. That investigation reported elevated levels of chromium and cadmium in vadose and saturated soil near the tanks to the maximum depth explored of 14 feet bgs. Analysis of Cr^{+6} or Cr^{+3} was not required. The result of that investigation concluded that the lateral and vertical extent of chromium soil contamination was not defined to the east of the excavation and the vertical extent of chromium contamination was not defined near borings 2, 3 and 4. (Field Sampling and Investigation Report, section 3.2, page 3-2).

Response: At the October 10, 2000 meeting, the Navy presented the results of the pre-removal soil sampling to DTSC, noting the chromium contamination in the soil had not been defined vertically at the three locations or laterally to the east. At this meeting, DTSC and the Navy agreed to the approach for remediation of the shallow chromium and cadmium impacted soils. The lateral and vertical extent of contamination is being handled under the CERCLA program for Site 4. As part of the remedial investigation, all former uses at the site and potential sources of contamination will be discussed, along with an evaluation of the nature and extent of contamination for soil and groundwater and the risks for human health and ecological receptors. A human health risk assessment will be performed to calculate the risk based on the exposure pathways, and will include the groundwater as a potential drinking water source.

Comment 6. These results were presented in a meeting with DTSC and the Navy on October 10, 2000. During that meeting the DTSC agreed to the following:

- Soil at borings 5 and 7 was to be removed to a depth of 10 feet
- Soil at boring 3 was to be removed to a depth of 12 feet
- All other soil was to be removed to a depth of 8 feet
- No confirmation soil samples were required

Response: The Navy met the above requirements. Soil was removed to a depth of 10 feet at all borings and to 12 feet at boring 3.

Comment 7. IT completed soil and tank removal activities in March 2001. No clearance confirmation soil samples were required. Groundwater was encountered at approximately 9 feet bgs during removal activities. During removal activities, IT encountered two 6-inch diameter clay pipes located 3 feet bgs that were connected to the concrete chromium and cyanide tanks. The clay pipes were connected to 6-inch diameter cast iron pipes that transmitted chromium and cyanide wastewater generated from the Building 360 plating shop to the chromium and cyanide tanks at 360 IWTP. Section 4.2 of the Closure Plan states that "Following removal of the solids, sludge and process chemicals, the interior of all tanks, pumps and piping will be flushed with clean water." During removal of the tanks IT removed the portions of the pipes from the tanks to the southern boundary of the excavation, near the connection to the cast iron pipes. The remainder of the clay and cast iron pipes was not removed. Obtaining clearance confirmation soil samples upon completion of excavation activities would have provided a more definitive evaluation of remaining subsurface soil contamination.

Response: As a point of clarification to the comment above, the Navy removed the two underground <u>sumps</u> in December 2000; the above ground <u>tanks</u> and <u>piping</u> associated with the IWTP had been previously removed in 1996 to1997. The underground 6-inch cast iron/clay pipes leading from the Building 360 plating shop to the chromium and cyanide sumps at the IWTP are not included in the list of pipes to be removed in the Closure Plan (see Table 4-1 of the Closure Plan).

The Field Sampling Investigation Plan for the soil sampling was approved by DTSC. Because of (1) the shallow groundwater table, (2) the proximity of Building 414 to the excavation area, (3) the anticipation of sloughing soils during excavation activities, and (4) the potential to undermine the building foundation, the original plan for excavation was to drive sheet pile walls around the planned excavation area and then remove the soils. This approach would have precluded the collection of post-removal confirmation soil samples and DTSC approved this approach (see attached facsimile transmittal from DTSC to the Navy on August 8, 2000).

The data from borings B16, B10, B15, and B11 (outside the excavation southern boundary) do provide confirmation sampling information adjacent to the waste line piping leading to the sumps from the plating shop. As presented on Figures 4, 5, and 6 of the Field Sampling Investigation Report, all concentrations of cadmium and chromium from borings B10, B11, B15, and B16 are either non-detect or below their respective residential PRGs.

Comment 8. Tanks and Tank Systems unable to demonstrate clean closure at the time of closure are required under Title 22 California Code of Regulations (CCR) Sections 66264.197 or 66265.197 to meet the post-closure care and financial responsibility requirements for landfills. It should be noted that for closure by removal, the requirement for removal of underlying and surrounding contaminated soil also includes contaminated groundwater exceeding beneficial use, protective water quality limits or maximum contaminant levels (MCLs). If a plan for closure by removal is approved, but it is later determined that closure by removal did not or cannot be completed for the unit, the unit is then subject to post-closure care requirements and a post-closure permit is required where applicable.

Response: The tanks and tank systems have been triple rinsed, dismantled, and removed. Confirmation sampling of the rinsewater has been collected and reported. The concrete pad, above ground storage tanks, and associated pipes and equipment have been sampled and removed from the IWTP site as specified in the Closure Plan.

The sumps have been removed and the soil has been over excavated in the area of the former sumps. Groundwater sampling has been conducted under the CERCLA investigations for Site 4, as discussed in the response to Comment 4. All residual soil and groundwater contamination will be addressed by the IRP as stated in the DTSC-approved Closure Plan. The remedial investigation report for Site 4 is scheduled for completion in 2004.

Comment:[2] GSU concurs with the statement presented in the Field Sampling Investigation Report that the lateral and vertical extent of soil contamination has not been completely defined. In order to determine if there is impact to groundwater the lateral and vertical extent of soil contamination needs to be defined. The GSU recommends additional subsurface investigation to determine the lateral and vertical extent of soil contamination to the east beyond the limits of the previous excavation and near soil borings 2, 3, and 4. In addition, the potential impact to groundwater, as a result of the release from the regulated unit, requires additional investigation by obtaining representative groundwater samples beneath the regulated unit for laboratory analysis. The Closure Plan did not describe specific actions to be taken related to the chromium and cyanide wastewater supply lines

[2] This unnumbered comment appeared on page 5 of the above-mentioned memorandum.

from the chromium and cyanide sumps to Building 360. The GSU recommends that the Navy provide a map that details the location of the remaining clay and cast iron pipes and conduct additional subsurface soil investigation along the length of the remaining piping. Additional soil and groundwater samples should be analyzed for all approved constituents listed in Table 3-3 of the Closure Plan and Cr^{+6}. A workplan for this additional investigation should be submitted to the DTSC for review and approval.

Response: All future sampling will be conducted under the IRP. The effluent pipes from Building 360 were not designated in the approved Closure Plan, the Field Work Plan, and the Field Sampling Investigation Plan for Building 360 IWTP. It has been recognized that cadmium and chromium have been detected at elevated concentrations in the soil beneath Building 360 as well as at the former IWTP. The remedial investigation for Site 4 under the IRP includes the land, buildings, and piping formerly occupied by the IWTP as well as the former plating shop within Building 360.

Additional sampling was conducted in summer 2001 under the Supplemental Data Gap Investigation for OU-1 and OU-2, with particular emphasis on chromium speciation of soil and groundwater at these locations. Two grab groundwater samples were collected within the excavation area. The results indicated no hexavalent chromium and total chromium below the MCL (see response to Comment 4). Additionally, wells in this area are included in the basewide groundwater monitoring plan.

Based on these sampling efforts, and the remedial investigation at Site 4, the Navy is not proposing further sampling in this area related to the RCRA closure of the IWTP at Building 360. The remedial investigation report is scheduled for completion in 2004. Figure 1 (attached) has been prepared to illustrate the former IWTP location, effluent pipes, excavation boundaries, and all previous sampling locations.

ATTACHMENT C
BACKGROUND CONCENTRATIONS IN SOIL AT ALAMEDA POINT

Reference

Tetra Tech. 2001c. "Summary of Background Concentrations in Soil and Groundwater, Alameda Point, Alameda, California." November.

Attachment C: BACKGROUND DATA FOR SITE 4, 9, 13, 19, 22, AND 23 DATA SUMMARY (Blue Background Area)
Amendment to the Closure Plan for IWTP 360, Final

Chemical	SQL Range	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	95 UCL Concentration	80LCL/95th percentile Concentration
Inorganic Chemicals (mg/kg)							
Cadmium[(1)]	0.06-1.3	29/88	0.1	0.82	0.31	0.36	0.78
Chromium[(1)]	NA	88/88	11.4	81.7	33.6	36.4	60.1
Copper[(2)]	5.8-6.3	83/89	4.2	89.4	10.4	15.1	42.7
Lead[(2)]	1.4-6.8	27/88	1.3	41	3.2	5.2	16.1
Nickel[(2)]	NA	88/88	11.6	88.5	26.9	31.9	63.4
Silver[(3)]	0.18-6.5	2/88	0.44	0.61	0.95	1.2	3.4

Source – Tetra Tech EM Inc. 2001. Summary of Background Concentrations in Soil and Groundwater Alameda Point, Alameda, California. November

Notes:

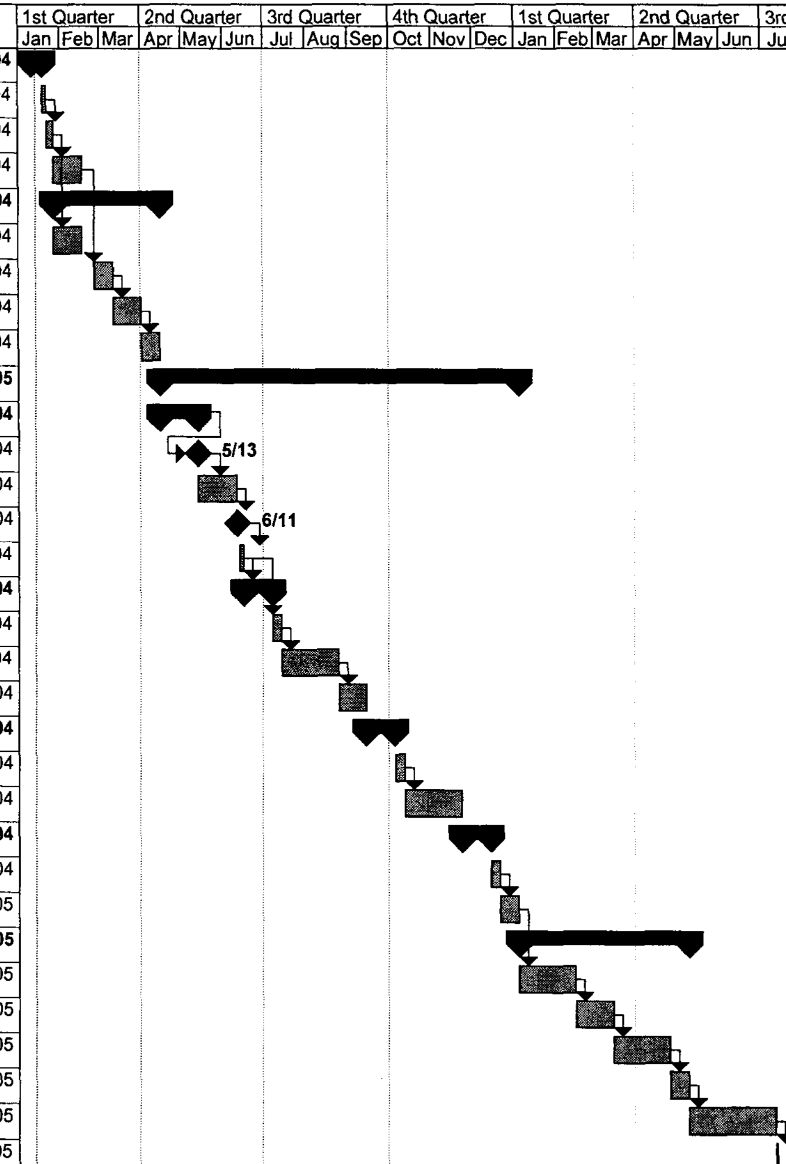
SQL	Sample quantitation limit
95 UCL	95 percent upper confidence limit of the mean concentration
80LCL/95th percentile	80th percent lower confidence limit of the 95th percentile of the distribution
NA	Not applicable
mg/kg	milligrams per kilogram

(1) Data normally distributed
(2) Data lognormally distributed. Calculated 80LCL/95th percentile for natural logarithm-transformed data.
(3) Too few detections to determine distribution. Calculated 80LCL/95th percentile from arithmetic mean and standard deviation.

ATTACHMENT D
SCHEDULES FOR CORRECTIVE ACTIONS AT IWTP 360, ALAMEDA POINT, ALAMEDA, CALIFORNIA

Attachment D - Schedule for IWTP 360

ID		Task Name	Duration	Start	Finish
1		**Tt prepare Final Closure Plan & Field Sampling Plan**	**6 days**	**Mon 1/12/04**	**Mon 1/19/04**
4		Navy O-S review of Final CP & FSP	3 days	Tue 1/20/04	Thu 1/22/04
5		Navy/TT submit final CP & FSP to DTSC	3 days	Fri 1/23/04	Tue 1/27/04
6		DTSC provides approval letter	15 days	Wed 1/28/04	Tue 2/17/04
7		**Tt -Field Work for IWTP 360**	**57 days**	**Wed 1/28/04**	**Thu 4/15/04**
8		Submit SOW to Sub	15 days	Wed 1/28/04	Tue 2/17/04
9		Oversight of Soil and Groundwater Sampling	10 days	Fri 2/27/04	Thu 3/11/04
10		Tt - Laboratory Analyses	15 days	Fri 3/12/04	Thu 4/1/04
11		Tt - Data Validation	10 days	Fri 4/2/04	Thu 4/15/04
12		**TT prepare IWTP 360 Investigation Report w/ lab data**	**188 days**	**Fri 4/16/04**	**Tue 1/4/05**
13		**TT prepare internal draft**	**20 days**	**Fri 4/16/04**	**Thu 5/13/04**
18		TT submits internal draft report	0 days	Thu 5/13/04	Thu 5/13/04
19		Navy reviews internal draft report	21 days	Fri 5/14/04	Fri 6/11/04
20		Navy submits review comments	0 days	Fri 6/11/04	Fri 6/11/04
21		TT/Navy resolve comments	3 days	Mon 6/14/04	Wed 6/16/04
22		**TT prepare draft report**	**15 days**	**Thu 6/17/04**	**Wed 7/7/04**
25		TT/Navy submit draft report to agencies	5 days	Thu 7/8/04	Wed 7/14/04
26		Agencies review draft report	30 days	Thu 7/15/04	Wed 8/25/04
27		TT/Navy & Agencies resolve comments	14 days	Thu 8/26/04	Tue 9/14/04
28		**TT prepare draft final report**	**15 days**	**Wed 9/15/04**	**Tue 10/5/04**
31		TT/Navy submit draft final report	5 days	Wed 10/6/04	Tue 10/12/04
32		Agencies review draft final report	30 days	Wed 10/13/04	Tue 11/23/04
33		**TT prepare final report**	**15 days**	**Wed 11/24/04**	**Tue 12/14/04**
36		TT/Navy submit final report	5 days	Wed 12/15/04	Tue 12/21/04
37		Agencies approve final investigation report for IWTP 360	10 days	Wed 12/22/04	Tue 1/4/05
38		**Closure Certification Report for IWTP 360**	**90 days**	**Wed 1/5/05**	**Tue 5/10/05**
39		Prepare internal draft closure certification report	30 days	Wed 1/5/05	Tue 2/15/05
40		Navy review internal draft closure certification report	20 days	Wed 2/16/05	Tue 3/15/05
41		Prepare draft closure certification repport	30 days	Wed 3/16/05	Tue 4/26/05
42		Navy submit closure certification report to agencies	10 days	Wed 4/27/05	Tue 5/10/05
43		Agencies review closure certification report	45 days	Wed 5/11/05	Tue 7/12/05
44		Agencies approve closure certification report	1 day	Wed 7/13/05	Wed 7/13/05



Project: Att D Schedule 01_14_04
Date: Wed 1/14/04

Task	Milestone	External Tasks
Split	Summary	External Milestone
Progress	Project Summary	Deadline

ATTACHMENT E
NAVY RESPONSE TO COMMENTS DATED OCTOBER 17, 2003 FROM THE CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL (DTSC) ON THE REVIEW OF DRAFT AMENDMENT TO THE CLOSURE PLAN AND SAMPLING AND ANALYSIS PLAN, INDUSTRIAL WASTE TREATMENT PLANT 360, ALAMEDA POINT (Formerly Naval air Station Alameda) Alameda, CALIFORNIA.

NAVY RESPONSE TO COMMENTS DATED OCTOBER 17, 2003 FROM THE CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL (DTSC) ON THE REVIEW OF DRAFT AMENDMENT TO THE CLOSURE PLAN AND SAMPLING AND ANALYSIS PLAN, INDUSTRIAL WASTE TREATMENT PLANT 360, ALAMEDA POINT (Formerly Naval air Station Alameda) ALAMEDA, CALIFORNIA .

DTSC comments are from Ms. Wei Wei Chui and Mr. Dean Wright.

Comment 1: GSU recommends additional clarification regarding the closure performance standards referenced in Part I, Section 8.0 and Part II, Section 1.1.8 and the use of Environmental Protection Agency (EPA) Preliminary Remediation Goals (PRGs) as initial screening levels. GSU understands that closure performance standards are either non-detectable concentrations, background concentrations or health-based risk levels. In the case of cadmium and chromium or other metals in soil and groundwater the closure performance standard should be background. Levels exceeding background concentrations would then require a health risk assessment and risk management decision.

Response: The text in the Sampling and Analysis Plan Part II, Section 1.1.8 will be modified to state: "The PRGs and background concentrations will be used as initial screening tools; however, when all data is available, quantitative human health and ecological risk assessments will be completed to make risk management decisions for closure." Similar text will be included in Part I, Section 8.0.

Comment 2: The document states that cadmium and chromium were established as the constituents of concern for the additional sampling based on the results of soil sampling collected in 1996 and 2000. GSU believes it would not be appropriate to exclude other metals based on comparisons of metal concentrations to PRGs as observed on Tables 5-1, 5-2 and 5-3. All metals should be compared to background concentrations. Metals that are above background concentrations are carried forward to a risk assessment. Therefore, it may be appropriate to analyze the full range of metals and hexavalent chromium as well as other appropriate constituents listed on Table 3-3 of the closure plan for any proposed sampling.

Response: The Navy agrees to analyze soil and groundwater samples for the metals listed in Tables 5-1, 5-2, and 5-3 (cadmium, chromium, copper, lead, nickel, and silver). The applicable text in Part I and Part II will be modified to reflect the requirement to analyze for the six metals.

The Navy does not agree to analyze for the additional constituents in Table 3-3 of the 1995 Closure Plan (discharge limitations for the IWTP). Instead, the Navy agrees to sample for the metals listed in Table 3-2 in the 1995 Closure Plan, which presents the hazardous wastes managed at the IWTP. Table 3-2 lists the six metals and cyanide.

Previous soil samples collected along the pipelines from Building 360 to IWTP 360 and in the vicinity of IWTP 360 contained cyanide at concentrations ranging from non-detect to 2.5 milligrams per kilogram (mg/kg). The EPA Region 9 residential preliminary remediation goal for soil (PRG) for cyanide (free) is 1,200 mg/kg (EPA 2002). The maximum concentration of cyanide detected was less than 1% of the PRG; therefore, no additional analysis for cyanide is planned.

Comment 3: Section 3.6, Part 1 describes flushing of the remaining IWTP pipelines. It is not clear to GSU if the pipeline is considered to be appropriately decontaminated and closed.

Response: The Navy has documentation that the pipelines from Building 360 to IWTP 360 were flushed before IWTP 360 was taken out of service. The Navy does not plan to remove the pipelines. Soil and groundwater sampling will be conducted along the length of the pipelines to evaluate whether the pipelines have released hazardous contaminants to the environment.

Comment 4a: Please provide the rationale for selecting and obtaining soil samples at only 2 and 8 feet below ground surface (bgs).

Response: The depth to groundwater in the area varies from 7 to 10 feet, depending on the time of year and amount of rainfall. Soil sampling depths were chosen above the groundwater. The soil sampling depths of 2 and 8 feet bgs are based on the data evaluation protocols for the human health risk assessment (HHRA). Relevant sections of the Closure Plan and the Sampling and Analysis Plan will be revised to state: "At each soil sampling location in the vicinity of the previous excavation area, two depths are proposed: 1.5 to 2.0 feet and 7.5 to 8.0 feet or at the groundwater interface, whichever is shallower. These depths may be modified in the field depending on the location of the groundwater table."

Comment 4b: Please describe the rationale for proposing only two boring locations east of the previous excavation area. Please describe why soil sampling can not be conducted inside building 414.

Response: The two proposed sampling locations east of the previous excavation area, Figure 4, Part II, are to confirm whether the eastern edge of the contaminated soil was removed. DTSC had requested, per comments in Attachment B, that the Navy define the lateral extent of soil contamination to the east beyond the limits of the previous excavation area. The Navy is proposing to collect one soil sample east of the former excavation area (and west of Building 414) as well as one soil sample east of Building 414.

Two soil samples have previously been collected within Building 414 in 1995 as part of the environmental baseline sampling; the concentrations of cadmium and chromium detected were less than PRGs in soil. The sampling data collected within Building 414 will be included in the evaluation of data including the background comparison and risk assessment.

Comment 4c: Please indicate in Figure 4, Part II the direction of groundwater flow in support of the proposed down gradient groundwater sampling locations.

Response: Figure 4 will be modified to show that groundwater flow is to the west-northwest direction in the vicinity of IWTP 360. Please note that groundwater sampling points were chosen to define lateral extent of possible groundwater contamination; the groundwater sample points are located north, west, and east of the former excavation area. The groundwater sample previously collected near IWT 360 was located to the south of the former excavation area.

Comment 5: Proposed laboratory reporting limits described in Part II, Section 1.3.2.6 and Appendix D should not be based on comparisons to PRGs.

Response: No changes to text. The proposed laboratory reporting limits were not based on the PRGs but rather based on the maximum sensitivity of the approved analytical methods, which are discussed in Section 1.3.2.6 and shown in tabular form in Appendix D to demonstrate that the laboratory reporting limits are less than PRGs in all cases.

Comment 6: A minimum of five working day notice should be provided to DTSC prior to commencing any field activities.

Response: Concur. Text will be added to Section 2.1 of Part II, Sampling and Analysis Plan that states: "A minimum of five working day notice will be provided to DTSC prior to commencing any field activities."

Comment 7: If requested by DTSC, the facility should collect, preserve and transport duplicate or concurrent soil and groundwater samples for analysis at DTSC Hazardous Materials Laboratory (HML).

Response: Comment noted. Text will be added to Section 2.1 of Part II, Sampling and Analysis Plan that states: "DTSC may request collection of field duplicate (split) samples for soil and groundwater at IWTP 360 at their discretion."

AECRU Contract Number N68711-00-D-0005
Delivery Order DO33

FINAL

Sampling and Analysis Plan for Industrial Waste Treatment Plant 360 Closure Confirmation Sampling

Naval Air Station Alameda (Now Known as Alameda Point), Alameda, California

January 16, 2004

Prepared for

DEPARTMENT OF THE NAVY
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DS.A033.12929

Final

Sampling and Analysis Plan
Industrial Waste Treatment Plant 360 Closure Confirmation Sampling
Naval Station Alameda (Now Known as Alameda Point)
Alameda, California

AECRU CONTRACT NUMBER N68711-00-D-0005
Delivery Order 033

Prepared for:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Tetra Tech Program QA Manager: ______ for ______ Date: 12 Jan 04
Greg Swanson, Tetra Tech

Navy QA Officer: ____________ Date: 1/15/04
Narciso A. Ancog

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TABLE 1: ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP
Industrial Waste Treatment Plant 360, Naval Air Station Alameda

	EPA QA/R-5 QAPP ELEMENT[a]		Tetra Tech SAP
A1	Title and Approval Sheet		Title and Approval Sheet
A2	Table of Contents		Table of Contents
A3	Distribution List		Distribution List
A4	Project/Task Organization	1.4	Project Organization
A5	Problem Definition/Background	1.1	Problem Definition and Background
A6	Project/Task Description	1.2	Project Description
A7	Quality Objectives and Criteria	1.3	Quality Objectives and Criteria
A8	Special Training/Certification	1.5	Special Training and Certification
A9	Documents and Records	1.6	Documents and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody
B4	Analytical Methods	2.4	Analytical Methods
B5	Quality Control	2.5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Inspection and Acceptance of Supplies and Consumables
B9	Nondirect Measurements	2.9	Nondirect Measurements
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review, Verification, and Validation
D2	Validation and Verification Methods		
D3	Reconciliation with User Requirements	4.2	Reconciliation with User Requirements

Notes:

a EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

EPA U.S. Environmental Protection Agency
QAPP Quality assurance project plan
SAP Sampling and analysis plan
Tetra Tech Tetra Tech EM Inc.

CONTENTS

REVIEW AND APPROVAL i

DISTRIBUTION LIST ii

1.0 PROJECT DESCRIPTION AND MANAGEMENT 1

- 1.1 Problem Definition and Background 1
  - 1.1.1 Purpose of the Investigation 2
  - 1.1.2 Problem to be Solved 2
  - 1.1.3 Facility Background 3
  - 1.1.4 Site Description 4
  - 1.1.5 Physical Setting 4
  - 1.1.6 Summary of Previous Investigations 7
    - 1.1.6.1 Vicinity of IWTP 360 7
    - 1.1.6.2 Along Pipelines From Building 360 to IWTP 360 8
  - 1.1.7 Principal Decision-Makers 8
  - 1.1.8 Technical or Regulatory Standards 8
- 1.2 Project Description 9
  - 1.2.1 Project Objectives 9
  - 1.2.2 Project Measurements 9
- 1.3 Quality Objectives and Criteria 10
  - 1.3.1 Data Quality Objectives 10
  - 1.3.2 Measurement Quality Objectives 10
    - 1.3.2.1 Precision 14
    - 1.3.2.2 Accuracy 16
    - 1.3.2.3 Representativeness 16
    - 1.3.2.4 Completeness 16
    - 1.3.2.5 Comparability 17
    - 1.3.2.6 Detection and Quantitation Limits 17
- 1.4 Project Organization 18
- 1.5 Special Training and Certification 18
  - 1.5.1 Health and Safety Training 18
  - 1.5.2 Subcontractor Training 23
  - 1.5.3 Specialized Training and Certification Requirements 23
- 1.6 Documents and Records 23
  - 1.6.1 Field Documentation 23
  - 1.6.2 Summary Data Package 24
  - 1.6.3 Full Data Package 24

1.6.4 Data Package Format 27
1.6.5 Reports Generated 27
2.0 DATA GENERATION AND ACQUISITION 28
2.1 Sampling Process Design 28
2.1.1 Investigation of Soil and Groundwater in the Vicinity of IWTP 360 28
2.1.2 Investigation of Soil and Groundwater Along the Pipelines from Building 360 to IWTP 360 34
2.1.3 Rationale for Selecting Analytical Parameters 34
2.1.4 Surveying 34
2.1.5 Underground Utilities Survey 34
2.2 Sampling Methods 35
2.2.1 Sampling Methods and Equipment 35
2.2.2 Decontamination 38
2.2.3 Management of Investigation-Derived Waste 38
2.2.4 Sample Containers and Holding Times 38
2.3 Sample Handling and Custody 40
2.3.1 Sample Identification 40
2.3.2 Sample Labels 40
2.3.3 Sample Documentation 41
2.3.4 Chain of Custody 41
2.3.5 Sample Shipment 43
2.4 Analytical Methods 44
2.4.1 Selection of Analytical Laboratories 44
2.4.1.1 Laboratory Evaluation and Prequalification 44
2.4.1.2 Laboratory Statement of Work 45
2.4.1.3 Laboratory Selection and Oversight 46
2.4.2 Project Analytical Requirements 47
2.5 Quality Control 47
2.5.1 Field Quality Control Samples 47
2.5.1.1 Field Duplicates 49
2.5.1.2 Equipment Rinsate Samples 49
2.5.1.3 Source Water Blank Samples 49
2.5.2 Laboratory Quality Control Samples 50
2.5.2.1 Method Blanks 50
2.5.2.2 Matrix Spike and Matrix Duplicates 50
2.5.2.3 Laboratory Control Samples 50

2.5.3 Additional Laboratory Quality Control Procedures 50
2.5.3.1 Method Detection Limit Studies 50
2.5.3.2 Sample Quantitation Limits 51
2.5.3.3 Control Charts 51
2.6 Equipment Testing, Inspection, and Maintenance 51
2.6.1 Maintenance of Field Equipment 51
2.6.2 Maintenance of Laboratory Equipment 52
2.7 Instrument Calibration and Frequency 52
2.7.1 Calibration of Field Equipment 53
2.7.2 Calibration of Laboratory Equipment 53
2.8 Inspection and Acceptance of Supplies and Consumables 53
2.9 Nondirect Measurements 54
2.10 Data Management 54
2.10.1 Data Tracking Procedures 54
2.10.2 Data Pathways 54
2.10.3 Data Management Strategy 55

3.0 ASSESSMENT AND OVERSIGHT 55
3.1 Assessment and Response Actions 56
3.1.1 Field Assessments 56
3.1.2 Laboratory Assessments 57
3.1.3 Assessment Responsibilities 57
3.1.4 Field Corrective Action Procedures 58
3.1.5 Laboratory Corrective Action Procedures 59
3.2 Reports to Management 59
3.2.1 Daily Progress Reports 59
3.2.2 Project Monthly Status Report 59
3.2.3 Quality Control Summary Report 60

4.0 DATA VALIDATION AND USABILITY 60
4.1 Data Review, Verification, and Validation 60
4.1.1 Field Data Verification 60
4.1.2 Laboratory Data Verification 61
4.1.3 Laboratory Data Validation 61
4.1.3.1 Cursory Data Validation 61
4.1.3.2 Full Data Validation 61
4.1.3.3 Data Validation Criteria 62

CONTENTS (Continued)

4.2 Reconciliation with User Requirements 62
REFERENCES 64

Appendix

A Method Precision and Accuracy Goals

B Standard Operating Procedures

C Field Forms

D Project-Required Reporting Limits

E Approved Laboratories

F Site-specific Safety and Health Plan (Short Form)

FIGURES

1 ~~Site Location Map~~ Alameda Point Location Map 5

2 ~~Regional Location Map~~ Alameda Point And The Location of IWTP 360 6

3 Project Team Organization Chart 22

4 Proposed Sampling Locations in the Vicinity of IWTP 360 ..... ~~29~~ 30

5 Proposed Sampling Locations Along Pipelines ..... ~~35~~ 36

TABLES

1 Elements of EPA QA/R-5 in Relation to this SAP iii

2 Implementation Schedule for Sampling, Analysis, and Reporting 11

3 DQOs 12

4 QC Samples for Precision and Accuracy 15

5 Key Personnel 19

6 Requirements for Summary and Full Data Packages 25

7 Proposed Soil and Groundwater Samples, Rationale, and Analyses 31

8 Summary of Closure Confirmation Sampling and Analysis 33

9 Sample Container, Holding Time, and Preservative Requirements 39

10 Field QC Samples 48

11 Data Validation Criteria 63

ACRONYMS AND ABBREVIATIONS

%R	Percent recovery
µg/L	Microgram per liter
AECRU	Architect-Engineer CERCLA/RCRA/UST
ASTM	American Society for Testing and Materials
Bay Area	San Francisco Bay Area
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
COPC	Contaminant of potential concern
CPR	Cardiopulmonary resuscitation
DHS	California Department of Health Services
DO	Delivery order
DQA	Data quality assessment
DQO	Data quality objective
DTSC	California Environmental Protection Agency Department of Toxic Substances Control
E&E	Ecology and Environment, Inc.
EDD	Electronic data deliverable
EFA-West	Engineering Field Activity, West
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FTL	Field team leader
GIS	Geographic information system
HASP	Health and safety plan
ID	Identification
IDL	Instrument detection limit
IDW	Investigation-derived waste
ICP	Inductively coupled plasma
IT	International Technology Corporation, Inc.
IWTP	Industrial waste treatment plant

L	Liter
LCS	Laboratory control sample
LIMS	Laboratory information management system
µg/L	Microgram per liter
µg/kg	Microgram per kilogram
MCAWW	Methods for Chemical Analysis of Water and Waste
MCL	Maximum contaminant level
MD	Matrix duplicate
MDL	Method detection limit
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mL	Milliliter
MLLW	Mean lower low water
MQO	Measurement quality objective
MS	Matrix spike
MSD	Matrix spike duplicate
MSR	Monthly status report
NEDTS	Navy Environmental Data Transfer Standards
NFESC	Naval Facilities Engineering Service Center
OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PE	Performance evaluation
PPE	Personal protective equipment
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
PRRL	Project-required reporting limit
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
%R	Percent recovery
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RPD	Relative percent difference
RPM	Remedial project manager

SAP	Sampling and analysis plan
SDG	Sample delivery group
SI	Site Investigation
SOP	Standard operating procedure
SOW	Statement of work
SQL	Sample quantitation limit
SWDIV	Naval Facilities Engineering Command Southwest Division
TSA	Technical systems audit
Tetra Tech	Tetra Tech EM Inc.
WET	Waste extraction test

1.0 PROJECT DESCRIPTION AND MANAGEMENT

Tetra Tech EM Inc. (Tetra Tech) received delivery order (DO) 33 from the U.S. Department of the Navy, Southwest Division (SWDIV), Naval Facilities Engineering Command, under the Architect-Engineer CERCLA/RCRA/UST (AECRU) contract. Under DO 33, Tetra Tech is conducting closure confirmation sampling in support of a closure plan amendment for the Resource Conservation and Recovery Act (RCRA) Part A interim status facility Industrial Waste Treatment Plant (IWTP) 360 at Alameda Point, California. To guide the field, laboratory, and data reporting efforts associated with this project, Tetra Tech prepared this sampling and analysis plan (SAP), consisting of a field sampling plan and a quality assurance project plan (QAPP) in an integrated format.

Table 1 follows the approval page at the beginning of this SAP. The table demonstrates how this SAP addresses all the elements of a QAPP currently required by the U.S. Environmental Protection Agency (EPA) QA/R-5 guidance document (EPA 2001).

Tables and figures follow the first reference in the text in this document. The appendices are organized as follows:

- Appendix A contains method precision and accuracy goals.
- Appendix B contains standard operating procedures (SOP).
- Appendix C contains all field forms.
- Appendix D lists project-required reporting limits.
- Appendix E lists laboratories that Tetra Tech has contracted to analyze samples collected under Navy contracts.

1.1 PROBLEM DEFINITION AND BACKGROUND

This section describes the following:

- Purpose of the Investigation (Section 1.1.1)
- Problem to be Solved (Section 1.1.2)
- Facility Background (Section 1.1.3)
- Site Description (Section 1.1.4)
- Physical Setting (Section 1.1.5)
- Summary of Previous Investigations (Section 1.1.6)

- Principal Decision-Makers (Section 1.1.7)
- Technical or Regulatory Standards (Section 1.1.8)

1.1.1 Purpose of the Investigation

The purpose of the closure confirmation sampling at IWTP 360 is to obtain the additional soil and groundwater characterization data that are needed to obtain closure of IWTP 360. The determination of closure will be accomplished by evaluating data from this investigation and previous investigations against the closure performance standards established in the amended closure plan amendment for IWTP 360 (Tetra Tech 2003). The additional data requirements relate to two potential source areas at this site: (1) in the vicinity of IWTP 360 and (2) along the pipelines from Building 360 to IWTP 360.

These data will supplement the information compiled in the following reports based on four previous investigations:

- "Closure Summary Report, Building 360, Industrial Waste Treatment Plant" (Ecology and Environment, Inc. [E&E] 1997)
- "Final Environmental Baseline Survey, Alameda Point, Alameda, California" (International Technology Corporation, Inc. [IT] 2001a
- "Final Field Sampling Investigation Report, (Addendum to Closure Report, September 25, 1997), Resource Conservation and Recovery Act (RCRA) Permitted Facility, Building 360, IWTP" (IT 2001b)
- "Data Summary Report, Supplemental Remedial Investigation Data Gap Sampling for Operable Units 1 and 2, Alameda Point, Alameda, California" (Tetra Tech 2002b).

1.1.2 Problem to be Solved

The Navy and California Environmental Protection Agency Department of Toxic Substances Control (DTSC) have held a series of meetings discussing the closure of IWTP 360. Based on these meetings, DTSC has requested additional sampling of two suspected source areas to obtain closure for IWTP 360.

One of the suspected source areas is the former location of IWTP 360. Although soil samples have been collected in the vicinity of the former IWTP 360, DTSC has requested that the Navy verify the lateral and vertical extent of cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver in soil. DTSC has also requested additional groundwater samples in the vicinity of the former IWTP 360 to determine whether IWTP activities have affected groundwater.

The second suspected source area is the area along the waste pipelines from Building 360 to IWTP 360. Soil and groundwater samples were collected along the pipeline in 2002. DTSC has requested collection of additional soil and groundwater samples at 25-foot intervals along the pipeline. Subsurface soil and groundwater characterization data are needed to determine whether the underground pipelines may have leaked and caused soil or groundwater contamination.

1.1.3 Facility Background

The U.S. Army acquired the Alameda Point installation property from the City of Alameda in 1930 and began construction activities in 1931 (see Figure 1). In 1936, the Navy acquired title to the land from the U.S. Army and began building the air station in response to the military buildup in Europe before World War II. Construction of the base included several iterations of filling the existing tidelands, marshlands, and sloughs with dredge materials from the San Francisco Bay (Tetra Tech 1998).

After the United States entered World War II in 1941, the Navy acquired more land to the west of the installation. Following the end of World War II in 1945, the installation continued its primary mission of providing facilities and support for fleet aviation activities. Thus, after World War II, NAS Alameda was one of the largest and most diversified naval facilities on the West Coast, providing berthing for Pacific Fleet ships and serving as a major center of naval aviation. Before the decision to close the base, NAS Alameda had about 60 military tenant commands, for a combined military and civilian work force of more than 18,000 personnel (Engineering Field Activity, West [EFA-West] 1999).

Construction activities at NAS Alameda initially focused on erecting permanent buildings on the eastern half of the installation and filling the southern and western parts of the installation. After World War II, filling of San Francisco Bay submerged land and tidelands increased the dry land acreage to the current acreage. Construction activities continued intermittently, until the decision was made in 1993 to close NAS Alameda (EFA-West 1999).

The installation supported several activities involving the use of substances such as industrial solvents, acids, paint strippers, degreasers, caustic cleaners, and metal plating. Oils, fuels, and asbestos also were used at the installation. In 1983, the largest tenants were the Naval Air Rework Facility and the Naval Air Reserve Unit (E&E 1983). In 1997, the two largest tenants were the Navy Public Works Center and Naval Aviation Depot Alameda.

The Navy submitted a revised RCRA Part A application in July 1987 to add IWTP 360 to the Interim Status Document. DTSC approved the Part A revision to include IWTP 360 in October 1987. The following units were also added to the Part A permit: IWTP 410 and IWTP 5 (HW-05). Closure procedures at the RCRA-permitted units were initiated when their operations began to cease.

The Navy initiated site investigations at Alameda Point under the Navy Assessment and Control of Installation Pollutants (NACIP) Program in 1982. On June 6, 1988, the Navy received a remedial action order from the California Department of Health Services (now the DTSC) that identified a total of 20 sites as needing a remedial investigation (RI) and feasibility study in conformance with requirements set forth in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1988, the Navy converted its NACIP Program into the Installation Restoration Program to be more consistent with CERCLA. Alameda Point was identified for closure in September 1993, and all naval operations ceased in April 1997. In July 1999, Alameda Point was identified as a National Priorities List site (EPA 1999b). The Navy is currently conducting an investigation in accordance with CERCLA (EPA 1988) at 31 CERCLA sites.

1.1.4 Site Description

IWTP 360 was constructed in 1973 and taken out of service in 1994. IWTP 360 treated chromium and cyanide wastewater generated from metal plating operations in the plating shop within Building 360. IWTP 360 was located inside a roofed, fenced enclosure west of Building 414. The facility was constructed on a continuously poured concrete slab bordered by a concrete curb with a total secondary containment capacity of 48,000 gallons. All tanks and associated aboveground equipment have been decontaminated and removed from IWTP 360 (E&E 1997).

IWTP 360 is located on the eastern side of the Seaplane Lagoon within CERCLA Site 4 west of Building 360 (Figure 2). The area surrounding IWTP 360 is covered with asphalt. Groundwater beneath the site is encountered at a depth of 5 to 7 feet below ground surface (bgs). In general, groundwater in the vicinity of IWTP 360 flows in a west-northwest direction.

1.1.5 Physical Setting

Alameda Point is located in the San Francisco Bay Area (Bay Area). Specifically, Alameda Point is located on the western tip of Alameda Island, along the eastern margin of the San Francisco Bay, adjacent to the City of Oakland (see Figure 2). The northern portion of Alameda Island was formerly tidelands, marshlands, and sloughs, adjacent to the historical San Antonio Channel, now known as the Oakland Inner Harbor. Most of the land that is now Alameda Point was created by filling the natural tidelands, marshlands, sloughs, and subtidal area with dredge spoils from the surrounding San Francisco Bay, Seaplane Lagoon, and Oakland Inner Harbor. The onshore portion of Alameda Point is roughly rectangular in shape, about 2 miles long east-west and 1 mile wide north-south, and occupies 1,734 acres of land. The land surface is low-lying and nearly flat. Elevations are less than 15 feet (5 meters) above mean sea level (EFA-West 1999).

The Bay Area experiences a maritime climate, with mild summer and winter temperatures. Prevailing winds in the Bay Area are from the west. Because of the varied topography of the Bay Area, climatic conditions vary considerably throughout the region. Heavy fogs occur on an

CITY

HIGHWAY

COUNTY BORDER

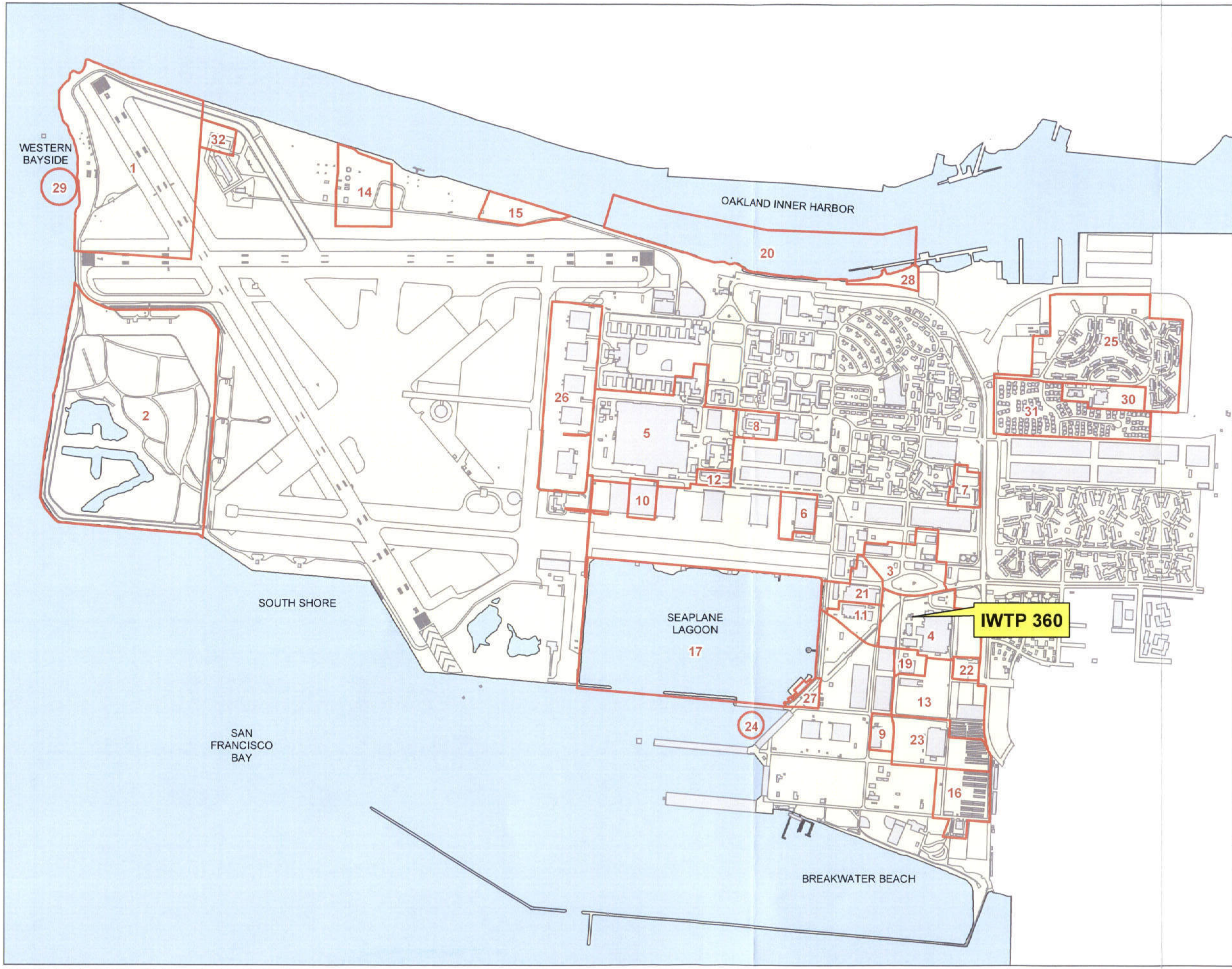
Tetra Tech EM Inc.

Alameda Point
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 1
ALAMEDA POINT LOCATION MAP

Closure Confirmation Sampling
Industrial Waste Treatment Plant 360

2003-08-11 U:\almda_sa\do033\iwtp360_closure_confirmation\mxd\fig01-01_regional_location.mxd TtEMI-SA K. Johnson



Note:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
IWTP = Industrial Waste Treatment Plant

Tetra Tech EM Inc.

Alameda Point
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 2
ALAMEDA POINT AND THE LOCATION OF IWTP 360

Closure Confirmation Sampling
Industrial Waste Treatment Plant 360

2003-08-11 U:\almda_sa\do033\iwtp360_closure_confirmation\mxd\fig02_iwtp360_location.mxd TtEMI-SA K. Johnson average of 21 days per year. Rainfall occurs primarily during the months of October through April. The installation averages about 18 inches of rainfall a year (Air Traffic Control NAS Alameda 1992). There are no naturally occurring surface streams or ponds on the installation, so precipitation returns to the atmosphere by evapotranspiration, runs off into the storm drain system that discharges to the San Francisco Bay, or infiltrates to groundwater (Tetra Tech 1998).

Physical features at Alameda Point include runways, streets, buildings, fuel lines, underground storage tanks (UST), aboveground storage tanks (AST), and utility lines (sanitary sewer, storm sewer, water, and power lines). Some fuel lines, USTs, and ASTs have been removed, and others have been closed in place.

1.1.6 Summary of Previous Investigations

Previous investigations at the site have focused on contamination in groundwater and soil in the vicinity of IWTP 360 and along the pipelines from Building 360 to IWTP 360. The previous investigations at the two locations are described below.

1.1.6.1 Vicinity of IWTP 360

Soil samples were collected in the vicinity of IWTP 360 during three separate investigations:

- IT conducted an environmental baseline survey in 1995. Four samples were collected from two boring locations within Building 414 at depths up to 4.5 feet bgs (IT 2001a).
- E&E collected a total of 26 soil samples from seven boring locations at depths up to about 10 feet bgs. Boring B3 refused at 1 foot bgs (E&E 1997). Soil in the vicinity of borings B3 and B4 was later excavated in December 2000 by IT.
- IT conducted field sampling in 2000. A total of 100 soil samples were collected from 20 boring locations to depths up to14.6 feet. Soil in the vicinity of borings 1 through 7 to depths ranging from 10 to 12 feet bgs was excavated in December 2000 (IT 2001b).

The soil samples collected by E&E were analyzed for metals, phenols, chlorinated hydrocarbons, cyanide, and total recoverable petroleum hydrocarbons. With the exception of cadmium and chromium, all analyzed compounds were either not detected or detected at concentrations less than the residential preliminary remediation goals (PRG) (or California-modified PRG, when available) (EPA 2002) or the background levels of metals at Alameda Point. The soil samples collected in 2000 by IT were, therefore, only analyzed for chromium and cadmium.

All soil with known concentrations of cadmium exceeding the residential PRGs was removed in December 2000. However, soil with known concentrations of total chromium exceeding the residential PRGs remains in place at depths greater than 10 feet.

Two groundwater grab samples were collected at one location south of the former sumps in 2001 (7 feet bgs and 12 feet bgs). The groundwater samples did not indicate concentrations of cadmium or chromium greater than the California maximum contaminant level (MCL) in drinking water (California Department of Health Services [DHS] 2003). Based on previous sampling results and discussions with DTSC, the metals of concern for the closure confirmation sampling in the vicinity of IWTP 360 are cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver.

1.1.6.2 Along Pipelines From Building 360 to IWTP 360

Soil and groundwater samples were collected along the pipeline from Building 360 to IWTP 360 during one investigation. That investigation is detailed in "Data Summary Report, Supplemental Remedial Investigation Data Gap Sampling for Operable Units 1 and 2, Alameda Point, Alameda, California" (Tetra Tech 2002b).

Ten soil samples were collected in 2002 along the underground pipelines from the Building 360 to IWTP 360 during the supplemental RI data gap sampling (Tetra Tech 2002b). Soil samples were collected during advancement of vacuum extraction wells at the following three locations: adjacent to Building 360, midway between Building 360 and IWTP 360, and south of the former IWTP sumps. Soil sampling results from the three locations indicated soil concentrations less than residential PRGs for the metals of concern (cadmium, chromium, copper, lead, nickel, and silver).

Groundwater samples were collected in 2002 from two locations along the underground pipelines from IWTP 360 to Building 360. The sample results were nondetect or less than California MCLs for the metals of concern (cadmium, chromium, copper, lead, nickel, and silver). Groundwater sampling results from the basewide monitoring well located north of the pipelines and west of Building 360 indicated concentrations of total chromium that exceed the California MCL of 50 micrograms per liter (μg/L). Total chromium concentrations in groundwater ranged from 87 to 105 μg/L (DHS 2003). Based on previous sampling results and discussions with DTSC, the metals of concern for the closure confirmation sampling along the pipeline are cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver.

1.1.7 Principal Decision-Makers

Principal decision-makers include the Navy, regulatory agencies (DTSC and the California Regional Water Quality Control Board), and the affected public. These decision-makers will use the data collected from this project as well as data generated previously to obtain closure of IWTP 360.

1.1.8 Technical or Regulatory Standards

As described in Section 8.0 of the closure plan amendment, analytical results from soil and groundwater samples will be screened initially using the EPA Region 9 PRGs (EPA 2002), and

California MCLs (DHS 2003). Soil results will be statistically compared with the Alameda Point background levels, as appropriate. Background levels determined for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver for Alameda Point are included in Attachment C of the closure plan amendment (Part I of this binder). Current EPA Region 9 PRGs and California MCLs are listed in Appendix D. The PRGs and background concentrations will be used as initial screening tools; however, when all data are available, quantitative human health and ecological risk assessments will be completed to make risk management decisions for closure

1.2 PROJECT DESCRIPTION

The following sections discuss the objectives and measurements of the project. Table 2 presents a schedule of sampling, analysis, and reporting for this project.

1.2.1 Project Objectives

As stated in Section 1.1, the primary objective of the closure confirmation sampling at IWTP 360 is to obtain closure for IWTP 360. A second objective is to further define the lateral and vertical extent of contamination in soil and groundwater in the vicinity of IWTP 360. A third objective is to evaluate whether soil or groundwater contamination occurred as a result of possible leaks from the underground pipelines. These data will be used to obtain closure at the site. To meet these objectives, the following field activities have been incorporated into the scope of work for this project and will be carried out at Alameda Point:

- Collect four soil samples from two locations east of the excavation area in the vicinity of IWTP 360; if no samples can be collected between the excavation area and Building 414, then only two soil samples will be collected from one location east of Building 414.

- Collect six groundwater samples in the vicinity of IWTP 360.

- Collect 12 soil samples and 6 groundwater samples along the pipeline from Building 360 to IWTP 360.

1.2.2 Project Measurements

Soil and groundwater samples will be collected in the two potential source areas at IWTP 360 and will be analyzed for cadmium, chromium (total and hexavalent), copper, lead, nickel, and silver. Soil and groundwater samples will be collected from the two locations as described below:

- Vicinity of IWTP (see Figure 4)
  - Collect soil samples from two direct-push locations east of the excavation area; if no sample can be collected between the excavation area and Building 414, then

samples from only one location will be collected east of Building 414. At each soil sampling location, two depths are proposed: 1.5 to 2.0 feet and 7.5 to 8.0 feet or at the groundwater interface, whichever is shallower. These depths may be modified in the field depending on the location of the groundwater table.

- Collect groundwater samples from three direct-push locations at two depths within the first water-bearing zone situated north, west, and east of the former excavation area; the location east of the excavation area will also be a soil sample point.

- Along pipeline from Building 360 to IWTP 360 (see Figure 5)
  - Collect soil samples from six locations at two depths: at approximately 3 feet bgs (level with the pipeline) and 5 feet bgs (2 feet deeper than the pipeline)
  - Collect groundwater samples from six locations at one depth (approximately 5 feet bgs, which is 2 feet deeper than the pipeline)

A minimum volume of investigation-derived wastes (IDW) will be produced during the investigation. Soil IDW will be sampled and analyzed for VOCs and metals (cadmium, chromium, copper, lead, nickel, and silver) using the waste extraction test (WET). Water from decontamination will be containerized and will be sampled and analyzed for VOCs and metals. All samples will be shipped to an off-site laboratory.

1.3 QUALITY OBJECTIVES AND CRITERIA

The following sections present the data quality objectives (DQO) and measurement quality objectives (MQO) identified for this project.

1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000b, 2000d). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this project are presented in Table 3.

1.3.2 Measurement Quality Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project

TABLE 2: IMPLEMENTATION SCHEDULE FOR SAMPLING, ANALYSIS, AND REPORTING

Industrial Waste Treatment Plant 360, Naval Air Station Alameda

Milestone	Due Date	Anticipated Date
Internal Draft SAP to Navy	14 calendar days after notification to proceed	August 13, 2003
Draft SAP to agencies	30 calendar days after Navy comments are received	September 12, 2003
Internal Final SAP to Navy and agencies	22 calendar days after all Navy and regulatory agency comments are received	November 3, 2003
Final SAP to regulatory agencies	10 calendar days after all Navy and regulatory agency comments are received	January 20, 2004
HASP to Navy	30 calendar days before field investigation begins	January 22, 2004
Field investigation	Immediately following finalization of SAP	February 27, 2004
Internal draft closure confirmation sampling report to Navy	30 calendar days after validation of all data	May 13, 2004
Draft closure confirmation sampling report to Agencies	30 calendar days after Navy comments are received	July 14, 2004
Internal final closure confirmation sampling report	45 calendar days after agency comments are received	October 12, 2004
Final closure confirmation sampling report to Agencies	30 calendar days after agency comments are received	December 21, 2004

Note:

HASP Health and safety plan
SAP Sampling and analysis plan
SI Site investigation

TABLE 3: DQOs

Industrial Waste Treatment Plant 360, Naval Air Station Alameda

STEP 1: State the Problem

- The primary objective of the closure confirmation sampling at IWTP 360 is to obtain closure for IWTP 360.
- A second objective is to further define the lateral and vertical extent of contamination in soil and groundwater in the vicinity of IWTP 360.
- A third objective is to evaluate whether soil or groundwater contamination occurred as a result of possible leaks from the underground pipelines.

STEP 2: Identify the Decisions

Are any of the target constituents present at concentrations above PRGs in subsurface soils or above MCLs in groundwater in the vicinity of IWTP 360 or along the pipelines from Building 360 to IWTP 360?

STEP 3: Identify Inputs to the Decisions

- Analytical results for soil samples collected from one to two soil direct-push locations east of the former excavation area within IWTP 360; samples to be collected at 1.5 to 2.0 feet bgs and 7.5 to 8.0 feet bgs or at the groundwater interface, whichever is shallower.
- Analytical results for groundwater samples collected from two depths within the first water bearing zone from each of the three direct-push locations in the vicinity of IWTP 360 (situated north, west, and east of the former excavation area).
- Analytical results for soil samples collected at two depths (3 feet and 5 feet bgs) from each of the six locations along the pipelines from Building 360 to IWTP 360.
- Analytical results for groundwater samples collected at one depth (5 feet bgs) from each of the six locations along the pipelines from Building 360 to IWTP 360.
- All soil and groundwater samples will be analyzed for cadmium, chromium, copper, lead, nickel, and silver.

STEP 4: Define Study Boundaries

- For the soil samples in the vicinity of IWTP 360, the lateral extent of the study area is the eastern side of Building 414 (located just to the east of IWTP 360).
- The vertical extent of the soil study area in the vicinity of IWTP 360 extends from the surface of the soil to 8 feet bgs (or at the groundwater interface, whichever is shallower) for the two locations east of the former excavation area
- For the groundwater samples in the vicinity of IWTP 360, the lateral extent of the study area is the perimeter of IWTP 360 and the vertical extent extends to the maximum depth of groundwater in the first water bearing zone (approximately 12 feet)
- For the soil and groundwater samples along the pipelines from Building 360 to IWTP 360, the lateral extent of the study is within 5 feet of the underground pipelines and the vertical extent extends 5 feet bgs, which is about 2 feet below the depth of the pipelines
- Temporal boundaries extend through the period of performance of the task order.

STEP 5: Develop Decision Rules

If concentrations of metals in soil and groundwater are below background and MCLs in the vicinity of IWTP 360 or along the pipelines from Building 360 to IWTP 360, then the data will be used to support a clean closure decision for IWTP 360.

If concentrations of metals are detected above background and MCLs in soil and groundwater samples collected in the vicinity of IWTP 360 or along the pipelines from Building 360 to IWTP 360, a human

TABLE 3: DQOs (Continued)
IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

health risk assessment will be conducted.
STEP 6: Specify Tolerable Limits on Decision Errors
Site-specific sampling objectives and the media being investigated limit the use of statistical methods in selecting sampling locations for this investigation. Sampling locations will be based on prior knowledge of likely hazardous material handling and waste disposal. Tolerable limits on decision errors cannot be precisely defined.
STEP 7: Optimize the Sampling Design
Two locations in the vicinity of IWTP 360 selected for soil sampling are based on knowledge of historical operations. Therefore, soil sample locations are judgmentally placed. Three locations in the vicinity of IWTP 360 selected for groundwater sampling are based on knowledge of historical operations. Therefore, groundwater sample locations are judgmentally placed. Six locations along the pipelines from Building 360 to IWTP 360 for soil and groundwater sampling are placed at about 25-foot intervals along the length of the pipelines; taking into account the previous sampling locations.

Notes:

bgs	Below ground surface
IWTP	Industrial Waste treatment plant
MCL	Maximum contaminant level
PRG	Preliminary remediation goal

objectives. Of these PARCC parameters, precision and accuracy will be evaluated quantitatively by collecting the quality control (QC) samples listed in Table 4. Specific precision and accuracy goals for these QC samples are listed in Appendix A.

The sections below describe each of the PARCC parameters and how they will be assessed within this project.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Usually, combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD).

$$RPD = \frac{|A-B|}{(A+B)/2} \; x \; 100\%$$

where:

A	=	First duplicate concentration
B	=	Second duplicate concentration

Field sampling precision is evaluated by analyzing field duplicate samples. However, because it is not practical to obtain true field duplicate soil samples, field duplicates will only be collected for groundwater samples for this project.

Laboratory analytical precision is evaluated by analyzing matrix duplicates (MD) or matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MD samples will be generated for all analytes. The results of the analysis of each sample/MD pair will be used to calculate an RPD for evaluating precision.

TABLE 4: QC SAMPLES FOR PRECISION AND ACCURACY

Industrial Waste Treatment Plant 360, Naval Air Station Alameda

QC Type	Precision	Accuracy	Frequency
Field QC		Equipment rinsate	Equipment rinsate = 1/day/piece of equipment used for sampling
		Source water blank	Source water blank = 1/sampling event/source of water used for the final decontamination rinse
	Field duplicate		Field duplicate = 10 percent but not less than one per sampling technique (groundwater only for direct push and vacuum extraction)
Laboratory QC	MD relative percent difference	MS %R Method Blanks LCS or Blank Spikes	MD/MS = 1/20 samples Method Blank = 1/20 samples LCS or Blank Spikes = 1/20 samples

Notes:

%R	Percent recovery
LCS	Laboratory control sample
MD	Matrix duplicate
MS	Matrix spike
QC	Quality control

Note: Analytical laboratories typically run matrix duplicates for inorganic analyses rather than matrix spike duplicates.

1.3.2.2 Accuracy

A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS samples, laboratory control samples (LCS) or blank spikes, and method blanks. MS samples will be prepared and analyzed at a frequency of 5 percent for soil and groundwater samples. LCS or blank spikes are also analyzed at a frequency of 5 percent. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy. where:

$$Percent\ Recovery = \frac{S-C}{T} \ x\ 100$$

S	=	Measured spike sample concentration
C	=	Sample concentration
T	=	True or actual concentration of the spike

Appendix A presents accuracy goals for the investigation based on the percent recovery of matrix spikes. Results that fall outside the accuracy goals will be further evaluated on the basis of the results of other QC samples.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Equipment rinsates, source water blanks, and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

1.3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

As discussed further in Section 4.2, completeness will also be evaluated as part of the data quality assessment process (EPA 2000c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

1.3.2.6 Detection and Quantitation Limits

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. Project required reporting limits (PRRL) are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the MDL to allow for matrix effects. PRRLs, which are established by Tetra Tech in the scope of work for subcontract laboratories, are set to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

For this project, analytical methods have been selected so that the PRRL for each target analyte is below the applicable regulatory screening criteria (the PRGs and MCLs), wherever practical. Appendix D compares the soil PRRLs for the selected analytical methods with both the industrial and residential PRGs since it has not been formally established which of these land uses will apply to this site. This comparison shows that the selected analytical methods and associated PRRLs are capable of quantifying contaminants of concern at concentrations below the residential PRG, which is the most stringent, in all cases. Appendix D also compares the groundwater PRRLs for the selected analytical methods with the MCLs. The selected analytical methods and associated PRRLs are capable of quantifying contaminants of concern at concentrations below the MCLs in all cases.

For this project, samples analyzed for metals will be reported as estimated values if concentrations are less than PRRLs but greater than MDLs. The MDL for each analyte will be listed as the detection limit in the laboratory's electronic data deliverable (EDD). This procedure is being adopted to help ensure that analytical results can effectively be compared with PRGs for certain metals where the PRRL is near the PRG. This procedure also will help to ensure that subsequent statistical evaluations of the data will not be biased by high-value nondetect results.

1.4 PROJECT ORGANIZATION

Table 5 presents the responsibilities and contact information for key personnel involved in soil sampling activities at IWTP 360 at Alameda Point. In some cases, more than one responsibility has been assigned to one person. Figure 3 presents the organization of the project team.

1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for Tetra Tech and subcontractor personnel working on site.

1.5.1 Health and Safety Training

Tetra Tech personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 *Code of Federal Regulations* (29 CFR) Part 1910.120(e). These requirements include: (1) 40 hours of formal off-site instruction, (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor, and (3) 8 hours of annual refresher training. Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers AECRU health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every Tetra Tech field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular," or equivalent.

Copies of Tetra Tech's health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are maintained in project files. Before work begins at a specific hazardous waste project site, Tetra Tech personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at a hazardous waste project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards

TABLE 5: KEY PERSONNEL

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Name	Organization	Role	Responsibilities	Contact Information
Lou Ocampo	Navy	Remedial project manager	Responsible for overall project execution and for coordination with base representatives, regulatory agencies, and Navy management Actively participates in DQO process Provides management and technical oversight during data collection	Naval Facilities Engineering Command, SWDIV, San Diego, CA ocampola@efdsw.navfac.navy.mil (619) 532-0969
Narciso A. Ancog	Navy	QA officer	Responsible for QA issues for all SWDIV environmental work Provides government oversight of Tetra Tech's QA program Reviews and approves SAP and any significant modifications Has authority to suspend project activities if Navy quality requirements are not met	Naval Facilities Engineering Command, SWDIV, San Diego, CA ancogna@efdsw.navfac.navy.mil (619) 532-2540
Beth Kelly	Tetra Tech	Installation coordinator	Responsible for ensuring that all Tetra Tech activities at this installation are carried out in accordance with current Navy requirements and Tetra Tech AECRU program guidance	Tetra Tech, Sacramento, CA Beth.Kelly@ttemi.com (916) 853-4525
Glynis Foulk	Tetra Tech	Project manager	Responsible for implementing all activities called out in DO Prepares or supervises preparation of SAP Monitors and directs field activities to ensure compliance with SAP requirements	Tetra Tech, Sacramento, CA Glynis.Foulk@ttemi.com (916) 853-4561
Greg Swanson	Tetra Tech	Program QA manager	Responsible for regular discussion and resolution of QA issues with Navy QA officer Provides program-level QA guidance to installation coordinator, project manager, and project teams Reviews and approves SAPs Identifies nonconformances through audits and other QA review activities and recommends corrective action	Tetra Tech, San Diego, CA Greg.Swanson@ttemi.com 619-525-7188
Ron Ohta	Tetra Tech	Project QA officer	Responsible for providing guidance to project teams that are preparing SAPs Verifies that data collection methods specified in SAP comply with Navy and Tetra Tech requirements May conduct laboratory evaluations and audits	Tetra Tech, Sacramento, CA Ron.Ohta@ttemi.com (916) 853-4506

TABLE 5: KEY PERSONNEL (Continued)
IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

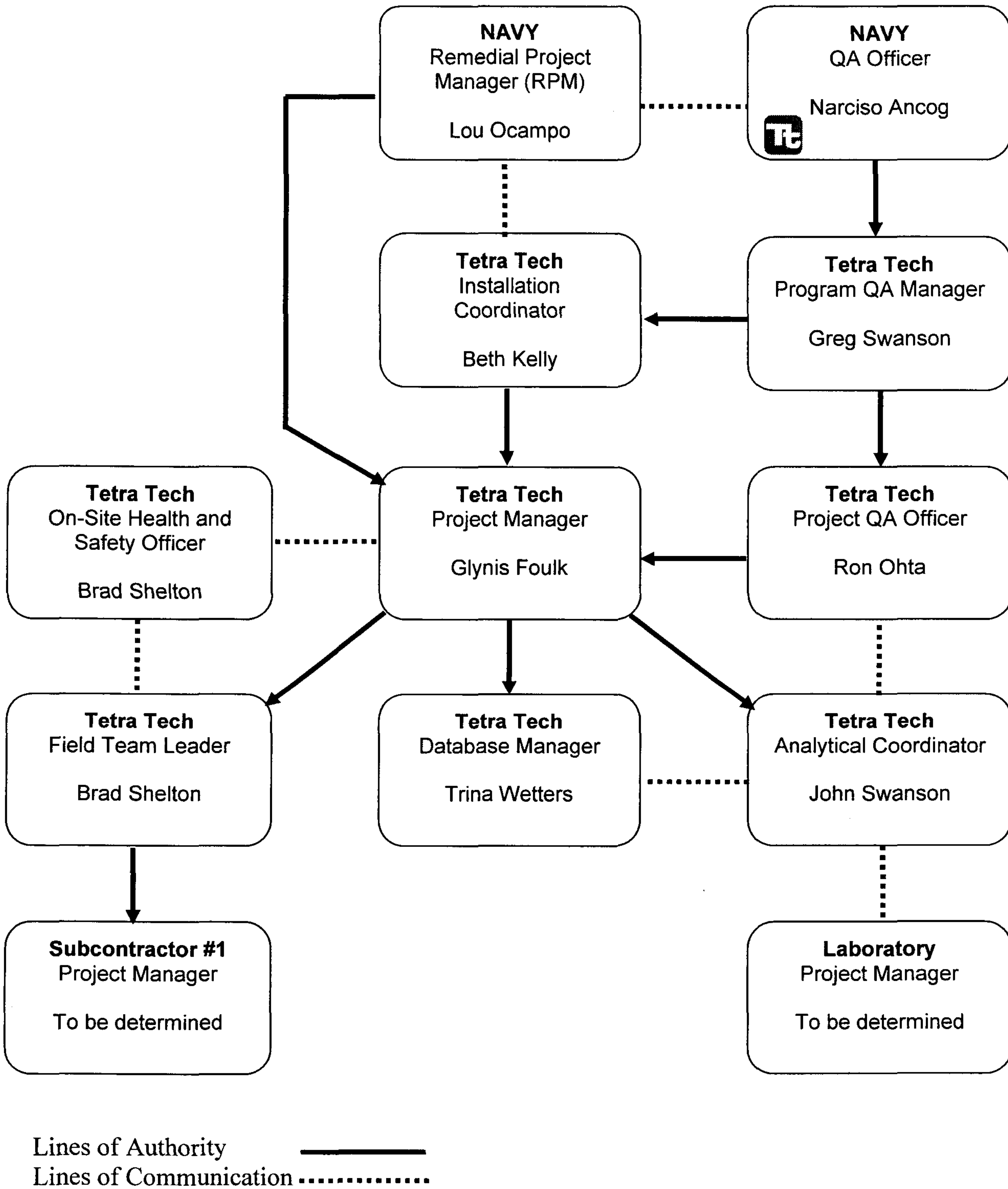
Name	Organization	Role	Responsibilities	Contact Information
Brad Shelton	Tetra Tech	Field team leader	Responsible for directing day-to-day field activities conducted by Tetra Tech and subcontractor personnel Verifies that field sampling and measurement procedures follow SAP Provides project manager with regular reports on status of field activities	Tetra Tech, Sacramento, CA Brad.shelton@ttemi.com (916) 853-4559
Brad Shelton	Tetra Tech	On-site safety officer	Responsible for implementing health and safety plan and for determining appropriate site control measures and personal protection levels Conducts safety briefings for Tetra Tech and subcontractor personnel and site visitors Can suspend operations that threaten health and safety	Tetra Tech, Sacramento, CA Brad.shelton@ttemi.com (916) 853-4559
John Swanson	Tetra Tech	Analytical coordinator	Responsible for working with project team to define analytical requirements Assists in selecting a pre-qualified laboratory to complete required analyses (see Section 2.4 of SAP) Coordinates with laboratory project manager on analytical requirements, delivery schedules, and logistics Reviews laboratory data before they are released to project team	Tetra Tech, Sacramento, CA John.Swanson@ttemi.com (916) 853-4582
Trina Wetters	Tetra Tech	Database manager	Responsible for developing, monitoring, and maintaining project database under guidance of project manager Works with analytical coordinator during preparation of SAP to resolve sample identification issues	Tetra Tech, Sacramento, CA Trina.Wetters@ttemi.com (916) 853-4534
To be determined	Laboratory	Project manager	Responsible for delivering analytical services that meet requirements of SAP Reviews SAP to understand analytical requirements Works with Tetra Tech analytical coordinator to confirm sample delivery schedules Reviews laboratory data package before it is delivered to Tetra Tech	To be determined

TABLE 5: KEY PERSONNEL (Continued)
IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Name	Organization	Role	Responsibilities	Contact Information
To be determined	Subcontractor	Project manager	Responsible for ensuring that subcontractor activities are conducted in accordance with requirements of SAP Coordinates subcontractor activities with Tetra Tech project manager or field team leader	To be determined

Notes:

CA	California
DO	Delivery order
DQO	Data quality objective
QA	Quality assurance
SAP	Sampling and analysis plan
SWDIV	U.S. Department of the Navy, Naval Facilities Engineering Command, Southwest Division



Naval Air Station Alameda

U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 3
PROJECT TEAM ORGANIZATION CHART

IWTP 360 Closure Confirmation Sampling

- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances

1.5.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to Tetra Tech.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the "Safety Meeting Sign-Off Sheet" before they conduct on-site work. This briefing covers the topics described in Section 1.5.1 and is conducted by the Tetra Tech on-site health and safety officer or other qualified person. Subcontractors are responsible for conducting their own safety briefings. Tetra Tech personnel may audit these briefings.

1.5.3 Specialized Training and Certification Requirements

Other than described above, there are no specialized training requirements.

1.6 Documents and Records

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of this project.

1.6.1 Field Documentation

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in the SAP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the DO number, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events

- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken

The field team will also use the various field forms included in Appendix C to record field activities.

1.6.2 Summary Data Package

The subcontracted laboratory will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statements of work (SOW) (EPA 1999a, 2000a). The summary data package will consist of a case narrative, copies of all associated chain-of-custody forms, sample results, and quality assurance and quality control (QA/QC) summaries. The case narrative will include the following information:

- Subcontractor name, project name, DO number, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample ID numbers
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Additional requirements for the summary data package are outlined in Table 6. The subcontracting laboratory will provide Tetra Tech with two copies of the summary data package within 28 days after it receives the last sample in the SDG.

1.6.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP SOWs (EPA 1999a, 2000a). Full data packages will contain all of the information from the summary data package and all associated raw data. Full data package requirements are outlined in Table 6. Full data packages are due to Tetra Tech

TABLE 6: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Requirements for Summary Data Packages – Inorganic Analysis

Section I — Case Narrative

1. Case narrative
2. Copies of nonconformance and corrective action forms
3. Chain-of-custody forms
4. Copies of sample receipt notices
5. Internal tracking documents, as applicable

Section II — Sample Results - Form I for the following:

1. Environmental sample including dilutions and reanalysis

Section III — QA/QC Summaries - Forms II through XIV for the following:

1. Initial and continuing calibration verifications (Form II)
2. PRRL standard (Form II)
3. Detection limit standard (Form II-Z)
4. Method blanks, continuing calibration blanks, and preparation blanks (Form III)
5. Inductively coupled plasma (ICP) interference-check samples (Form IV)
6. MS and post-digestion spikes (Forms V and V-Z)
7. Sample duplicates (Form VI)
8. LCSs (Form VII)
9. Method of standard additions (Form VIII)
10. ICP serial dilution (Form IX)
11. IDL (Form X)
12. ICP interelement correction factors (Form XI)
13. ICP linear working range (Form XII)

Requirements for Full Data Packages -- Inorganic Analysis

<u>Sections I, II, III</u> Summary Package

Instrument Raw Data - Sequential measurement readout records for ICP, graphite furnace atomic absorption (GFAA), flame atomic absorption (AA), cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:

1. Environmental samples, including dilutions and re-analysis
2. Initial calibration
3. Initial and continuing calibration verifications
4. Detection limit standards
5. Method blanks, continuing calibration blanks, and preparation blanks
6. ICP interference check samples
7. MS and post-digestion spikes
8. Sample duplicates
9. LCSs
10. Method of standard additions
11. ICP serial dilution

<u>Section V</u> Other Raw Data

1. Percent moisture for soil samples
2. Sample digestion, distillation, and preparation logs, as necessary
3. Instrument analysis log for each instrument used

Standard preparation logs, including initial and final concentrations for each standard used

5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results

within 35 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

1.6.4 Data Package Format

The subcontracted laboratory will provide EDDs for all analytical results. An automated laboratory information management system (LIMS) must be used to produce the EDDs. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDDs will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with Navy Environmental Data Transfer Standards (NEDTS). Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG
- All re-analysis, re-extractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples

Electronic and hard-copy data must be retained for a minimum of 3 and 10 years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system.

1.6.5 Reports Generated

A closure confirmation sampling report for IWTP 360 will be prepared at the conclusion of the field work. The report will include a summary of the results of previous related investigations, field and sampling procedures for the soil and groundwater investigation, soil and groundwater target analyte concentrations and associated QC data, conclusions, and recommendations for the site.

2.0 DATA GENERATION AND ACQUISITION

This section describes the requirements for the following:

- Sampling Process Design (Section 2.1)
- Sampling Methods (Section 2.2)
- Sample Handling and Custody (Section 2.3)
- Analytical Methods (Section 2.4)
- Quality Control (Section 2.5)
- Equipment Testing, Inspection, and Maintenance (Section 2.6)
- Instrument Calibration and Frequency (Section 2.7)
- Inspection and Acceptance of Supplies and Consumables (Section 2.8)
- Nondirect Measurements (Section 2.9)
- Data Management (Section 2.10)

2.1 SAMPLING PROCESS DESIGN

The soil samples collected from the closure confirmation sampling effort will provide information for the primary objective to obtain closure for IWTP 360 as well as the secondary objectives to (1) further define the lateral and vertical extent of contamination in soil and groundwater in the vicinity of IWTP 360, and (2) evaluate whether soil or groundwater contamination occurred as a result of possible leaks from the underground pipelines. The following sections present the proposed sample locations and planned chemical analyses. Section 2.1 also includes information on surveying sampling locations and locating underground utilities.

A minimum of five working day notice will be provided to DTSC prior to commencing any field activities. DTSC may request collection of field duplicate (split) samples for soil and groundwater at IWTP 360 at their discretion.

2.1.1 Investigation of Soil and Groundwater in the Vicinity of IWTP 360

A total of four soil and groundwater sample locations were selected in the vicinity of IWTP 360: one soil sampling location, two groundwater sampling locations, and one location for both soil and groundwater sampling. Locations for soil and groundwater samples in the vicinity of IWTP 360 were selected based on historical knowledge of IWTP activities. The locations for the soil and groundwater samples, sample IDs, sample depths, and the rationale for selecting these soil and groundwater sample locations are presented in Table 7. The proposed sampling locations, which will be designated IWTP360-DP01 through IWTP360-DP04, are shown on Figure 4. Samples for chemical analysis will be submitted to California state-certified laboratories that have been approved by the Navy. Table 8 summarizes the proposed analytical suite for the environmental, and QC samples for this project.

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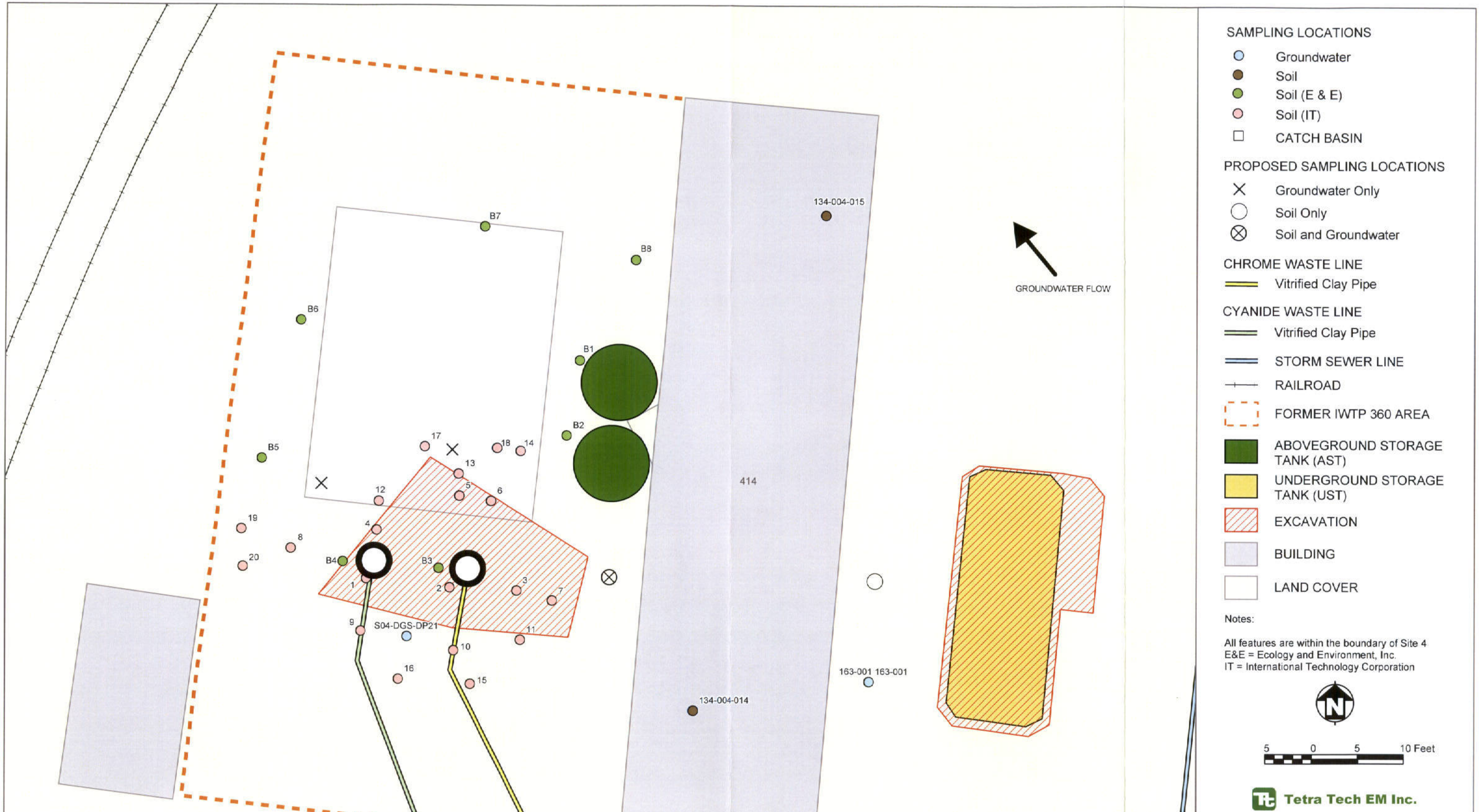

Alameda Point
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 4
PROPOSED SAMPLING LOCATIONS IN THE VICINITY OF IWTP 360

Closure Confirmation Sampling
Industrial Waste Treatment Plant 360

1/13/2004 U:\almda_sa\do033\iwtp360_closure_confirmation\mxd\fig04_proposed_samples.mxd TtEMI-SA TPM

TABLE 7: PROPOSED SOIL AND WATER SAMPLES, RATIONALE, AND ANALYSES

IWTP Closure confirmation sampling, Naval Air Station Alameda

Location Name	Total Depth (feet bgs)	Analyses	Sample ID	Matrix	Sample Depth (feet bgs)	Rationale
IWTP360-DP01-SO-2	2.0	Metals (cadmium, chromium [hexavalent and total], copper, lead, nickel, and silver)	033-IWTP360-001	Soil	1.5 to 2.0	Collect soil and groundwater samples to define the lateral and vertical extent of contamination in soil and groundwater
IWTP360-DP01-SO-8	8.0	Same as above	033-IWTP360-002	Soil	7.5 to 8.0(1)	Same as above.
IWTP360-DP02-SO-2	2.0	Same as above	033-IWTP360-003	Soil	1.5 to 2.0	Same as above.
IWTP360-DP02-SO-8	8.0	Same as above	033-IWTP360-004	Soil	7.5 to 8.0(1)	Same as above.
IWTP360-DP02-GW-7	7.0	Same as above	033-IWTP360-005	Water	7.0	Same as above.
IWTP360-DP02-GW-12	12.0	Same as above	033-IWTP360-006	Water	12.0	Same as above.
IWTP360-DP03-GW-7	7.0	Same as above	033-IWTP360-007	Water	7.0	Same as above.
IWTP360-DP03-GW-12	12.0	Same as above	033-IWTP360-008	Water	12.0	Same as above.
IWTP360-DP04-GW-7	7.0	Same as above	033-IWTP360-009	Water	7.0	Same as above.
IWTP360-DP04-GW-12	12.0	Same as above	033-IWTP360-010	Water	12.0	Same as above.
IWTP360-DP04-GW-7D	7.0	Same as above	033-IWTP360-011	Water	7.0	Field duplicate.
IWTP360-VE01-SO-3	3.0	Same as above	033-IWTP360-012	Soil	3.0	Collect soil and groundwater samples to evaluate whether contamination occurred as a result of possible leaks from the underground pipelines
IWTP360-VE01-SO-5	5.0	Same as above	033-IWTP360-013	Soil	5.0	Same as above.
IWTP360-VE01-GW-6	6.0	Same as above	033-IWTP360-014	Water	6.0	Same as above.
IWTP360-VE02-SO-3	3.0	Same as above	033-IWTP360-015	Soil	3.0	Same as above.
IWTP360-VE02-SO-5	5.0	Same as above	033-IWTP360-016	Soil	5.0	Same as above.
IWTP360-VE02-GW-6	6.0	Same as above	033-IWTP360-017	Water	6.0	Same as above.
IWTP360-VE03-SO-3	3.0	Same as above	033-IWTP360-018	Soil	3.0	Same as above.
IWTP360-VE03-SO-5	5.0	Same as above	033-IWTP360-019	Soil	5.0	Same as above.
IWTP360-VE03-GW-6	6.0	Same as above	033-IWTP360-020	Water	6.0	Same as above.

TABLE 7: PROPOSED SOIL SAMPLES, RATIONALE, AND ANALYSES (Continued)

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Location Name	Total Depth (feet bgs)	Analyses	Sample ID	Matrix	Sample Depth (feet bgs)	Rationale
IWTP360-VE04-SO-3	3.0	Same as above	033-IWTP360-021	Soil	3.0	Same as above.
IWTP360-VE04-SO-5	5.0	Same as above	033-IWTP360-022	Soil	5.0	Same as above.
IWTP360-VE04-GW-6	6.0	Same as above	033-IWTP360-023	Water	6.0	Same as above.
IWTP360-VE05-SO-3	3.0	Same as above	033-IWTP360-024	Soil	3.0	Same as above.
IWTP360-VE05-SO-5	5.0	Same as above	033-IWTP360-025	Soil	5.0	Same as above.
IWTP360-VE05-GW-6	6.0	Same as above	033-IWTP360-026	Water	6.0	Same as above.
IWTP360-VE06-SO-3	3.0	Same as above	033-IWTP360-027	Soil	3.0	Same as above.
IWTP360-VE06-SO-5	5.0	Same as above	033-IWTP360-028	Soil	5.0	Same as above.
IWTP360-VE06-GW-6	6.0	Same as above	033-IWTP360-029	Water	6.0	Same as above.
IWTP360-VE06-GW-6D	6.0	Same as above	033-IWTP360-030	Water	6.0	Field duplicate

Notes:

bgs Below ground surface
ID Identification
NA Not applicable
Field duplicate locations may be modified in the field based on well production.
(1) Sample depth will be from 7.5 to 8.0 feet bgs or at the groundwater interface, whichever is shallower.

TABLE 8: SUMMARY OF CLOSURE CONFIRMATION SAMPLING AND ANALYSIS

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Analytical Methods	Matrix	Field Samples	Equipment Rinsate	Source Water Blank	Field Duplicate	Total Number of Samples	MS/MD (at 5%)[a]
Environmental and QC Samples - Metals							
	Soil	16	1	NA	NA	17	2
	Water	12	1	1	2	16	2

Notes:

a Matrix spike and matrix duplicates are not considered additional samples; collect one per day of sampling
% Percent
QC Quality control
MD Matrix duplicate
MS Matrix spike

2.1.2 Investigation of Soil and Groundwater Along the Pipelines from Building 360 to IWTP 360

A total of six soil and groundwater sample locations were selected along the pipelines from Building 360 to ITWP 360. Locations for soil and groundwater samples collected along the pipelines were selected based on DTSC's request to collect samples at 25-foot intervals along the length of the pipelines and taking into account the locations of the previous samples collected along the pipelines. The locations for the soil and groundwater samples, sample IDs, sample depths, and the rationale for selecting these soil and groundwater sample locations are presented in Table 7. The proposed sampling locations, which will be designated IWTP360-VE01 through IWTP360-VE06 are shown on Figure 5. Samples for chemical analysis will be submitted to California state-certified laboratories that have been approved by the Navy. Table 8 summarizes the proposed analytical suite for the environmental, and QC samples for this project.

2.1.3 Rationale for Selecting Analytical Parameters

As stated in Section 1.0, the Navy's goal is to obtain closure of IWTP 360. Analytical parameters were therefore selected to provide information about the chemicals of concern previously identified for this area. The specific analytical parameters specified for each location were selected based on the available historical information regarding hazardous material use and the characteristics of wastes potentially disposed at the site.

The suite of analyses specified for IDW has been selected to be consistent with waste characterization required by disposal facilities.

2.1.4 Surveying

After the boreholes have been backfilled, a professional land surveyor, licensed by the State of California, will provide the elevation of each boring to a precision of 0.10 foot and its location to 0.1 foot horizontally. The elevations will be surveyed relative to the 1929 U.S. Geological Survey mean lower low water (MLLW) datum. A baseline of 100 feet will be added to the MLLW datum to remove the possibility of negative elevations to remain consistent with standard survey practices used at Alameda Point. The boring locations will be surveyed using the State Plane Coordinate System. The survey data will be merged with existing survey data in the installation database. Vertical coordinates will be reported as feet above mean sea level. All surface soil sample locations will be digitized from the map.

2.1.5 Underground Utilities Survey

An underground utilities survey will be conducted to clear all soil boring locations before any intrusive activities begin. The survey will include water distribution piping, telecommunications lines, storm sewer lines, sanitary sewer lines, industrial wastewater lines, gas lines, fire water lines, fuel product lines, and electrical lines.

2.2 SAMPLING METHODS

This section describes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of IDW.

2.2.1 Sampling Methods and Equipment

Soil and groundwater samples in the vicinity of IWTP 360 will be collected by direct-push technology using a GeoProbe rig. This rig consists of a hydraulic drive-point system operated from the rear of a truck. A pump mounted directly to the truck's transmission powers the probe unit hydraulically. Sampling equipment will be a 4-foot long stainless-steel sampler, lined with acetate, which will be advanced to the desired depth using direct push. The operation of the GeoProbe will follow general practices listed in Tetra Tech SOP No. 054 (Appendix B). The probe rod will be advanced in 4-foot increments from the surface to 8 feet bgs, where groundwater is expected, to collect the samples. The acetate sleeves will be removed from the sampler and will first be cut in 2-foot sections. Then, each section will be cut open and the soil will be placed in disposable containers, where it will be homogenized using stainless-steel or plastic tools. The sample containers will then be filled with the homogenized soil and prepared for shipment to the laboratory. A second borehole will be installed as close as possible to the first if sample material from one 2-foot interval is insufficient to fill all required containers, and all material from the target interval from both borings will be homogenized before the sample containers are filled.

Soil collected from the desired depth will be placed in a disposable mixing bowl and homogenized using stainless-steel or plastic tools; then, the required volumes will be placed in appropriate sample containers for shipment to the laboratory.

Depth-specific groundwater samples will be collected during this investigation using a direct-push probe with a screen-point (slotted) sampling tip. The direct-push probe consists of 3-foot sections of 2-inch-diameter hollow tubular steel rods connected by threads. The tip section contains a smaller diameter section of rod that is slotted to allow water to enter. A sacrificial drip point is attached to the tip section to allow for easy penetration into the soil. During advancement, the slotted sampling tip is held up into the tip section of the rod. The probe is advanced through the soil using hydraulic, vibratory, or hammer force, depending upon the resistance to penetration. In most shallow boreholes less than 10 feet in depth, hydraulic force will be used.

As the probe is advanced, additional sections of rod are screwed into place until the desired sampling depth can be reached. After the desired depth is reached, the probe is extracted about 18 inches, which pops off the sacrificial drive tip and exposes the slotted sampling tip to the water table.

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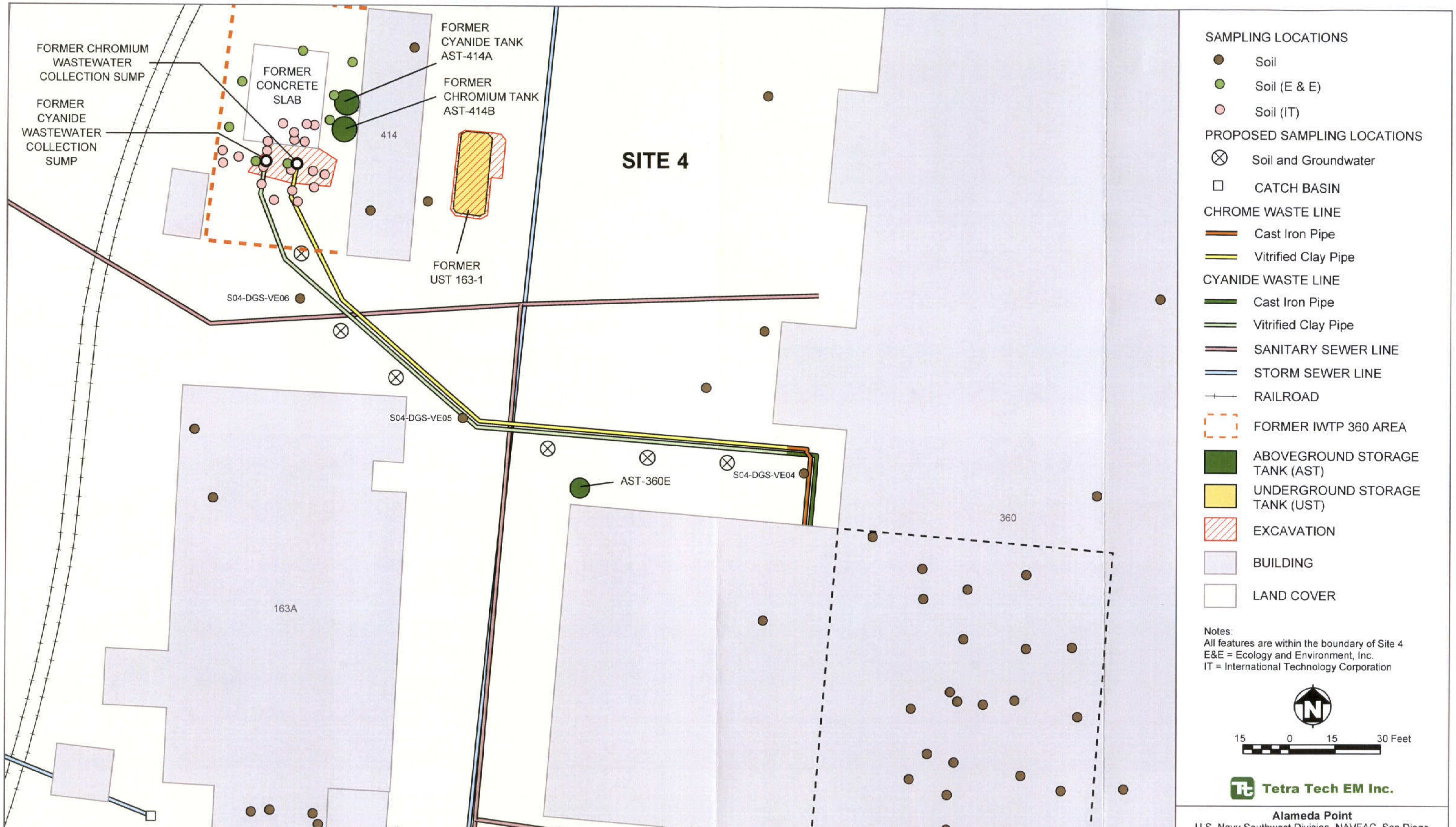

FIGURE 5
PROPOSED SAMPLING LOCATIONS ALONG PIPELINES
Closure Confirmation Sampling
Industrial Waste Treatment Plant 360

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For shallow samples, a length of disposable polyethylene tubing will be pushed down the drive rod to the bottom of the screen-point sampling head. The sample end of the tubing is then attached to a slow purge pump, such as a peristaltic pump, that will be used to slowly draw water from the desired depth, in accordance with SOP No. 015. The volume of the tubing will be purged, and sample bottles filled as appropriate. Groundwater samples will be filtered, decanted into appropriate containers for analysis for dissolved metals, and labeled.

After the groundwater sample is collected, the rods are extracted from the soil, decontaminated, and re-fitted with a clean, slotted sampling tip. The sampling probe is then readvanced through the soil to collect the next groundwater sample. If hydrogeologic conditions are such that the permeability of the aquifer is insufficient to produce the required amount of sample water, a 1-inch, temporary slotted well screen will be placed in the boring. The groundwater sample will then be collected at a later time using a small-diameter well bailer. Upon completion of sampling, the holes will be filled with grout and covered with asphalt to grade.

Vacuum excavation will be used for the collection of soil and groundwater samples along the pipelines from Building 360 to IWTP 360. Vacuum excavation can be used safely near any type of utility line. The process consists of loosening the soil within a hole by using a 100-pound-per-square-inch, high-pressure air jet and withdrawing the loosened soil with a 4-inch-diameter vacuum hose. Vacuum excavation is most effective above the water table, but can also penetrate below the water table if the excavation does not produce much water. A truck-mounted vacuum excavation rig will be used for subsurface investigations within and below utility corridors at the site.

To reduce the potential for contaminant volatilization, the vacuum excavation subcontractor will be instructed to stop excavating when the top of the wastewater pipeline is exposed. Soil samples will be collected along the side of the wastewater pipe at the targeted locations. Soil samples will be collected using a hand driven stainless-steel core sampler fitted with an internal, stainless-steel sleeve (2 by 6 inches). The stainless-steel tube sampler will be driven 6 inches into the soil at the selected depth(s) within a vacuum excavation by using an 11-pound, manual slide hammer. The sampler will then be removed from the hole, and the stainless steel sleeve containing the soil sample will be extracted, labeled, and sealed at both ends with Teflon sheet, which will be held in place by tight-fitting plastic end caps. The sampler or hand auger will be decontaminated between each sample location. The depth to the top and bottom of the wastewater pipe, and the depth to groundwater will be recorded on the soil boring log. Soil samples will be handled as described in Section 2.3.

Groundwater samples will be collected with a peristaltic pump equipped with disposable Tygon tubing. Groundwater samples will be filtered, decanted into appropriate containers for analysis for dissolved metals, and labeled. Groundwater samples collected during vacuum excavation activities will be handled as described in Section 2.3.

Waste soil and groundwater withdrawn from vacuum excavations will be temporarily stored at the IDW area in properly labeled soil bins or 55-gallon drums before transport off site for disposal. Once soil and groundwater sampling is completed, the vacuum excavations will be backfilled with imported clean fill and properly compacted using a pneumatic powered compactor. When necessary, an asphalt or concrete patch will be placed on top of the grout to match the ground surface surrounding the boring location. Vacuum excavation sample location numbers will be painted on the ground surface adjacent to each vacuum excavation for future reference.

Table 7 presents the proposed ID numbers for soil samples, depth of samples, and the rationale for each sample location.

2.2.2 Decontamination

Direct-push equipment and vacuum extraction equipment, including rods and samplers and the back end of the rig, will be steam cleaned before work begins and between installation of each soil boring. Decontamination of the equipment will follow general practices listed in Tetra Tech SOP No. 002 (Appendix B). A portable steam cleaner and an on-site source of potable water will be used for decontamination, and all water derived from decontamination will be collected and temporarily stored on site for characterization. An on-site source of potable water for the steam cleaner will be available. No other equipment will require decontamination.

2.2.3 Management of Investigation-Derived Waste

Minimal quantities of IDW will be generated during this investigation. IDW will include the remainder of homogenized soil extracted by direct-push samplers and wastewater from decontamination procedures and collection of equipment rinsate samples. The extra soil and the wastewater will be containerized in drums.

It is expected that one drum of solid IDW will be generated. One composite IDW soil sample will be obtained from this drum. The soil sample will be analyzed for VOCs, and WET metals for characterization before disposal. After the IDW soil sample is analyzed and results are received, soil cuttings will be disposed of properly.

It is expected that no more than four drums of wastewater will be generated during this investigation. One composite sample will be collected from these drums and will be sent to the laboratory for the following analyses: VOCs, and metals.

2.2.4 Sample Containers and Holding Times

The type of sample containers to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for samples before extraction and analysis are presented in Table 9. All groundwater samples will be filtered and preserved in the field.

TABLE 9: SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Parameter	Method Number	Sample Volume	Sample Container	Preservative	Holding Time
Soil					
Metals (cadmium, chromium, copper, lead, nickel, and silver)	EPA 6010B, SW-846	250 mL Jar	Clear Glass with Teflon-lined lid	Cool, 4 ± 2 °C	6 months
Metals (hexavalent chromium)	EPA 7196A, SW-846	250 mL Jar	Clear Glass with Teflon-lined lid	Cool, 4 ± 2 °C	30 days to extraction, 7 days after extraction
Water					
Dissolved Metals (cadmium, chromium, copper, lead, nickel, and silver)	EPA 6010B, SW-846	1 Liter	Polyethylene	pH < 2 with HNO_3; Cool, 4 ± 2 °C	6 months
Dissolved Metals (hexavalent chromium)	EPA 7196A, SW-846	500 mL	Polyethylene	Cool, 4 ± 2 °C	24 hours

Notes: More than one analysis can be performed from the same sample container. The sample quantities listed in the table are the quantities necessary if only the specific analysis is requested. The laboratory will indicate which of the analyses can be performed from the same container, so that a smaller quantity of sample can be collected at each depth.

Analyses for characterization of IDW samples are not included in the table.

<	Less than
±	Plus or minus
°C	Degrees Celsius
EPA	U.S. Environmental Protection Agency
mL	Milliliter
L	Liter

2.3 SAMPLE HANDLING AND CUSTODY

The sections below describe sample handling procedures, including sample ID and labeling, documentation, chain-of-custody, and shipping.

2.3.1 Sample Identification

A unique sample ID number will be assigned to each sample collected during this project. The sample ID numbering system is designed to be compatible with a computerized data management system that includes previous results for samples collected at this installation. The sample numbering system allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis. The numbering system indicates the DO and site numbers, sampling type, and the location number. The numbering scheme is illustrated below.

DO	033
Site	IWTP360
Specific Sample Location	Specific sample locations will be numbered consecutively for each specific sampling activity

For example, the soil sample collected by GeoProbe under DO 033 at IWTP 360 at the first location will be designated 033-IWTP360-001.

Field QC samples for this investigation are limited to equipment rinsates and source water blanks. One source water blank will be necessary for each source of water used at the site. Because the only means of decontamination will be steam cleaning (all other sampling equipment will be disposable), one blank will be collected from the on-site water source that will be used during the event. This blank will be designated the consecutive sample ID at the time it is collected. One equipment rinsate sample per day will be required from the GeoProbe and vacuum extraction sampling equipment. The ID for these samples will again be the consecutive sample IDs at the time of collection.

Additional volume may be required for matrix spike/matrix spike duplicate analysis by the laboratory. No special requirements for nomenclature apply to these samples.

2.3.2 Sample Labels

A sample label will be affixed to all sample containers. The label will be completed with the following information written in indelible ink:

- Project name and location
- Sample ID number
- Date and time of sample collection

- Preservative used
- Sample collector's initials
- Analysis required

After it is labeled, each soil sample will be refrigerated or placed in a cooler that contains ice to maintain the sample temperature at 4 ± 2 °C.

2.3.3 Sample Documentation

Documentation during sampling is essential to ensure proper sample ID. Tetra Tech personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.
- Any serialized documents will be maintained at Tetra Tech and referenced in the site logbook.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

Section 1.6.1 includes additional information on how Tetra Tech will use logbooks to document field activities. The Tetra Tech field team leader (FTL) is responsible for ensuring that sampling activities are properly documented.

2.3.4 Chain of Custody

Tetra Tech will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record (Appendix C) also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample ID number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory chain of custody begins when samples are received and continues until samples are discarded. Laboratories analyzing samples under the AECRU contract must follow custody procedures at least as stringent as are required by the EPA CLP SOWs (EPA 1999a, 2000a). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons delivering the samples, the date and time received, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample ID numbers, and any unique laboratory ID numbers for the samples. This information should be entered into a computerized LIMS. When the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples requiring special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained before analysis.

2.3.5 Sample Shipment

The following procedures (also outlined in SOP No. 19) will be implemented when samples collected during this project are shipped:

- The cooler will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment. Enough ice will be added to maintain the sample temperature of below 4 ± 2 °C.
- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, it will be taped shut both inside and outside of the cooler.
- Signed and dated custody seals will be placed on the front and side of each cooler. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The chain-of-custody record will be transported within the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the chain-of-custody record to document transfer of samples.

Multiple coolers may be sent in one shipment to the laboratory. The outside of the coolers will be marked to indicate the number of coolers in the shipment.

2.4 ANALYTICAL METHODS

Table 9 presents the analytical methods that will be used to analyze samples collected during this project, and Appendix A presents the MQOs and control limits for sample analysis. Table D-1 in Appendix D presents the individual target analytes for this investigation and their associated PRRLs. The analytical laboratories will attempt to achieve the PRRLs for all the investigative samples collected. If problems occur in achieving the PRRLs, the laboratories will contact the Tetra Tech analytical coordinator immediately and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing nontarget compound peaks to go off scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the MDL will be reported with appropriate flags to indicate the greater uncertainty associated with these values.

The analytical methods required for this investigation are all EPA SW-846 methods (EPA 1996). Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are presented in the following sections.

2.4.1 Selection of Analytical Laboratories

Laboratories for this investigation will be selected from a list of prequalified laboratories developed by Tetra Tech to support Navy contracts. Prequalification streamlines laboratory selection by reducing the need to compile and review detailed bid and qualification packages for each individual investigation. Prequalification also improves flexibility in the program by allowing analyses to be directed to a number of different capable laboratories with available capacity at the time samples are collected.

Tetra Tech's laboratory prequalification and selection process relies on (1) a standard procedure to evaluate and prequalify laboratories for work under the contract, and (2) the "Tetra Tech EM Inc. Laboratory Analytical Statement of Work" for Navy contracts (Tetra Tech 2002a), a contractual document that specifies standard requirements for analyses that are routinely conducted. Tetra Tech establishes a basic ordering agreement that incorporates and enforces the laboratory SOW with each prequalified laboratory. Individual purchase orders can then be written for specific investigations. These aspects of laboratory selection are further described in the following sections, along with Tetra Tech's procedures for selecting laboratories when the laboratory SOW does not specifically address project-specific analytical methods or QC requirements.

2.4.1.1 Laboratory Evaluation and Prequalification

Laboratories that support the Navy either directly or through subcontracts are evaluated and approved for Navy use by the Naval Facilities Engineering Service Center (NFESC). Laboratories that support Tetra Tech under Navy contracts have been selected from the list of laboratories approved by NFESC and evaluated by Tetra Tech to assure that the laboratory can meet the technical requirements of the laboratory SOW and produce data of acceptable quality.

The evaluation of the laboratories is conducted in accordance with the NFESC *Installation Restoration Chemical Data Quality Manual* (NFESC 1999). The laboratory evaluation includes the following elements:

- **Certification and approval.** Laboratories must be currently certified by the DHS Environmental Laboratory Accreditation Program (ELAP) for analysis of hazardous materials for each method specified. Laboratories must also have or obtain similar approval from NFESC. The California DHS ELAP certification and NFESC approval must be obtained before the laboratory begins work.

- **Performance evaluation (PE) samples.** Each laboratory must initially and yearly demonstrate its ability to satisfactorily analyze single-blind PE samples for all analytical services it will provide under Navy contracts. At its discretion, Tetra Tech may submit one or more double-blind PE samples at Tetra Tech's cost. When the results for the PE sample are deficient, the laboratory must correct any problems and analyze (at its own cost) a subsequent round of PE samples for the deficient analysis.

- **Audits.** Laboratories must initially and yearly demonstrate their qualifications by submitting to one or more audits by Tetra Tech. The audits may consist of (1) an on-site review of laboratory facilities, personnel, documentation, and procedures, or (2) an off-site review of hard copy and electronic deliverables, or magnetic tapes. When deficiencies are identified, the laboratory must correct the problem and provide Tetra Tech with a written summary of the corrective action that was taken.

Appendix E provides a current list of subcontractor laboratories that have passed this evaluation program. Each laboratory was evaluated before it was added to the list, and each is reevaluated annually. If a laboratory fails to meet any of the evaluation criteria, it is removed from the list of approved laboratories.

2.4.1.2 Laboratory Statement of Work

The laboratory SOW establishes standard requirements for the analytical methods that are most commonly used under Navy contracts. For each method, the laboratory SOW specifies (1) standard method-specific target analyte lists and PRRLs, (2) QC samples and associated control limits, (3) calibration requirements, and (4) miscellaneous method performance requirements. The laboratory SOW also specifies standard data package requirements, electronic data deliverable formats, data qualifiers, and delivery schedules. In addition, the laboratory SOW outlines support services (such as providing sample containers, trip blanks, temperature blanks, sample coolers, and custody forms and seals) that are expected of laboratories. The laboratory SOW incorporates Navy QA policy, as well as applicable EPA and state QA guidelines, as appropriate.

Tetra Tech's laboratory SOW is based on EPA CLP methods for VOCs, semivolatile organic compounds, pesticides, polychlorinated biphenyls, metals, and cyanide. The laboratory SOW also addresses frequently used non-CLP methods for a variety of organic, inorganic, and physical parameters. Non-CLP methods include (1) the methods published by EPA in SW-846 and in "Methods for Chemical Analysis of Water and Waste" (MCAWW); (2) American Society for Testing and Materials (ASTM) methods; and (3) those published by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation in "Standard Methods for the Examination of Water and Waste Water." Laboratories on Tetra Tech's approved laboratory list can elect to provide all or a portion of the analytical services specified in the laboratory SOW.

As noted above, the laboratory SOW is incorporated into all laboratory subcontracts established for analytical services supporting Navy projects. Thus, the prequalified laboratories commit to meeting the requirements in the laboratory SOW during the contracting process before they receive samples. Tetra Tech reviews and revises the laboratory SOW regularly to incorporate new methods and requirements, modifications or updates to existing methods, changes in Navy QA policy or regulatory requirements, and any other necessary corrections or revisions.

2.4.1.3 Laboratory Selection and Oversight

After project-specific analytical and QA/QC requirements have been identified and documented in the SAP, the Tetra Tech analytical coordinator works closely with a Tetra Tech procurement specialist to select a laboratory that can meet these requirements. When project-specific analytical and QC requirements are consistent with Tetra Tech's laboratory SOW, the analytical coordinator identifies one or more prequalified subcontractor laboratories that are capable of carrying out the work. As part of this process, the analytical coordinator typically contacts the laboratories to discuss the analytical requirements and project schedule. The analytical coordinator then forwards the name of the recommended laboratory (or laboratories) to the Tetra Tech procurement specialist, who issues a purchase order for the work. When analytical requirements are consistent with Tetra Tech's laboratory SOW and multiple prequalified laboratories are capable of performing the work, a specific laboratory is typically selected based on laboratory workload and project schedule considerations.

Tetra Tech follows a similar procedure when project-specific analytical and QC requirements are nonstandard and differ from those specified in Tetra Tech's laboratory SOW. The analytical coordinator contacts analytical laboratories, beginning with those on Tetra Tech's prequalified list, to discuss the analytical and QA/QC requirements in the SAP and to assess the laboratories' ability to meet the requirements. In many cases, Tetra Tech works cooperatively with analytical laboratories to develop and refine appropriate QC requirements for nonstandard analyses or matrixes.

If the analytical coordinator is unable to identify one or more prequalified laboratories that can perform the work, additional laboratories are contacted. In general, the additional laboratories must be evaluated as described in Section 2.4.1.1 before they will be allowed to analyze any samples. However, some steps in the evaluation may be waived for certain investigations and circumstances (for example, unusual analytes, urgent project needs, experimental methods, mobile laboratories, or on-site screening analyses). After additional laboratories have been identified, the analytical coordinator forwards their names to the procurement specialist. The procurement specialist prepares a solicitation package, including the project-specific analytical and QC requirements, and submits the package to the laboratories. The procurement specialist, in cooperation with the analytical coordinator and project manager, then evaluates the proposals that are received and selects a laboratory that meets the requirements and provides the best value to the Navy and Tetra Tech. Finally, the procurement specialist issues a purchase order to the selected laboratory that incorporates the project-specific analytical and QA/QC requirements.

After a laboratory has been selected, the analytical coordinator holds a kickoff meeting with the laboratory project manager. The kickoff meeting is held regardless of whether project-specific analytical and QA/QC requirements are consistent with Tetra Tech's laboratory SOW or are outside the SOW. The Tetra Tech project manager, procurement specialist, and other key project and laboratory staff may also be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

2.4.2 Project Analytical Requirements

For this investigation, one or more prequalified subcontractor laboratories will analyze samples of soil and water off site. The laboratories will be selected before the field program begins based on their ability to meet the project analytical and QC requirements, as well as their ability to meet the project schedule. The analytical methods selected for the closure confirmation sampling investigation at IWTP 360 at Alameda Point are standard EPA methods that are described in Tetra Tech's laboratory SOW. All methods are listed in Table 9 and are from EPA's SW-846 "Test Methods for Evaluating Solid Waste" (EPA 1996).

This SAP documents project-specific QC requirements for the selected analytical methods. Sample volume, preservation, and holding time requirements are specified in Table 9. Requirements for laboratory QC samples are described in Table 4 and in Section 2.5. Appendix A includes project-specific precision and accuracy goals for the methods. Finally, PRRLs for each method are documented in Appendix D.

2.5 QUALITY CONTROL

Tetra Tech will assess the quality of field data through regular collection and analysis of field QC samples. Laboratory QC samples will also be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures are conducted properly and that the quality of the data is known.

2.5.1 Field Quality Control Samples

QC samples are collected in the field and analyzed to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purposes of field QC samples that will be collected for this project. Table 10 provides a summary of the types and frequency of collection of field QC samples.

TABLE 10: FIELD QC SAMPLES
IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Sample Type	Frequency of Analysis	Matrix
Matrix spike and matrix duplicate	5 percent[a]	Water
Field duplicate	10 percent but not less than 1 per sample technique (direct-push and vacuum extraction)	Water
Equipment rinsate	1 per day per team per type of reusable sampling tool used	Water
Source water blank	1 per each water source used for decontamination	Water

Notes:

a MS and MD will be selected by the laboratory.

2.5.1.1 Field Duplicates

Field duplicate samples are collected at the same time and from the same source and then submitted as separate samples to the laboratory for analysis. Although field duplicate soil samples are sometimes collected as soil samples from adjacent locations, duplicate samples for soil will not be collected for this project for two reasons. First, because adjacent soil samples incorporate some spatial variability, these samples cannot be used directly to assess sampling precision. Furthermore, it is not practical to set QC limits for the RPD of these samples, which precludes their use for QC purposes. Second, while the information on spatial variability that can be obtained from adjacent soil samples may be useful in assessing or implementing remedial options, no objectives relating to these data uses have been identified for this project. Rather, it has been determined that this type of information on spatial variability will be obtained during subsequent investigations at this site, if deemed necessary.

Water, however, is generally a more uniform mixture and field duplicates to be collected for water samples will be used to evaluate the precision of the sampling method. A field duplicate water sample is collected at the same time and from the same source as the original sample, but is submitted to the laboratory as a separate sample to assess the consistency of the overall sampling and analytical system. Field duplicates will be collected for 10 percent of the groundwater samples but not less than at least one duplicate per sampling technique (direct push and vacuum extraction). Field duplicate samples will be collected, numbered, packaged, and sealed in the same manner as other samples and submitted blind to the laboratories.

2.5.1.2 Equipment Rinsate Samples

Equipment rinsate samples will be collected during soil sampling at a frequency of once per day of sampling per team per type of tool used. An equipment rinsate is a sample collected after a sampling device is subjected to standard decontamination procedures. Water will be poured over or through the sampling equipment into a sample container and sent to the laboratory for analysis. Analytically certified, organic-free water or equivalent will be used for organic parameters; deionized or distilled water will be used for inorganic parameters.

During data validation, the results for the equipment rinsate samples will be used to qualify data or to evaluate the levels of analytes in the field samples collected on the same day.

2.5.1.3 Source Water Blank Samples

One source water blank will be collected for each sampling event and for each source of water (distilled, deionized, or from an industrial or residential water source). For the closure confirmation sampling at IWTP 360, only one source water blank will be needed, as the only equipment decontaminated will be steam cleaned.

2.5.2 Laboratory Quality Control Samples

The types of laboratory QC samples that will be used for this project are discussed in the following sections. Table 4 presents the required frequencies for laboratory QC samples, and Appendix A presents project-specific precision and accuracy goals for these samples.

2.5.2.1 Method Blanks

Method blanks will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

2.5.2.2 Matrix Spike and Matrix Duplicates

MS/MD samples for water matrices require collection of an additional volume of material for laboratory spiking and analysis; for soil matrices, additional sample volume is generally not required. MS/MD samples will be collected at a frequency of 5 percent for soil. The percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. The RPD between duplicate samples will be calculated to evaluate precision. Project-specific precision and accuracy goals are presented in Appendix A.

2.5.2.3 Laboratory Control Samples

LCSs, or blank spikes, will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to gauge the usability of the data.

2.5.3 Additional Laboratory Quality Control Procedures

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed in the following sections.

2.5.3.1 Method Detection Limit Studies

The MDL is the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL takes into account sample matrix and preparation. The subcontractor laboratory will demonstrate the MDLs for all analyses except physical properties test methods.

MDL studies will be conducted annually for soil and water matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than required quantitation limits.

The replicates will be extracted and analyzed in the same manner as routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

2.5.3.2 Sample Quantitation Limits

Sample quantitation limits (SQL), also referred to as practical quantitation limits, are PRRLs adjusted for the characteristics of individual samples. The PRRLs presented in Appendix D are chemical-specific levels that a laboratory should be able to routinely detect and quantitate in a given sample matrix. The PRRL is usually defined in the analytical method or in laboratory method documentation. The SQL takes into account changes in the preparation and analytical methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

2.5.3.3 Control Charts

Control charts document data quality in graphic form for specific method parameters such as surrogate standards and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in determining whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Although they are not required, Tetra Tech recommends that subcontractor laboratories maintain control charts for organic and inorganic analyses. At a minimum, method-blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Blank spike recoveries should be charted for inorganic methods. Control charts should be updated monthly.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual, or (2) SOPs that describe equipment operation associated with particular applications of the instrument. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The field team leader will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. When the condition of equipment is suspect, unscheduled testing, inspection, and maintenance should be conducted. Any significant problems with field equipment will be reported in the daily field QC report.

A GeoProbe will be used to collect soil and groundwater samples during the closure confirmation sampling at IWTP 360. The GeoProbe subcontractor will be required to provide detailed written procedures for inspecting, maintaining, and servicing field equipment that will be available on site. At a minimum, these procedures should address standard GeoProbe maintenance outlined in Tetra Tech SOP No. 054 (Appendix B).

Vacuum extraction will be used to collect soil and groundwater samples during the closure confirmation sampling along the pipelines from Building 360 to IWTP 360. The vacuum extraction subcontractor will be required to provide detailed written procedures for inspecting, maintaining, and servicing field equipment that will be available on site.

2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected for this project. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance performed, and procedures for documenting maintenance activities.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

The following sections discuss calibration procedures that will be followed to ensure the accuracy of measurements made using field and laboratory equipment.

2.7.1 Calibration of Field Equipment

Field equipment, if used, will be calibrated at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Detailed calibration procedures for field equipment are available from the specific manufacturers' instruction manuals, and general guidelines are included in Tetra Tech SOPs. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of ID is not feasible, equipment calibration records will be readily available for reference.

Tetra Tech does not plan to use any field equipment that requires calibration during the closure confirmation sampling at IWTP 360.

2.7.2 Calibration of Laboratory Equipment

Procedures and frequencies for calibration of laboratory equipment will follow the requirements in the methods referenced in Section 2.4.2 of this SAP. Qualified analysts will calibrate laboratory equipment and document the procedures and results in a logbook.

The laboratory will obtain calibration standards from commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate standards and other inorganic mixes will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation on receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

2.8 Inspection and Acceptance of Supplies and Consumables

Tetra Tech project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete Navy projects and are responsible for determining acceptance criteria for these items.

Supplies and consumables can be received either at a Tetra Tech office or at a work site. When supplies are received at an office, the project manager or field team leader will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. When supplies are received, the Tetra Tech project manager or field team leader will inspect all items against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers" (EPA 1992).

2.9 NONDIRECT MEASUREMENTS

No data for project implementation or decision-making will be obtained from nondirect measurement sources.

2.10 DATA MANAGEMENT

Field and analytical data collected from this project and other environmental investigations at Alameda Pont are critical to site characterization efforts, development of the comprehensive conceptual site model, risk assessments, and selection of remedial actions to protect human health and the environment. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into Tetra Tech's database for Alameda Point. The database contains data for (1) summarizing observations on contamination and geologic conditions, (2) preparing reports and graphics, (3) using with geographic information systems (GIS), and (4) transmitting in an electronic format compatible with NEDTS. The following sections describe Tetra Tech's data tracking procedures, data pathways, and overall data management strategy for Alameda Point.

2.10.1 Data Tracking Procedures

All data that are generated in support of the Navy program at Alameda Point are tracked through a database created by Tetra Tech. Information related to the receipt and delivery of samples, project order fulfillment, and invoicing for laboratory and validation tasks is stored in the Tetra Tech program, SAMTRAK. All data are filed according to the document control number.

2.10.2 Data Pathways

Data are generated from three primary pathways at Alameda Point—data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into the Alameda Point database. Data pathways must be established and well documented to evaluate whether the data have been accurately loaded into the database in a timely manner.

Data generated during field activities are recorded using field forms (Appendix C). The analytical coordinator or field team leader reviews these forms for completeness and accuracy. Data from the field forms, including the chain-of-custody form, are entered into SAMTRAK according to the document control number.

Data generated during laboratory analysis are recorded in hard copy and in EDDs after the samples have been analyzed. The laboratory will send the hard copy and EDD records to the analytical coordinator. The analytical coordinator reviews the data deliverable for completeness, accuracy, and format. After the format has been approved, the electronic data are manipulated and downloaded into the Alameda Point database. Tetra Tech data entry personnel will then update SAMTRAK with the total number of samples received and number of days required to receive the data.

After validation, the analytical coordinator reviews the data for accuracy. Tetra Tech will then update the Alameda Point database with the appropriate data qualifiers. SAMTRAK is also updated to record associated laboratory and data validation costs.

2.10.3 Data Management Strategy

Tetra Tech's short- and mid-term data management strategies require that the database for Alameda Point be updated monthly. The data consist of chemical and field data from Navy contractors, entered into an Oracle (Version 7.3) database. The database can be used to generate reports using available computer-aided drafting and design and contouring software. All electronic data from this database will be managed in a manner consistent with SWDIV environmental work instruction (EWI) #6.

To satisfy long-term data management goals, the data will be loaded into the database at Tetra Tech for storage, further manipulation, and retrieval after laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired from field activities are recorded on field forms (Appendix C) that are reviewed for completeness and accuracy by the analytical coordinator or field team leader. Hard copies of forms, data, and chain-of-custody forms are filed in a secure storage area according to project and document control numbers. Laboratory data packages and reports will be archived at Tetra Tech or Navy offices. Laboratories that generated the data will archive hard-copy data for a minimum of 10 years.

3.0 ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project. It also details the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to Tetra Tech and Navy management.

3.1 ASSESSMENT AND RESPONSE ACTIONS

Tetra Tech and the Navy will oversee collection of environmental data using the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed, Tetra Tech and Navy responsibilities for conducting the assessments, and corrective action procedures to address problems identified during an assessment.

3.1.1 Field Assessments

Tetra Tech conducts field technical systems audits (TSA) on selected Navy projects to support data quality and encourage continuous improvement in the field systems that involve environmental data collection. The Tetra Tech QA program manager selects projects for field TSAs quarterly based on available resources and the relative significance of the field sampling effort. During the field TSA, the assessor will use personnel interviews, direct observations, and reviews of project-specific documentation to evaluate and document whether procedures specified in the approved SAP are being implemented. Specific items that may be observed during the TSA include the following:

- Availability of approved project plans such as the SAP and health and safety plan
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Sampling equipment decontamination
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)

During the TSA, the Tetra Tech assessor will verbally communicate any significant deficiencies to the FTL for immediate correction. These and all other observations and comments will also be documented in a TSA report. The TSA report will be issued to the Tetra Tech project manager, FTL, program QA manager, and project QA officer in electronic (e-mail) format within 7 days after the TSA is completed.

The Tetra Tech program QA manager determines the timing and duration of TSAs. Generally, TSAs are conducted early in the project so that any quality issues can be resolved before large amounts of data are collected.

The Navy QA officer may also independently conduct a field assessment of any Tetra Tech project. Items reviewed by the Navy QA officer during a field assessment may be similar to those described above.

3.1.2 Laboratory Assessments

As described in Section 2.4.1, NFESC assesses all laboratories before they are allowed to analyze samples under Navy contracts. Tetra Tech also conducts a preaward assessment of each laboratory before they are placed on the approved list for performing work under the AECRU contract (Appendix E). These assessments include (1) reviews of laboratory certifications, (2) initial and annual demonstrations of the laboratory's ability to satisfactorily analyze single-blind PE samples, and (3) laboratory audits. Laboratory audits may consist of an on-site review of laboratory facilities, personnel, documentation, and procedures, or an off-site evaluation of the ability of the laboratory's data management system to meet contract requirements. Tetra Tech also conducts an assessment when an approved laboratory has been selected for nonroutine analyses or when a laboratory that is not on the approved list must be used.

Tetra Tech will conduct a TSA of the selected laboratory for this project after the laboratory receives and begins processing samples. The purpose of this TSA will be to review the project-specific implementation of the methods specified in this SAP and to ensure that appropriate QC procedures are being implemented in association with these methods.

The Navy may audit any laboratory that will analyze samples on this project. The Navy QA officer will determine the need for these audits, and typically will conduct the audits before samples are submitted to the laboratory for analysis.

3.1.3 Assessment Responsibilities

Tetra Tech personnel who conduct assessments will be independent of the activity evaluated. The Tetra Tech program QA manager will select the appropriate personnel to conduct each assessment and will assign them responsibilities and deadlines for completing the assessment. These personnel may include the program QA manager, project QA officer, or senior technical staff with relevant expertise and experience in assessment.

When an assessment is planned, the Tetra Tech program QA manager selects a lead assessor who is responsible for the following:

- Selecting and preparing the assessment team
- Preparing an assessment plan
- Coordinating and scheduling the assessment with the project team, subcontractor, or other organization being evaluated

- Participating in the assessment
- Coordinating preparation and issuance of assessment reports and corrective action request forms
- Evaluating responses and resulting corrective actions

After a TSA is completed, the lead assessor will submit an audit report to the Tetra Tech program QA manger, project manager, and project QA officer; other personnel may be included in the distribution as appropriate. Assessment findings will also be included in the QC summary report for the project (Section 3.2.3).

The Navy QA officer is responsible for coordinating all audits that may be conducted by Navy personnel under this project. Audit preparation, completion, and reporting responsibilities for Navy auditors would be similar to those described above.

3.1.4 Field Corrective Action Procedures

Field corrective action procedures will depend on the type and severity of the finding. Tetra Tech classifies assessment findings as either deficiencies or observations. Deficiencies are findings that may have a significant impact on data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

As described in Section 3.1.1, project teams are required to respond to deficiencies identified in TSA reports. The project manager, FTL, and project QA officer will discuss the deficiencies and the appropriate steps to resolve each deficiency by:

- Determining when and how the problem developed
- Assigning responsibility for problem investigation and documentation
- Selecting the corrective action to eliminate the problem
- Developing a schedule for completing the corrective action
- Assigning responsibility for implementing the corrective action
- Documenting and verifying that the corrective action has eliminated the problem
- Notifying the Navy of the problem and the corrective action taken

In responding to the TSA report, the project team will include a brief description of each deficiency, the proposed corrective action, the individual responsible for determining and implementing the corrective action, and the completion dates for each corrective action. The project QA officer will use a status report to monitor all corrective actions.

The Tetra Tech program QA manager is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. The program QA manager can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The program QA manager can also request the reanalysis of any or all samples and a review of all data acquired since the system was last in control.

3.1.5 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded. The laboratory will report out-of-control situations to the Tetra Tech analytical coordinator within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the Tetra Tech analytical coordinator. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify the situation.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection requires (1) timely assessment and review of all activities, and (2) open communication, interaction, and feedback among all project participants. Tetra Tech will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.

3.2.1 Daily Progress Reports

Tetra Tech will prepare a daily progress report to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used, Tetra Tech and subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The daily progress report is prepared by the field team leader and submitted to the project manager and to the Navy remedial project manager (RPM), if requested. The content of the daily reports will be summarized and included in the final report submitted for the field investigation.

3.2.2 Project Monthly Status Report

The Tetra Tech project manager will prepare a monthly status report (MSR) to be submitted to the Tetra Tech's program manager and the Navy RPM. Monthly status reports address project-specific quality issues and facilitate their timely communication. The MSR will include the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

If appropriate, Tetra Tech will obtain similar information from subcontractors who are participating in the project and will incorporate the information within the MSR.

3.2.3 Quality Control Summary Report

Tetra Tech will prepare a QC summary that will be included in the final report for the field investigation report. The QC summary will include a summary and evaluation of QA/QC activities, including any field or laboratory assessments, completed during the investigation. The QC summary will also indicate the location and duration of storage for the complete data packages. Particular emphasis will be placed on determining whether project DQOs were met and whether data are of adequate quality to support required decisions.

4.0 DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs and MQOs for the project.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining defensible data of acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called "outliers." A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

4.1.3 Laboratory Data Validation

An independent third-party contractor will validate all laboratory data (except IDW data) in accordance with current EPA national functional guidelines (EPA 1994, 1999c). The data validation strategy will be consistent with Navy guidelines. For this project, 80 percent of the data for contaminants of concern will undergo cursory validation and 20 percent of the data for contaminants of concern will undergo full validation. Requirements for cursory and full validation are listed below.

4.1.3.1 Cursory Data Validation

Cursory validation will be completed on 80 percent of the summary data packages for analysis of contaminants of concern. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data.

4.1.3.2 Full Data Validation

Full validation will be completed on 20 percent of the full data packages for analysis of contaminants of concern. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. Data summary packages will consist of sample results, QC summaries, and all raw data associated with the sample results and QC summaries.

4.1.3.3 Data Validation Criteria

Table 11 lists the QC criteria that will be reviewed for both cursory and full data validation. The data validation criteria selected from Table 11 will be consistent with the project-specific analytical methods referenced in Section 2.4 of the SAP.

4.2 RECONCILIATION WITH USER REQUIREMENTS

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met.

To the extent possible, Tetra Tech will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis" (EPA 2000c). The DQA process includes five steps: (1) review the DQOs and sampling design, (2) conduct a preliminary data review, (3) select a statistical test, (4) verify the assumptions of the statistical test, and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative, Tetra Tech will systematically assess data quality and data usability. This assessment will include the following:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives

- A review of project-specific data quality indicators for PARCC and quantitation limits (defined in Section 1.3.2) to determine whether acceptance criteria have been met

- A review of project-specific DQOs to determine whether they have been achieved by the data collected

- An evaluation of any limitations associated with the decisions to be made based on the data collected; for example, if data completeness is only 90 percent compared with a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence

- The final report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

TABLE 11: DATA VALIDATION CRITERIA

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Analytical Parameter Group	Cursory Data Validation Criteria	Full Data Validation Criteria
Non-CLP Inorganic Analyses	Method compliance Holding times Calibration Blanks Matrix spike recovery Matrix duplicate precision Laboratory control sample or blank spike Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Matrix spike recovery Matrix duplicate precision Laboratory control sample Field duplicate sample analysis Other laboratory QC specified by the method Detection limits Analyte identification Analyte quantitation Sample results verification Overall assessment of data for an SDG

Notes:

CLP Contract Laboratory Program
QC Quality control
SDG Sample delivery group

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APPENDIX A
METHOD PRECISION AND ACCURACY GOALS

TABLE A-1: Method Precision and Accuracy Goals

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

	Water		Soil	
Analyses	% Recovery	RPD	% Recovery	RPD
Metals - Method 6010B, SW-846[a]				
Cadmium, chromium, copper, lead, nickel, and silver	80-120	20	80-120	20
Hexavalent Chromium – Method 7199				
Hexavalent Chromium	75-125	25	NA	NA
Hexavalent Chromium – Method 7196A				
Hexavalent Chromium	NA	NA	75-125	25

Notes:

a Complete EPA Method references are provided in Section 2.4 of this SAP.

% Percent
EPA U.S. Environmental Protection Agency
RPD Relative percent difference

APPENDIX B
STANDARD OPERATING PROCEDURES

SOP 002	General Equipment Decontamination (5 pages)
SOP 015	Groundwater Sample Collection Using Micropurge Technology (8 pages)
SOP 019	Packaging and Shipping Samples (15 pages)
SOP 054	Using the Geoprobe System (49 pages)

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 2

Last Reviewed: December 1999

Quality Assurance Approved	*February 2, 1993* Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap

1.4 REFERENCES

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1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles

- Alconox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, and general sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off-site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums.

Personnel decontamination procedures will be as follows:

1. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

2. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

3. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

4. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

5. Remove disposable gloves and place them in plastic bag for disposal.

6. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on-site before drilling operations begin, between borings, and at completion of the project.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting.

The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket using a stiff, long bristle brush and Liquinox or Alconox solution.

2. Steam clean the sampling equipment over the rinsate tub and allow to air dry.

3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.

4. Containerize all water and rinsate.

5. Decontaminate all pipe placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Wipe the sounding cable with a disposable soap-impregnated cloth or paper towel.
2. Rinse with deionized organic-free water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (methanol or hexane) rinse, if applicable or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (methanol or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLE COLLECTION USING MICROPURGE TECHNOLOGY

SOP NO. 015

REVISION NO. 0

Last Reviewed: January 2000

RRiesing

Quality Assurance Approved

April 7, 1998

Date

1.0 BACKGROUND

Groundwater sample collection is an integral part of site characterization at many contaminant release investigation sites. Often, a requirement of groundwater contaminant investigation is to evaluate contaminant concentrations in the aquifer. Since data quality objectives of most investigations require a laboratory setting for chemical analysis, samples must be collected from the aquifer and submitted to a laboratory for analysis. Therefore, sample collection and handling must be conducted in a manner that minimizes alteration of chemical characteristics of the groundwater.

In the past, most sample collection techniques followed federal and state guidance. Acceptable protocol included removal of water in the casing of a monitoring well (purging), followed by sample collection. The water in the casing was removed so groundwater from the formation could flow into the casing and be available for sample collection. Sample collection was commonly completed with a bailer, bladder pump, controlled flow impeller pump, or peristaltic pump. Samples were preserved during collection. Often, samples to be analyzed for metals contamination were filtered through a 0.45-micron filter prior to preservation and placement into the sample container.

Research conducted by several investigators has demonstrated that a significant component of contaminant transport occurs while the contaminant is sorbed onto colloid particles. Colloid mobility in an aquifer is a complex, aquifer-specific transport issue, and its description is beyond the scope of this Standard Operating Procedure (SOP). However, concentrations of suspended colloids have been measured during steady state conditions and during purging activities. Investigation results indicate standard purging procedures can cause a significant increase in colloid concentrations, which in turn may bias analytical results.

Micropurge sample collection provides a method of minimizing increased colloid mobilization by removing water from the well at the screened interval at a rate that preserves or minimally disrupts steady-state flow conditions in the aquifer. During micropurge sampling, groundwater is discharged from the aquifer at a rate that the aquifer will yield without creating a cone of depression around the sampled well. Research indicates that colloid mobilization will not increase above steady-state conditions during low-flow discharge. Therefore, the collected sample is more likely to represent steady-state groundwater chemistry.

1.1 PURPOSE

The purpose of this SOP is to describe the procedures to be used to collect a groundwater sample from a well using the micropurge technology. The following sections describe the equipment to be used and the methods to be followed to promote uniform sample collection techniques by field personnel that are experienced in sample collection and handling for environmental investigations.

1.2 SCOPE

This SOP applies to groundwater sampling using the micropurge technology. It is intended to be used as an alternate SOP to the general "Groundwater Sampling" SOP (SOP No. 10) that provides guidance for the general aspects of groundwater sampling.

1.3 DEFINITIONS

Colloid: Suspended particles that range in diameter from 5 nanometers to 0.2 micrometers.

Dissolved oxygen: The ratio of the concentration or mass of oxygen in water relative to the partial pressure of gaseous oxygen above the liquid which is a function of temperature, pressure, and concentration of other solutes.

Flow-through cell: A device connected to the discharge line of a groundwater purge pump that allows regular or continuous measurement of selected parameters of the water and minimizes contact between the water and air.

pH: The negative base-10 log of the hydrogen-ion activity in moles per liter.

Reduction and oxidation potential: A numerical index of the intensity of oxidizing or reducing conditions within a system, with the hydrogen-electrode potential serving as a reference point of zero volts.

Specific conductance: The reciprocal of the resistance in ohms measured between opposite faces of a centimeter cube of aqueous solution at a specified temperature.

Turbidity: A measurement of the suspended particles in a liquid that have the ability to reflect or refract part of the visible portion of the light spectrum.

1.4 REFERENCES

Puls, R. W. and M. J. Barcelona. 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. U.S. Environmental Protection Agency. Office of Research and Development. EPA/540/S-95/504. April.

1.5 REQUIREMENTS AND RESOURCES

The following equipment is required to complete micropurge sample collection :

- Water level indicator
- Adjustable flow rate pump (bladder, piston, peristaltic, or impeller)
- Discharge flow controller
- Flow-through cell
- pH probe
- Dissolved oxygen (DO) probe
- Turbidity meter
- Oxidation and reduction (Redox or Eh) probe
- Specific conductance (SC) probe (optional)
- Temperature probe (optional)
- Meter to display data for the probes
- Calibration solutions for pH, SC, turbidity, and DO probes, as necessary
- Container of known volume for flow measurement or calibrated flow meter
- Data recording and management system

2.0 PROCEDURE

The following procedures and criteria were modified from the U. S. Environmental Protection Agency guidance titled "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" (Puls and Barcelona 1996). This reference may be consulted for a more detailed description of micropurge sampling theory.

Micropurging is most commonly accomplished with low-discharge rate pumps, such as bladder pumps, piston pumps, controlled velocity impeller pumps, or peristaltic pumps. Bailers and high capacity submersible pumps are not considered acceptable micropurge sample collection devices. The purged water is monitored (in a flow-through cell or other constituent monitoring device) for chemical and optical parameters that indicate steady state flow conditions between the sample extraction point and the aquifer. Samples are collected when steady state conditions are indicated.

Groundwater discharge equipment may be permanently installed in the monitoring well as a dedicated system, or it can be installed in each well as needed. Most investigators agree that dedicated systems will provide the best opportunity for collecting samples most representative of steady state aquifer conditions, but the scope of a particular investigation and available investigation funds will dictate equipment selection.

2.1 EQUIPMENT CALIBRATION

Prior to sample collection, the monitoring equipment used to measure pH, Eh, DO, turbidity, and SC should be calibrated or checked according to manufacturer's directions. Typically, calibration activities are completed at the field office at the beginning of sampling activities each day. The pH meter calibration should bracket the pH range of the wells to be sampled (acidic to neutral pH range [4.00 to 7.00] or neutral to basic pH range [7.00 to 10.00]). The DO meter should be calibrated to one point (air-saturated water) or two points (air-saturated water and water devoid of all oxygen). The SC meter cannot be calibrated in the field. It is checked against a known standard (typical standards are 1, 10, and 50 millimhos per centimeter at 25 • C). The offset of the measured value of the calibration standard can be used as a correction value. Similarly, the Eh probe cannot be calibrated in the field, but is checked against a known standard, such as Zobell solution. The instrument should display a millivolt (mv) value that falls within the range set by the manufacturer. Because Eh is temperature dependent, the measured value should be corrected for site-specific variance from standard temperature (25 • C). The Eh probe should be replaced if the reading is not within the manufacturer's specified range. All calibration data should be recorded on the Micropurging Groundwater Sampling Data Sheet attached to this SOP or in a logbook.

2.2 WELL PURGING

The well to be sampled should be opened and groundwater in the well allowed to equilibrate to atmospheric pressure. Equilibration should be determined by measuring depth to water below the marked reference on the wellhead (typically the top of the well casing) over two or more 5-minute intervals. Equilibrium conditions exist when the measured depth to water varies by less than 0.01 foot over two consecutive readings. Total depth of well measurement should be made following sample collection, unless the datum is required to place nondedicated sample collection equipment. Depth to water and total well depth measurements should be made in accordance with procedures outlined in SOP No. 014 (Static Water Level, Total Well Depth, and Immiscible Layer Measurement).

If the well does not have a dedicated sample collection device, a new or previously decontaminated portable sample collection device should be placed within the well. The intake of the device should be positioned at the midpoint of the well screen interval. The device should be installed slowly to minimize turbulence within the water in the casing and mixing of stagnant water above the screened interval with water in the screened interval. Following installation, the flow controller should be connected to the sample collection device and the flow-through cell connected to the outlet of the sample collection device. The calibrated groundwater chemistry monitoring probes should be installed in the flow-through cell. If a flow meter is used, it should be installed ahead of the flow-through cell.

If the well has a dedicated sample collection device, the controller for the sample collection device should be connected to the sample collection device. The flow meter and flow-through cell should be connected in line to the discharge tube, and the probes installed in the flow-through cell.

The controller should be activated and groundwater extracted (purged) from the well. The purge rate should be monitored, and should not exceed the capacity of the well. The well capacity is defined as the maximum discharge rate that can be obtained with less than 0.1 meter (0.3 foot) drawdown. Typically, the discharge rate will be less than 0.5 liters per minute (L/min) (0.13 gallons per minute). The maximum purge rate should not exceed 1 L/min (0.25 gallons per minute), and should be adjusted to achieve minimal drawdown.

Water levels, effluent chemistry, and effluent flow rate should be continuously monitored while purging the well. Purging should continue until the measured chemical and optical parameters are stable. Stable parameters are defined as monitored chemistry values that do not fluctuate by more than the following ranges over three successive readings at 3-minute intervals: ±0.1 pH unit; ±3 percent for SC; ±10 mv for Eh; and ±10 percent for turbidity and DO. Purging will continue until these stabilization criteria have been met or three well casing volumes have been purged. If three casing volumes of water have been purged and the stabilization criteria have not been met, a comment should be made on the data sheet that sample collection began after three well casing volumes were purged. The final pH, SC, Eh, turbidity, and DO values will be recorded. All data should be recorded on the Micropurging Groundwater Sampling Data Sheet attached to this SOP or in a logbook.

2.3 SAMPLE COLLECTION

Following purging, the flow through cell shall be disconnected, and groundwater samples collected directly from the discharge line. Discharge rates should be adjusted so that groundwater is dispensed into the sample container with minimal aeration of the sample. Samples collected for volatile organic compound analysis should be dispensed into the sample container at a flow rate equal to or less than 100 milliliters per minute. Samples should be preserved and handled as described in the investigation field sampling plan or quality assurance project plan.

Tetra Tech EM Inc.

MICROPURGING GROUNDWATER SAMPLING DATA SHEET

Page ____ of ____

Date ____________

Well Name ____________
Project ____________
Project No. ____________
Well Location ____________
Sample Date ____________
Sampling Personnel ____________
____
____
Sample ID ____________
Duplicate ID ____________

Screen Interval ____________
Station Elevation ________ GND ____ TOC ____
Static Water Level (from TOC) ____________
Well Stick Up ____________
Static Elevation ____________
Well Depth ________ MEAS ____ RPTD ____
Feet of Water ____________
Gallons/Foot ____________
Casing Volume ____________

Immiscible Phases Present ☐ Yes ☐ No
Type ____________
Measured with ____________
PID Readings (background) ____________
PID Reading (TOC) ____________
Wells Installed by ____________
Installation Date ____________
Development Date(s) ____________

FIELD CHEMISTRY CALIBRATIONS

Date/Time ____________ Spec. Conductance: Standard ________ μmhos/cm at 25•C Reading ________ μmhos/cm at ____•C
pH: pH 4.00 - ______ at ______•C pH 7.00 - ______ at ______•C pH 10.00 - ______ at ______•C Slope ________
Dissolved Oxygen: D.O. Meter ______ mg/L at ______•C PID: Calibration Gas ________ PPM ______ Span ______ Reading ________

PURGING													
								Cumulative Volume of Water Removed (Purged)		PID/OVA Reading			
Time	Discharge Rate (mL/min)	Dissolved Oxygen (mg/L)	pH	Eh/ORP (mV)	Temp. (•C)	Specific Conduct. (μmhos/cm at •C)	Turbidity (NTU)	Gallons	Casing Vol.	Location	Value	Depth to Water (ft)	Comments

SAMPLE PARAMETERS

Condition of well: ____________
Remarks: ____________

FIELD EQUIPMENT

pH Meter ____________ Serial Number ____________
Spec. Cond. Meter ____________ Serial Number ____________
Pump ____________ Serial Number ____________
Water Level Meter ____________ Serial Number ____________
D.O. Meter ____________ Serial Number ____________
Filter Apparatus ____________ Filters ____________
Temperature Measure ____________
Interface Probe ____________ Serial Number ____________
PID/OVA ____________ Serial Number ____________

Field Chemistry Calibrations

Fractions ____________
____
____
Number of Bottles ____________
Sample Depth ____________
Field Notebook ____________
Sample Method ____________
____
Discharge Water Containerized ☐ Yes ☐ No

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 5

Last Reviewed: January 2000

[signature]

Quality Assurance Approved

January 28, 2000

Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. Procedures for classifying, packaging, and shipping samples are described below. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples. When hazardous substances and dangerous goods are sent by common carrier, their packaging, labeling, and shipping are regulated by the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR, *Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180) and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR).

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Sampler's Guide to the Contract Laboratory Program (CLP)," the DGR, and the HMR. Sample packaging and shipping procedures described in this SOP should be followed for all sample packaging and shipping. Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already collected in the appropriate sample jars and that the sample jars are labeled and tagged appropriately.

1.2 SCOPE

This SOP applies to sample classification, packaging, and shipping.

1.3 DEFINITIONS

Custody seal: A custody seal is a tape-like seal. Placement of the custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping.

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 1999).

Environmental samples: Environmental samples include drinking water, most groundwater and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, and biological specimens. Environmental samples typically contain low concentrations of contaminants and when handled require only limited precautionary procedures.

Hazardous Materials Regulations: The HMR are DOT regulations for the shipment of hazardous materials by air, water, and land; they are located in 49 CFR 106 through 180.

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the HMR.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in Appendix A of 49 CFR 172.101 and its quantity, in one package, equals or exceeds the reportable quantity (RQ) listed in the appendix.

IATA Dangerous Goods Regulations: The DGR are regulations that govern the international transport of dangerous goods by air. The DGR are based on the International Civil Aviation Organization (ICAO) Technical Instructions. The DGR contain all of the requirements of the ICAO Technical Instructions and are more restrictive in some instances.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample and **do not** need to be packaged and shipped in accordance with the DGR or HMR.

Overpack: An enclosure used by a single shipper to contain one or more packages and to form one handling unit (IATA 1999). For example, a cardboard box may be used to contain three fiberboard boxes to make handling easier and to save on shipping costs.

1.4 REFERENCES

U.S. Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (DOT and others). 1996. "1996 North American Emergency Response Guidebook."

International Air Transport Association (IATA). 1997. "Guidelines for Instructors of Dangerous Courses."

IATA. 1999. "Dangerous Goods Regulations." 40th Edition.

U.S. Environmental Protection Agency. 1996. "Sampler's Guide to the Contract Laboratory Program." Office of Solid Waste and Emergency Response. Washington, DC. EPA/540/R-96/032. On-Line Address: http://www.epa.gov/oerrpage/superfund/programs/clp/guidance.htm#sample

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping **nonhazardous** samples require the following:

- Coolers
- Ice
- Vermiculite, bubble wrap, or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)

The procedures for packaging and shipping **hazardous** samples require the following:

- Ice
- Vermiculite or other non-combustible, absorbent packing material
- Chain-of-custody forms and seals
- Appropriate dangerous goods airbills and emergency response information to attach to the airbill

- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Appropriate shipping containers as specified in the DGR
- Labels that apply to the shipment such as hazard labels, address labels, "Cargo Aircraft Only" labels, and package orientation labels (up arrows)

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and hazardous samples.

2.1 SAMPLE CLASSIFICATION

Prior to sample shipment, it must be determined whether the sample is subject to the DGR. Samples subject to these regulations shall be referred to as hazardous samples. If the hazardous sample is to be shipped by air, then the DGR should be followed. Any airline, including FedEx, belonging to IATA must follow the DGR. As a result, FedEx **may not** accept a shipment that is packaged and labeled in accordance with the HMR (although in most cases, the packaging and labeling would be the same for either set of regulations). The HMR states that a hazardous material may be transported by aircraft in accordance with the ICAO Technical Instruction (49 CFR 171.11) upon which the DGR is based. Therefore, the use of the DGR for samples to be shipped by air complies with the HMR, but not vice versa.

Most environmental samples are not hazardous samples and do not need to be packaged in accordance with any regulations. Hazardous samples are those samples that can be classified as specified in Section 3 of the DGR, can be found in the List of Dangerous Goods in the DGR in bold type, are considered a hazardous substance (see definition), or are mentioned in "Section 2 - Limitations" of the DGR for countries of transport or airlines (such as FedEx). The hazard classifications specified in the DGR (and the HMR) are as follows:

Class 1 - Explosives

Division 1.1 - Articles and substances having a mass explosion hazard

Division 1.2 - Articles and substances having a projection hazard but not a mass explosion hazard
Division 1.3 - Articles and substances having a fire hazard, a minor blast hazard and/or a minor projection hazard but not a mass explosion hazard
Division 1.4 - Articles and substances presenting no significant hazard
Division 1.5 - Very sensitive substances mass explosion hazard
Division 1.6 - Extremely insensitive articles which do not have a mass explosion hazard

Class 2 - Gases

Division 2.1 - Flammable gas
Division 2.2 - Non-flammable, non-toxic gas
Division 2.3 - Toxic gas

Class 3 - Flammable Liquids

Class 4 - Flammable Solids; Substances Liable to Spontaneous Combustion; Substances, which, in Contact with Water, Emit Flammable Gases

Division 4.1 - Flammable solids.
Division 4.2 - Substances liable to spontaneous combustion.
Division 4.3 - Substances, which, in contact with water, emit flammable gases.

Class 5 - Oxidizing Substances and Organic Peroxide

Division 5.1 - Oxidizers.
Division 5.2 - Organic peroxides.

Class 6 - Toxic and Infectious Substances

Division 6.1 - Toxic substances.
Division 6.2 - Infectious substances.

Class 7 - Radioactive Material

Class 8 - Corrosives

Class 9 - Miscellaneous Dangerous Goods

The criteria for each of the first eight classes are very specific and are outlined in Section 3 of the DGR and 49 CFR 173 of the HMR. Some classes and divisions are further divided into packing groups based on their level of danger. Packing group I indicates a great danger, packing group II indicates a medium danger, and packing group III indicates a minor danger. Class 2, gases, includes any compressed gas being shipped and any noncompressed gas that is either flammable or toxic. A compressed gas is defined as having a pressure over 40 pounds per square inch (psi) absolute (25 psi gauge). Most air samples and empty cylinders that did not contain a flammable or toxic gas are exempt from the regulations. An empty hydrogen cylinder, as in a flame ionization detector (FID), is considered a dangerous good unless it is properly purged with nitrogen in accordance with the HMR. A landfill gas sample is usually considered a flammable gas because it may contain a high percentage of methane. Class 3, flammable liquids, are based on the boiling point and flash point of a substance. Most class 3 samples include solvents, oil, gas, or paint-related material collected from drums, tanks, or pits. Division 6.1, toxic substances, is based on oral toxicity (LD_{50} [lethal dose that kills 50 percent of the test animals]), dermal toxicity (LD_{50} values), and inhalation toxicity (LC_{50} [lethal concentration that kills 50 percent of the test animals] values). Division 6.1 substances include pesticides and cyanide. Class 7, radioactive material, is defined as any article or substance with a specific activity greater than 70 kiloBecquerels (kBq/kg) (0.002 [microCuries per gram [µCi/g]). If the specific activity exceeds this level, the sample should be shipped in accordance with Section 10 of the DGR. Class 8, corrosives, are based on the rate at which a substance destroys skin tissue or corrodes steel; they are not based on pH. Class 8 materials include the concentrated acids used to preserve water samples. Preserved water samples are not considered class 8 substances and should be packaged as nonhazardous samples. Class 9, miscellaneous dangerous goods, are substances that present a danger but are not covered by any other hazard class. Examples of class 9 substances include asbestos, polychlorinated biphenyls (PCB), and dry ice.

Unlike the DGR, the HMR includes combustible liquids in hazard class 3. The definition of a combustible liquid is specified in 49 CFR 173.120 of the HMR. The HMR has an additional class, ORM-D, that is not specified in the DGR. "ORM-D material" refers to a material such as a consumer commodity, that although otherwise subject to the HMR, presents a limited hazard during transport due to its form, quantity, and packaging. It must be a material for which exceptions are provided in the table of 49 CFR 172.101. The DGR lists consumer commodities as a class 9 material.

In most instances, the hazard of a material sampled is unknown because no laboratory testing has been conducted. A determination as to the suspected hazard of the sample must be made using knowledge of the site, field observations, field tests, and other available information.

According to 40 CFR 261.4(d) and (e), samples transported to a laboratory for testing or treatability studies, including samples of hazardous wastes, are **not** hazardous wastes. FedEx will not accept a shipment of hazardous waste.

2.2 PACKAGING NONHAZARDOUS SAMPLES

Nonhazardous samples, after being appropriately containerized, labeled, and tagged, should be packaged in the following manner. Note that these are general instructions; samplers should be aware of any client-specific requirements concerning the placement of custody seals or other packaging provisions.

1. Place the sample in a resealable plastic bag.
2. Place the bagged sample in a cooler and pack it to prevent breakage.
3. Prevent breakage of bottles during shipment by either wrapping the sample container in bubble wrap, or lining the cooler with a noncombustible material such as vermiculite. Vermiculite is especially recommended because it will absorb any free liquids inside the cooler. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.
4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. As an option, a temperature blank (a sample bottle filled with distilled water) can be included with the cooler.
5. Seal the completed chain-of-custody forms in a plastic bag and tape the plastic bag to the inside of the cooler lid.
6. Tape any instructions for returning the cooler to the inside of the lid.
7. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once. Tape shut any drain plugs on the cooler.
8. Place two signed custody seals on the cooler, ensuring that each one covers the cooler lid and side of the cooler. Place clear plastic tape over the custody seals.
9. Place address labels on the outside of the cooler.
10. Ship samples overnight by a commercial carrier such as FedEx.

2.3 PACKAGING HAZARDOUS SAMPLES

The procedures for packaging hazardous samples are summarized below. Note that according to the DGR, all spellings must be exactly as they appear in the List of Dangerous Goods, and only approved abbreviations are acceptable. The corresponding HMR regulations are provided in parentheses following any DGR referrals. The HMR must be followed only if shipping hazardous samples by ground transport.

1. Determine the proper shipping name for the material to be shipped. All proper shipping names are listed in column B of the List of Dangerous Goods table in Section 4 of the DGR (or column 2 of the Hazardous Materials Table in 49 CFR 172.101). In most instances, a generic name based on the hazard class of the material is appropriate. For example, a sample of an oily liquid collected from a drum with a high photoionization detector (PID) reading should be packaged as a flammable liquid. The proper shipping name chosen for this sample would be "flammable liquid, n.o.s." The abbreviation "n.o.s." stands for "not otherwise specified" and is used for generic shipping names. Typically, a specific name, such as acetone, should be inserted in parentheses after most n.o.s. descriptions. However, a technical name is not required when shipping a sample for testing purposes and the components are not known. If shipping a hazardous substance (see definition), then the letters "RQ" must appear in front of the proper shipping name.

2. Determine the United Nations (UN) identification number, class or division, subsidiary risk if any, required hazard labels, packing group, and either passenger aircraft or cargo aircraft packing instructions based on the quantity of material being shipped in one package. This information is provided in the List of Dangerous Goods (or Hazardous Materials Table in 49 CFR 172.101) under the appropriate proper shipping name. A "Y" in front of a packing instruction indicates a limited quantity packing instruction. If shipping dry ice or a limited quantity of a material, then UN specification shipping containers do not need to be used.

3. Determine the proper packaging required for shipping the samples. Except for limited quantity shipments and dry ice, these are UN specification packages that have been tested to meet the packing group of the material being shipped. Specific testing requirements of the packages is listed in Section 6 of the DGR (or 49 CFR 178 of the HMR). All UN packages are stamped with the appropriate UN specification marking. Prior planning is required to have the appropriate packages on hand during a sampling event where hazardous samples are anticipated. Most samples can be shipped in either a 4G fiberboard box, a 1A2 steel drum, or a 1H2 plastic drum. Drums can be purchased in 5- and 20-gallon sizes and are ideal for shipping multiple hazardous samples. When FedEx is used to ship samples containing PCBs, the samples must be shipped in an inner metal packaging (paint can) inside a 1A2 outer steel drum. This method of packaging PCB samples is in accordance with FedEx variation FX-06, listed in Section 2 of the DGR.

4. Place each sample jar in a separate resealable plastic bag. Some UN specification packagings contain the sample jar and plastic bag to be used when shipping the sample.

5. Place each sealed bag inside the approved UN specification container (or other appropriate container if a limited quantity or dry ice) and pack with enough noncombustible, absorbent, cushioning material (such as vermiculite) to prevent breakage and to absorp liquid.

6. Place chain-of-custody forms in a resealable plastic bag and either attach it to the inside lid of the container or place it on top inside the container. Place instructions for returning the container to the shipper on the inside lid of the container as appropriate. Close and seal the shipping container in the manner appropriate for the type of container being used.

7. Label and mark each package appropriately. All irrelevant markings and labels need to be removed or obliterated. All outer packagings must be marked with proper shipping name, UN identification number, and name and address of the shipper and the recipient. For carbon dioxide, solid (dry ice), the net weight of the dry ice within the package needs to be marked on the outer package. For limited quantity shipments, the words "limited quantity" or "LTD. QTY." must be marked on the outer package. Affix the appropriate hazard label to the outer package. If the material being shipped contains a subsidiary hazard, then a subsidiary hazard label must also be affixed to the outer package. The subsidiary hazard label is identical to the primary hazard label except that the class or division number is not present. It is acceptable to obliterate the class or division marking on a primary hazard label and use it as the subsidiary hazard label. If using cargo aircraft only packing instructions, then the "Cargo Aircraft Only" label must be used. Package orientation labels (up arrows) must be placed on opposite sides of the outer package. Figure 1 depicts a properly marked and labeled package.

8. If using an overpack (see definition), mark and label the overpack and each outer packaging within the overpack as described in step 7. In addition, the statement "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS" must be marked on the overpack.

9. Attach custody seals, and fill out the appropriate shipping papers as described in Section 2.4.

2.4 SHIPPING PAPERS FOR HAZARDOUS SAMPLES

A "Shippers Declaration for Dangerous Goods" and "Air Waybill" must be completed for each shipment of hazardous samples. FedEx supplies a Dangerous Goods Airbill to its customers; the airbill combines both the declaration and the waybill. An example of a completed Dangerous Goods Airbill is depicted in Figure 2. A shipper's declaration must contain the following:

- Name and address of shipper and recipient
- Air waybill number (not applicable to the HMR)
- Page ___ of ___
- Deletion of either "Passenger and Cargo Aircraft" or "Cargo Aircraft Only," whichever does not apply
- Airport or city of departure
- Airport or city of destination
- Deletion of either "Non-Radioactive" or "Radioactive," which ever does not apply
- The nature and quantity of dangerous goods. This includes the following information in the following order (obtained from the List of Dangerous Goods in the DGR): proper shipping name, class or division number, UN identification number, packing group number, subsidiary risk, quantity in liters or kilograms (kg), type of packaging used, packing instructions, authorizations, and additional handling information. Authorizations include the words "limited quantity" or "LTD. QTY." if shipping a limited quantity, any special provision numbers listed in the List of Dangerous Goods in the DGR, and the variation "USG-14" when a technical name is required after the proper shipping name but not entered because it is unknown.
- Signature for the certification statement
- Name and title of signatory
- Place and date of signing certification
- A 24-hour emergency response telephone number for use in the event of an incident involving the dangerous good
- Emergency response information attached to the shipper's declaration. This information can be in the form of a material safety data sheet or the applicable North American Emergency Response Guidebook (NAERG; DOT 1996) pages. Figure 3 depicts the appropriate NAERG emergency response information for "Flammable liquids, n.o.s." as an example.

Note that dry ice does not require an attached shipper's declaration. However, the air waybill must include the following on it: "Dry ice, 9, UN1845, ____ x ____ kg." The blanks must include the number of packages and the quantity in kg in each package. If using FedEx to ship dry ice, the air waybill includes a box specifically for dry ice. Simply check the appropriate box and enter in the number of packages and quantity in each package.

The HMR requirements for shipping papers are located in 49 CFR 172 Subpart C.

3.0 POTENTIAL PROBLEMS

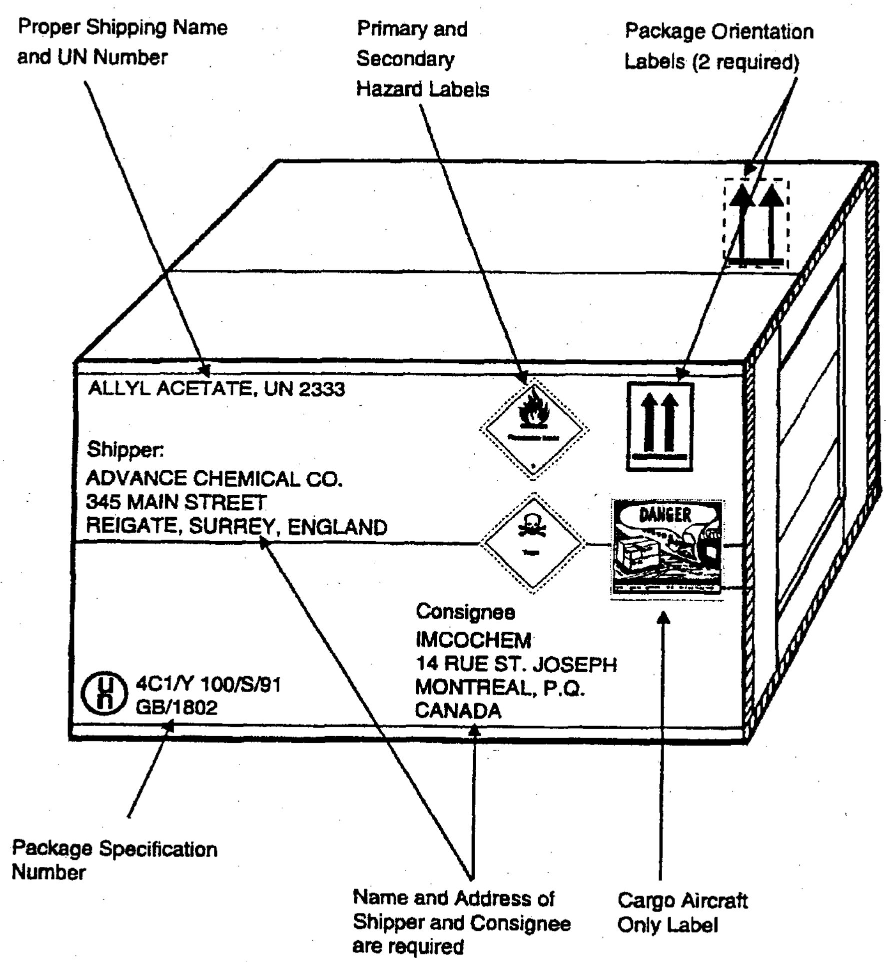
The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks, the carrier may open the package, return the package, and if a dangerous good, inform the Federal Aviation Administration (FAA), which can result in fines.
- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment.
- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice this as well and return the package to the shipper.

Contact FedEx with questions about dangerous goods shipments by calling 1-800-463-3339 and asking for a dangerous goods expert.

FIGURE 1

EXAMPLE OF A CORRECTLY MARKED AND LABELED DANGEROUS GOODS PACKAGE



Source: International Air Transport Association (IATA). 1997.

FIGURE 2

EXAMPLE OF A DANGEROUS GOODS AIRBILL

FedEx *Dangerous Goods Airbill* — Sender's Copy — RETAIN THIS COPY FOR YOUR RECORDS

11729489

The World On Time.

1 From *Please print and press hard*

Date: FILL IN — Sender's FedEx Account Number: 1788-8014-4

Sender's Name: FILL IN — Phone (312) 856 8700

Company: TETRA TECH EM INC

Address: 200 E RANDOLPH ST STE 4700 — Dept./Floor/Suite/Room

City: CHICAGO — State: IL — ZIP: 60601

2 Your Internal Billing Reference (First 24 characters will appear on invoice): FILL IN

3 To

Recipient's Name: ______ Phone ( )

Company: ______

Address: ______ (To "HOLD" at FedEx location, print FedEx address here. We cannot deliver to P.O. boxes or P.O. ZIP codes.) Dept./Floor/Suite/Room

City ______ State ______ ZIP ______

FILL IN

For HOLD at FedEx Location check here: ☐ Hold Weekday ☐ Hold Saturday (Available for FedEx Priority Overnight and FedEx 2Day to select locations)

For WEEKEND Delivery check here: ☐ Saturday Delivery (Available for FedEx Priority Overnight and FedEx 2Day to select ZIP codes) ☐ Sunday Delivery (Available for FedEx Priority Overnight to select ZIP codes)

4a Express Package Service *Packages up to 150 lbs.* (Delivery commitment may be later in some areas.)

☒ FedEx Priority Overnight (Next business morning) ☐ FedEx Standard Overnight (Next business afternoon)

☐ FedEx 2Day (Second business day) ☐ FedEx Express Saver (Third business day)

4b Express Freight Service *Packages over 150 lbs.* (Delivery commitment may be later in some areas.)

☐ FedEx 1Day Freight* (Next business day) ☐ FedEx 2Day Freight (Second business day) ☐ FedEx 3Day Freight (Third business day)

* Call for Confirmation: ______

Questions? Call 1·800·Go·FedEx® (800-463-3339) or Visit our Web site at www.fedex.com

5 Packaging: ☒ Other Packaging — Dangerous Goods cannot be shipped in FedEx packaging.

6 Special Handling: ☒ Dangerous Goods as per attached Shipper's Declaration ☐ Cargo Aircraft Only

7 Payment — Bill to: ☒ Sender (Acct. No. in Section 1 will be billed) ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

FedEx Account No. ______ Credit Card No. ______ Exp. Date ______

Total Packages ______ Total Weight ______ Total Declared Value* $ .00

Signature Release Unavailable

FedEx Tracking Number: 813350883058 — Form I.D. No.: 0204

374

Page 1 of 1 Pages

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: (delete non-applicable) PASSENGER AND CARGO AIRCRAFT / ~~CARGO AIRCRAFT ONLY~~

Airport of Departure: Chicago

Airport of Destination: "City sending sample to"

Shipment type: (delete non-applicable) NON-RADIOACTIVE / ~~RADIOACTIVE~~

NATURE AND QUANTITY OF DANGEROUS GOODS

Proper Shipping Name	Class or Division	UN or I.D. No.	Packing Group	Subsidiary Risk	Quantity and Type of Packaging	Packing Instr.	Authorization
Flammable liquid, n.o.s.	3	UN 1993	III	—	4 glass jars in a 1A2 steel drum; Net Quantity = 4 L	309	A3 USG-14

Additional Handling Information: NAERG # 128 Attached.

Prepared for AIR TRANSPORT according to: (Customer MUST check one) ☐ 49 CFR ☒ ICAO / IATA

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked, and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Name/Title of Signatory: Me, Environmental Scientist

Place and Date: 200 E Randolph, Chicago, IL xx/xx/xx

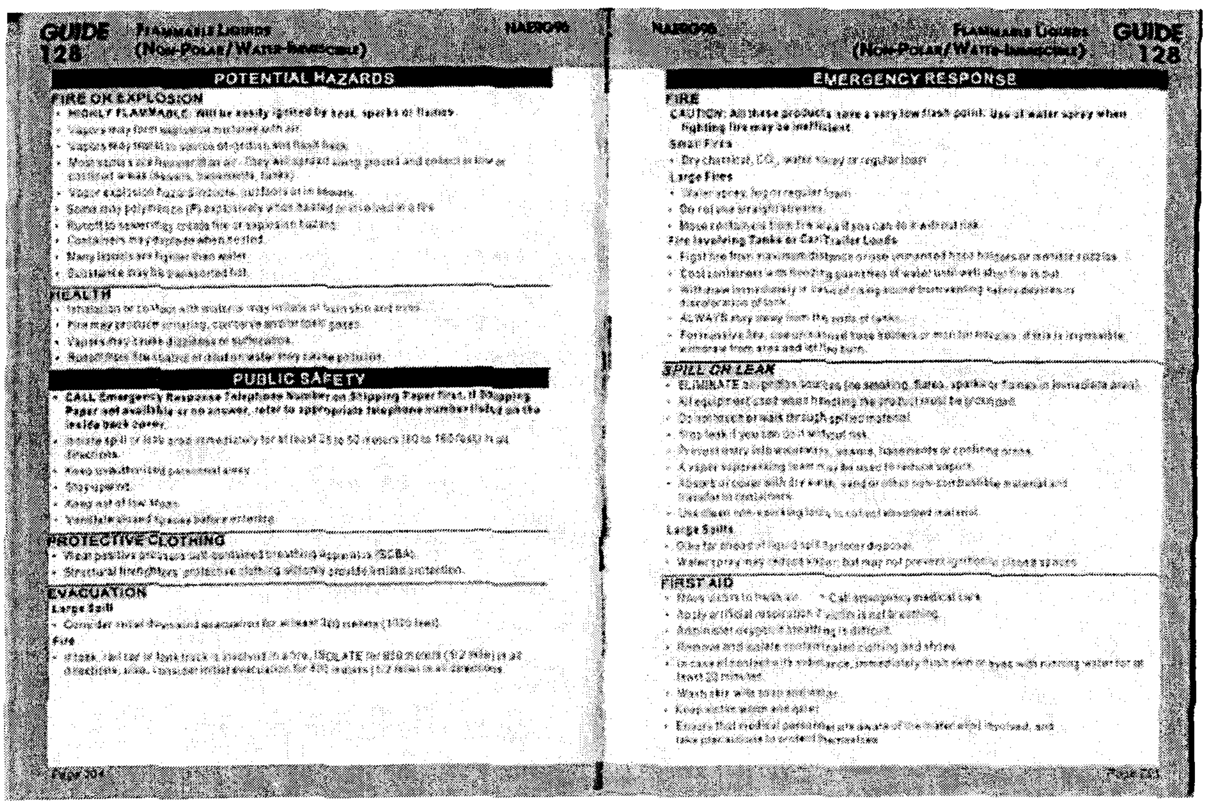
Signature (see warning above): me

Emergency Telephone Number (Required for U.S. Origin or Destination Shipments): FILL IN

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

FIGURE 3

NAERG EMERGENCY RESPONSE INFORMATION FOR FLAMMABLE LIQUIDS, N.O.S.


GUIDE 128 — FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) — NAERG96

POTENTIAL HAZARDS

FIRE OR EXPLOSION

HEALTH

PUBLIC SAFETY

PROTECTIVE CLOTHING

EVACUATION

EMERGENCY RESPONSE

FIRE

SPILL OR LEAK

FIRST AID

Source: DOT and others. 1996.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

USING THE GEOPROBE SYSTEM

SOP NO. 054

REVISION NO. 1

Last Reviewed: December 1999

March 28, 1994

Quality Assurance Approved

Date

1.0 BACKGROUND

This standard operating procedure (SOP) details all procedures for using the Geoprobe System, a hydraulically operated sampling probe, and its specialized sampling tools. The procedures described within this SOP include soil gas sampling, groundwater sampling, and soil sampling procedures as well as procedures for installing piezometers and vapor sampling implants. This SOP also describes general procedures for rod removal, backfilling, and decontamination which are common elements to all sampling procedures. This SOP No. 054 replaces former draft SOP No. 054 (Geoprobe Soil Gas Sampling) and draft SOP No. 055 (Geoprobe Groundwater Sampling).

Use of the Geoprobe System is only one of many sampling techniques used by Tetra Tech EM Inc. (Tetra Tech); however, it is a preferred sampling method when certain conditions prevail. Specifically, Geoprobe sampling should be considered when sampling is limited to relatively shallow depths and any of the following are factors: (1) costs must be kept very low, (2) the time period is short to perform the sampling, (3) maneuverability is important, and (4) the required sampling volume is limited.

Prior to the use of the Geoprobe equipment, all buried utility lines and other underground structures must be marked because this equipment can penetrate buried piping and tanks. A diagram of the Geoprobe system is shown in Figure 1.

1.1 PURPOSE

The purpose of SOP No. 054 is to establish positioning, preparing, and sampling procedures; piezometer and vapor sampling implant installation procedures; rod removal procedures; backfilling procedures; and decontamination procedures to guide field personnel.

1.2 SCOPE

The procedures outlined in SOP No. 054 are applicable to all Tetra Tech personnel involved in soil gas, soil, or groundwater sampling using the Geoprobe System or any of its specialized equipment. It also is applicable to all personnel using the Geoprobe System to install piezometers and vapor sampling implants. This SOP, in fact, applies to all uses of the Geoprobe System.

1.3 DEFINITIONS

Because Geoprobe Systems is a corporation specializing in an innovative sampling process, many of the terms used to describe its equipment are specialized and specific. For this reason, familiarity with hydraulic system, soil sampling, soil gas sampling, and groundwater sampling terms is necessary. These terms are discussed below.

1.3.1 Hydraulic System Terms

The following terms are principally used to discuss the basic operation of the hydraulic punch and its major components. If terms are encountered while using this SOP that are not listed below, check Sections 1.3.2, 1.3.3, and 1.3.4 below.

Hydraulic Punch: The principal part of the Geoprobe System, the hydraulic punch, looks very much like a small mobile drilling rig and is usually attached to a truck or van. The punch's hydraulic system uses the weight of the vehicle for support and a hydraulic system installed in the vehicle to advance sampling tools into the soil (see Figure 1).

Hammer: The hydraulic hammer pounds the rods and accessories into the soil once the hydraulic punch is unable to push it farther (see Figure 1).

Control Panel: The control panel is located near the hydraulic punch and contains the levers that control the movement of the punch (see Figure 2).

Probe Lever: This lever is found on the control panel and causes the hydraulic punch to push the drive rod and accessories into the soil. Overall, this lever controls the vertical movement of the punch (see Figure 2).

Hammer Lever: This lever is found on the control panel and engages the hydraulic hammer when the hammer release valve is moved to its extended position (see Figure 2).

Hammer Release Valve: This lever is found on the front of the hydraulic punch and allows the hammer to work when in its extended position. If the valve is not extended, pushing the hammer lever will not engage the hammer.

Foot Lever: This lever is found on the control panel and lowers the foot of the hydraulic punch so that it rests on the ground to stabilize the punch (see Figure 2).

Extend Lever: This lever is found on the control panel and controls the horizontal movement of the hydraulic punch. The lever extends the punch out of the van or truck. It also enables the hydraulic punch to extend about 2 feet from the rear of the vehicle (see Figure 2).

Fold Lever: This lever is found on the control panel and folds and unfolds the hydraulic punch so that it can be easily moved and stored (see Figure 2). This lever enables the hydraulic punch to move from the horizontal position to the vertical position.

Electrical Control Switch: This switch is found on the control panel and turns on the Geoprobe System's hydraulic system. None of the other levers work until this switch is turned on. It has slow, fast, and off speed positions (see Figure 2).

Vacuum System Panel: The vacuum system panel is located near the right rear of the vehicle and contains the vacuum system controls, the hydraulic oil cooling switch, and the remote ignition (see Figure 2).

Remote Ignition: This device is found on the vacuum system panel and allows one to start the vehicle's engine from near the hydraulic punch instead of walking around the vehicle and climbing into the vehicle's cab (see Figure 2).

Hydraulic Oil Cooling Switch: This switch is found on the vacuum system panel and turns on the auxiliary cooling system for the hydraulic oil (see Figure 2).

Vacuum/Volume (Vac/Vol) Pump Switch: This switch is found on the vacuum system panel and allows pressure to build up in the vacuum tank (see Figure 2).

Vacuum Line Valve: This valve is found on the vacuum system panel and opens and closes the vacuum line (see Figure 2).

Sample Line Gauge: This gauge is found on the vacuum system panel and registers the sample line pressure in inches of mercury (see Figure 2).

Drive Rod: The Geoprobe drive rod (sometimes called a probe rod) is a high-strength-steel, hollow tube with a 1-inch outer diameter. Though the rods come in 1-foot, 2-foot, and 3-foot lengths, the standard length is 3 feet. Each rod is threaded on both ends and has a male end and a female end (see Figure 3).

Drive Cap: This cap is a steel cap screwed onto the male end of the drive rod so that the rod can be pushed or hammered into the soil without damaging its threads. The drive cap is always installed to the top of the drive rod before advancing probe rods or sampling tools (see Figure 3).

Pull Cap: This cap is a steel cap that screws onto the male end of the drive rod and is used to pull the drive rod from the soil once the sample has been collected (see Figure 3).

Anvil: This piece of steel is placed inside the hydraulic punch at the point where the hammer actually makes contact. The anvil transfers the force of the hammer to the drive cap (see Figure 3).

Rotary-Impact Carbide-Tipped Drill Bit: This 18-inch or 24-inch steel drill bit fits directly into the hydraulic punch and is used to drill through concrete or hard asphalt. The bit does not spin with appreciable torque but is driven by the hammer, spinning only slightly to clear itself of debris (see Figure 3).

Chain-Assisted Pull Cap: This modified pull cap is attached to the hydraulic punch with a chain. It is most useful when the drive rod, for one reason or another, is not aligned directly underneath the hydraulic punch. With this cap, the rod can still be pulled using the punch (see Figure 3).

Rod Extractor: This tool threads onto a drive rod and is sent down into the hole made by a drive rod that has broken in the soil. The rod extractor, which looks a little like a drill bit, is then hammered into the broken rod and is used to pull the broken rod from the soil (see Figure 3).

Rod Pull Plate: This steel plate has a hole in its center through which a drive rod can be fitted. It is used to extract drive rods when installing piezometers, soil gas implants, or to expose the screen to groundwater when using a screen point sampler (see Figure 3).

O-Ring: An O-ring is a rubber ring used to seal sections of drive rods or various other Geoprobe tools so that, once together, they are air- and water-tight.

Teflon Tape: This inert, sticky tape can be used to create air-tight seals when pieces of the drive rod or accessories are threaded together. The tape can replace an O-ring.

1.3.2 Soil Sampling Terms

These terms are usually used when discussing soil sampling using the Geoprobe System. Sometimes, though, the terms are used when discussing other sampling techniques. If terms are encountered while using this SOP that are not listed below, check Sections 1.3.1 above and Sections 1.3.3 and 1.3.4 below.

Shelby Tube: This tube is used to collect large samples of cohesive soils. Its greatest disadvantages are that it cannot be used to sample from depths greater than about 10 feet and has no mechanism to stay closed until reaching the proper depth (see Figure 4).

Shelby-Tube-Drive Head: This 2-inch diameter piece of steel attaches to the Shelby tube using hex bolts. The Shelby-tube-drive head consists of two parts: a standard 2-inch Shelby tube drive head and a Geoprobe drive rod adapter. This allows the 2-inch wide Shelby tube to be driven by the hydraulic punch, which is actually designed for 1-inch diameter drive rods (see Figure 4).

Hex Bolts: These are the bolts used to attach a Shelby tube to a drive head (see Figure 4).

Extruder Latch: This device secures the Shelby tube to the extruder rack during the extrusion process that removes the soil from the tube (see Figure 4).

Extruder Piston: This piston is threaded onto a drive rod, and with the help of the hydraulic punch, extrudes the soil sample from the Shelby tube (see Figure 4).

Probe-Drive Systems: This sampling system allows samples to be collected at deeper depths than the Shelby tube system. Each probe-drive sampler remains closed until it reaches the depth desired and then is opened by those operating the punch by removing a stop pin (see Figure 5). The sampler is then pushed through the soil at the desired depth and removed. Three types of probe-drive samplers exist: the standard sampler, the Kansas sampler, and the large bore probe-drive sampler.

Standard Probe-Drive Sampler: This probe-drive sampler has a diameter of 1 inch and lengths of 10 or 24 inches. Its greatest difference from the other probe-drive sampler is that it does not have a removable cutting shoe (see Figure 5).

Stop Pin: This pin stops the point of a probe-drive sampler from retracting into the sampler tube. Once it is removed, the sample can be collected (see Figure 5).

Piston Rod: This rod connects the drive head of a probe-drive sampler to the sampler's point. Once the stop pin is removed, this rod slides through the sampler, allowing the point to retract inside the tube (see Figure 5).

Drive Head: This head is the top of a probe-drive sampler, which allows the piston rod to slide straight up the sample tube after the piston stop has been removed and the drive rod is advanced (see Figure 5).

Cutting Shoe: This portion of the probe-drive sampler cuts through the soil once the point is allowed to retract inside. The Kansas samplers and large-bore sampler have removable cutting shoes (see Figure 5).

Extruder Rack: This device holds soil samplers in place during extrusion. The Shelby tube extruder rack is shown in Figure 4, and the standard probe-drive extruder rack is shown in Figure 5.

Extension Rod: This long, thin, threaded, solid rod is dropped through a drive rod to the probe-drive sampler so that the stop pin can be removed. Often more than one extension rod (an extension rod string) must be put together to reach the stop pin (see Figure 5).

Extension Rod Handle: This small metal handle screws to the top of the extension rod string so that it can be turned easily while being used to remove the stop pin (see Figure 5).

Large-Bore Probe-Drive Sampler: This probe-drive sampler is 1-1/8 inches in diameter and 24 inches long. Its larger width allows for the collection of larger samples. The diameter also allows for acetate or brass liners to be used in sample collection. These liners can make viewing the sample easier and preparing it for analysis simpler.

Kansas Sampler: This specially designed probe-drive sampler has a removable cutting shoe to enable easy extraction of soil and to allow the shoe to be replaced without replacing the complete sampler.

Kansas Stainless Sampler: This sampler has a stainless-steel sampling tube. It works in the same way as the Kansas sampler.

1.3.3 Soil Gas Sampling Terms

The following terms are used principally to discuss soil gas sampling. A few terms, though, are used while discussing groundwater sampling as well. If unfamiliar terms not listed below are encountered while using this SOP, check Sections 1.3.1 and 1.3.2 above and Section 1.3.4 below.

Expendable Point: These points fit into an expendable point holder that has been threaded into the lead drive rod. When the drive rod is pulled back, these points do not move with it, leaving a gap from which soil gas can be collected. The points are ultimately left in the ground (see Figure 6).

Expendable Point Holder: This holder threads into the leading drive rod. It is used for driving expendable points (see Figure 6).

Retractable Point Holder: This holder lifts off its point, leaving a gap so that soil gas can be drawn, but unlike expendable points, the holder does not separate completely and ultimately is retrieved with the lead drive rod (see Figure 6).

Gas Sampling Cap: When using the standard soil gas sampling method, the gas sampling cap replaces the drive cap on top of the drive rod and allows tubing to be connected to the drive rod. A soil gas sample is drawn through the probe rod through this cap and into a sample container (see Figure 6).

Post-Run Tubing (PRT) System: This system collects soil gas drawn directly through a tube instead of through the drive rod itself. The system involves one of two specially designed point holders, each threaded on top so that an adapter that has been attached to the tube can be screwed into it after being advanced down the drive rod string. The two point holders differ in that one uses a retractable point and the other uses an expendable point (see Figure 7).

PRT Expendable Point Holder: This holder is threaded into the leading probe rod and is used for driving expendable points (see Figure 7).

PRT Adapter: The PRT adapter attaches the tubing through which the soil gas is to be drawn to the point holder, which has been driven to the proper sampling depth (see Figure 7).

Polyethylene Tubing: This tubing is the preferred tubing for connecting the PRT system to the sample container. Its stiff nature, however, sometimes makes it difficult to attach to the sample container and a coupler of Tygon tubing is necessary (see Figure 7).

Tygon Tubing: This tubing is the preferred tubing for connecting soil gas sampling containers to the drive rod and vacuum system. It often is also necessary as a coupler sample between the stiff polyethylene tubing used with PRT sampling systems and the sample container.

Glass Bulb: This bulb of glass has valves on each side and a neoprene septum through which gas can be withdrawn. The bulb is used to collect soil gas and can be used as the container in which the gas is taken for analysis (see Figure 8).

Tedlar Bag: This small bag has a valve on it. It is placed in an air-tight chamber, the air in the chamber is evacuated, and the bag fills with soil gas. The bags can then be taken for analysis.

Tedlar Bag Chamber: Tetra Tech uses these modified, air-tight kitchen containers as vacuum chambers. These chambers are modified with nipples on each side, which enable it to be attached to a vacuum pump, to a Tedlar bag, and to the Tygon tubing.

1.3.4 Groundwater Sampling Terms

The following terms are used to discuss groundwater sampling. If unfamiliar terms not listed below are encountered while using this SOP, check Sections 1.3.1, 1.3.2, and 1.3.3 above.

Mill-Slotted Well Point: This 3-foot long tube has 15 mill-cut slots in it, each 2 inches long and 0.020 inches wide. Only the bottom 2 feet of this tube is slotted, and sometimes mill-slotted well points come in two parts: a 2-foot slotted section and a 1-foot unslotted section. The slots allow groundwater to enter (see Figure 9).

Geoprobe Screen Point Sampler: This sampler has a 19-inch screen that encases a perforated stainless-steel sleeve. Once in place, the screen allows the water to enter the tube and prevents coarse sediment from entering the tube (see Figure 9).

Thieving Tube: This tube is used to extract the water from either mill-slotted well points or Geoprobe screen point samplers, Tetra Tech uses polyethylene tubing as thieving tubes. This tubing is lowered into the water, capped on top, and then extracted. The result is much like putting a straw into a glass of water, sealing the straw with a finger and lifting it. This method is used primarily for the collection of groundwater samples to be analyzed for volatile organic compounds. A check valve can also be attached to the thieving tube which seals the bottom and holds the groundwater within the tube.

Check Valve: This stainless steel valve has a small ball which, when attached to a thieving tube, floats to the top of the groundwater table and then sinks, ultimately sealing the thieving tube with groundwater. Oscillating the thieving tube will allow groundwater to rise within the tube for larger retrieval volume.

Well Mini-Bailer: This specially designed bailer drops through the drive rods and into the groundwater in the mill-slotted well point or screen point. A small ball in the bailer floats to the top and then sinks, ultimately sealing the bailer after it fills with about 40 milliliters of groundwater.

1.4 REFERENCES

The following references were used to prepare this SOP:

Driscoll, F.G. 1987. *Groundwater and Wells*. Second Edition. Johnson Division. St. Paul, Minnesota.

Fisher Scientific. 1991. "The Fisher Catalog of Scientific Instruments."

Geoprobe Systems. 1990. "8-M Operations Manual." July 27.

Geoprobe Systems. 1991. "Accessory Tools Catalog."

Geoprobe Systems. 1992. "Equipment and Tools Catalog."

2.0 POSITIONING, PREPARING AND SAMPLING PROCEDURES

The Geoprobe System uses a hydraulic punch that is usually installed in the back of a van or truck to first push and then to hammer its hollow drive rod through soils. Depending on which tools are attached to the end of the drive rod and which sampling equipment is attached to it, the Geoprobe can be used to remove soil, soil gas, or groundwater. It can also be used to drill through cement or concrete and can aid in the installation of piezometer wells and vapor sampling implants. The following sections detail the procedures for positioning the Geoprobe unit, preparing the sampling system, and sampling with the Geoprobe unit.

2.1 POSITIONING THE GEOPROBE UNIT

Before the Geoprobe System can be used, the Geoprobe hydraulic punch and accessories must be properly positioned near the sampling site. The hydraulic punch and other equipment also needs to be prepared. In cases where concrete or other hard surfaces hinder sampling, the Geoprobe must be used to reach soil. This section details methods to perform these activities.

To position and unload the Geoprobe System use the following procedures:

1. Drive the vehicle containing the Geoprobe System to the sampling location and align the center of the rear of the vehicle with the point at which the sample will be taken. The rear bumper should be 1 to 2 feet from the sampling point so that the foot of the hydraulic punch can be extended out over it.

2. Shut off the vehicle.

3. Put it in park.

4. Set the emergency brake before proceeding.

5. One person only should operate the hydraulic punch and the assembly and disassembly of probe rods and accessories. A second person is usually necessary to handle the samples and to decontaminate equipment. All personnel present must wear steel-toed shoes, gloves, and eye protection. When drilling through concrete or using the hydraulic hammer, ear protection is also necessary.

6. Once ready to take the sample, start the engine using the remote ignition located in the right rear of the vehicle. As a safety device, the remote ignition will not work unless the vehicle is in park.

7. Activate the hydraulic system by turning on the electrical control switch. The vehicle's engine must be running for the hydraulic system to work.

8. Slowly extend the Geoprobe out of the vehicle using the extend lever. Always use the slow speed on the hydraulic controls when positioning the hydraulic punch. The punch and mast should be far enough out of the van or truck so that the mast will not strike the roof when it is unfolded.

9. Unfold the hydraulic punch out of the vehicle using the fold lever. Once the punch has been lined up perpendicular to the ground surface, lower the foot of the punch using the foot lever until the vehicle itself is raised about 1 foot on its springs. This stabilizes the vehicle and punch. **Never lift the vehicle completely off the ground using the foot lever.** Doing so destabilizes the vehicle and hydraulic punch and may cause damage to equipment or injury to those nearby. Also, as pressure is placed on the rod, tools, and accessories, the foot of the punch may begin to lift. Do not allow it to lift farther than 6 inches from the ground. Allowing it to lift farther than 6 inches may throw the vehicle off balance and cause the rod to bend or break.

The Geoprobe System is now positioned. If it is necessary to drill through concrete or hard asphalt, use the following procedures:

1. Raise the hydraulic punch using the probe lever and then deactivate the hydraulic system by turning the electrical control switch to off. The hydraulic system should always be turned off when the hydraulic controls are not being used.

2. Place the drill bit into the hydraulic hammer. The bit is not used with a drive rod or anvil.

3. Activate the hammer rotation control knob, which is located on the hydraulic hammer, by turning the knob counter-clockwise. This allows the drill bit to rotate when the hammer lever on the control panel is pressed.

4. Activate the hammer release valve, which is located on the hydraulic hammer, by pulling the lever out and down.

5. To drill through solid surfaces, both the probe and hammer mechanisms of the hydraulic punch must be used. The hammer mechanism drives the drill bit in a percussion fashion and causes it to turn slightly. The probe mechanism allows the hammer and bit to be raised and lowered so that the bit can clear itself of debris. Once ready to begin, turn on the hydraulic system.

6. Fully depress the hammer lever. This lever needs to remain depressed throughout the drilling procedure and keeps the bit pounding and rotating.

7. Put pressure on the bit by pressing the probe lever down. Using this lever, advance the bit in small increments through the concrete or other hard surface. If advanced too quickly, the bit will bind and stop rotating. Should this happen, raise the punch slightly to allow the bit to rotate. If too little pressure is placed on the bit, too little percussion will occur, and drilling will be slow.

8. Continue drilling, in small increments, until soil has been reached. At that time prepare for sampling.

2.2 PREPARING THE SAMPLING SYSTEM

Before the hydraulic punch is used to sample, decisions must be made concerning which type of sample will be taken, whether several samples will be taken at varying depths, and which type of Geoprobe sampling equipment will be used. The following sections discuss preparation procedures for soil sampling, soil gas sampling, and groundwater sampling.

2.2.1 Soil Sampling

The samplers attached to the hydraulic punch for soil sampling come in two forms. The first type is the 2-inch diameter Shelby tube system that is common to other soil sampling methods. The second system uses various specially designed probe-drive systems that remain completely sealed while being pushed or driven to a particular depth. They then are opened to allow a sample to be collected. The Shelby tube and probe-drive systems are discussed below.

Shelby Tube System

The Shelby tube is a thin-walled steel tube, 2 inches in diameter and 30 inches long, with four mounting holes around its top. It allows large amounts of soil to be sampled at once, but the soil must be relatively cohesive. Because the tube remains open at all times, the tube cannot be driven to great depths and must be removed and replaced after coring 30 inches of soil. Usually, the Shelby tube system is chosen when large amounts of soil are needed at depths no deeper than 10 feet. Rocky or sandy soils are not conducive to this sampling method.

To prepare for sampling using Shelby tubes, use the following procedures:

1. First attach a Shelby tube to the Shelby-tube-drive head by putting the head's hex bolts through the holes in the tube.

2. Next, screw a Geoprobe drive rod adapter into the top of the drive head to allow the 2-inch-wide Shelby tube to be driven by the hydraulic punch and hammer, which are actually made for 1-inch outer diameter drive rods.

3. A drive cap is then screwed onto the top of Geoprobe drive rod adapter. The tube is now ready to be attached to the hydraulic punch.

4. To attach the tube, raise the hydraulic punch using the probe lever and then turn off the Geoprobe hydraulic system.

5. Lift the hammer latch and insert the anvil inside.

6. Place the assembled Shelby tube sampler so that it is aligned under the anvil.

The hydraulic punch is now ready to drive a Shelby tube and collect a sample core. For collecting soil cores at depths of greater than 30 inches, attach sections of probe rod to an assembled Shelby tube sampler and drive the sampler down the same hole using a new Shelby tube for each 30-inch increment in depth.

Probe-Drive Systems

All of the probe-drive systems work in essentially the same way. A sampler is attached to a hollow drive rod, inserted into the hydraulic punch, and punched or hammered into the soil. Once the sampler reaches the depth at which the sample is to be taken, a stop pin in the sampler is removed using an extension rod that has been dropped through the inside of the hollow drive rod. The release of the stop pin allows the point of the sampler to retract inside the sample tube as the sampler is further advanced into the soil. The probe is then punched through the soil where the sample is to be taken. The rod and probe are then pulled to the surface for sample extraction.

Currently, three types of samplers are used in the probe-drive systems: the standard probe-drive sampler, the Kansas sampler, and the large bore probe-drive sampler. Preparation of each is slightly different. Each is discussed separately below.

Standard Probe-Drive Samplers

The standard probe-drive sampler comes in 10- and 24-inch lengths. The proper length is determined by the size of the sample desired. The point of this sampler is connected to a piston rod that will slide through its length. At its top, the piston rod is connected to the drive head, which keeps it centered and holds the piston stop pin, which stops the piston from sliding.

To prepare the standard probe-drive sampler, use the following procedures:

1. Insure that the sampler is assembled and complete, and that the piston stop pin which is reverse threaded is tightly locked so that the sampler point will not slide into the sampling tube.

2. Attach a shortened Geoprobe drive rod to the sampler so that the total length is nearly the standard 3 feet. If the 10-inch sampler is used, a 2-foot drive rod should be attached, and if the 24-inch sampler is used, a 1-foot drive rod should be attached.

3. Screw a drive cap onto the top of the shortened drive rod. The sampler is now ready for attachment to the hydraulic punch.

4. To insert the probe-drive sampler, raise the hydraulic punch using the probe lever, and then turn the hydraulic system off.

5. Lift the hammer latch and insert the anvil inside.

6. Place the assembled standard probe-drive sampler and shortened drive rod directly under the anvil so that the drive cap touches the anvil and the point of the sampler is aimed at the place where the sample is to be taken. The standard probe-drive sampler and the hydraulic punch should both be vertical.

<u>**Kansas Samplers**</u>

The Kansas sampler is much like the standard probe-drive sampler. However, it has a removable hardened cutting shoe near its point that allows it to penetrate rockier soils and to be easily replaced and decontaminated. Kansas samplers come in two versions: the Kansas Stainless Sampler, which has a stainless-steel tube, and the Kansas Sampler, which has an alloy steel tube.

To prepare a Kansas sampler, use the following procedures:

1. Ensure that the hardened cutting shoe is in place.

2. Assemble and install the Kansas sampler in the same manner as the standard probe-drive sampler (see Procedures 2 through 7 above).

<u>**Large Bore Samplers**</u>

The large bore sampler, similar to both types of Kansas samplers, has a removable cutting shoe and works in the same manner. It is slightly larger than the Kansas samplers, usually 24 inches long and 1-1/8 inches wide. The larger bore allows for the use of acetate or brass liners. The soil, therefore, can be removed easily by removing the liner. The acetate liner allows for easy visual examination of the core and can be easily sliced away so that the sample can be prepared for the laboratory. The brass liners come in four 6-inch sections that allow for easy separation and packaging of 6-inch soil samples. Some laboratories accept full 6-inch brass liners, allowing the samples to be collected with a very minimal disturbance to the soil matrix.

To prepare a large-bore sampler, use the following procedures:

1. Place the desired liner into the sampler by unscrewing the cutting shoe and sampler drive head from the two ends and then inserting the liner.

2. Assemble the sampler and attach a 12-inch drive rod to the sampler.

3. Screw a drive cap onto the top of the drive rod.

4. Place the assembled sampler and drive rod under the hydraulic punch in the manner detailed in the section above for preparing standard probe-drive samplers (see Procedures 5, 6, and 7 above).

2.2.2 Soil Gas Sampling

Two main methods are used to collect soil gas using the Geoprobe system: the standard method and the PRT system.

To use the standard method, the drive rods are decontaminated and assembled in an air-tight manner as they are punched into the soil. To ensure an air-tight seal, either Teflon tape or an O-ring can be placed on the male threads of the drive rods. The probe rods are driven approximately 6 inches below the area from where the sample is to be taken. The rods are then lifted approximately 6 inches leaving the expendable point and a small opening between the point and the end of the rod behind. A gas sampling cap is then attached to the top of the rod, a vacuum pump removes the necessary volume of gas, and the sample is collected.

To collect soil gas samples using the PRT system, polyethylene tubing attached to a stainless steel adapter is pushed through the drive rod after the rod is in place. The tubing and adapter is then reverse threaded onto the top of the PRT expendable point holder, and the gas is collected through the tubing. This method increases the accuracy of soil gas sampling, eliminates the potential for leaks in the rod, and simplifies probe rod decontamination.

Standard Method

Only decontaminated drive rods can be used with the standard method. Rods should be decontaminated using the procedures in Section 6.0 of this SOP.

To prepare a decontaminated drive rod for soil gas sampling using the standard method, use the following procedures:

1. Screw an expendable point holder into the female end of a 3-foot drive rod. (Note: a retractable point can also be used with this method; however, decontamination requirements almost always preclude its use.)
2. Place an expendable point into this holder.
3. Screw a drive cap onto the male end of the drive rod.
4. Place the rod into the hydraulic punch.
5. Turn on the hydraulic system.
6. Install the anvil within the hydraulic punch's hammer by lifting the hammer latch and inserting it.
7. Place the assembled drive rod directly under the anvil so that the drive cap faces the anvil and the expendable point is aimed at the desired sampling location.
8. Push sampler and hydraulic punch through the soil to gather the sample.

PRT System

Two types of PRT systems are available. The first uses an expendable point holder and expendable point like the standard method. The second uses a retractable point holder that lifts off of the drive-point without actually separating from it. Both systems allow the threading of a PRT adapter and tubing through the drive rod so that the gas can be taken from the depth required without being sucked through the drive rod.

To prepare the drive rod and sampler for PRT soil gas sampling, use the following procedures:

1. Select the desired PRT sampler (either one with an expendable point or one with a retractable point) and ensure that the PRT adapter easily screws into the threads on top of the sampler. This step is necessary to ensure that the adapter will fit easily when it is affixed from above ground.
2. If using the sampler with an expendable point, attach the point.

3. Screw the sampler to the end of a shortened drive rod so that the total length of the sampler is nearly 3 feet.

4. Screw the drive cap to the other end of the drive rod.

5. Attach the drive rod and sampler to the hydraulic punch using the same procedures detailed in the standard method (see Procedures 4, 5, and 6 above).

2.2.3 Groundwater Sampling

The Geoprobe System offers two systems for collecting groundwater, each with several groundwater sampling options. The first method involves the use of a mill-slotted well point. The second method uses a specially designed Geoprobe screen point sampler.

Mill-Slotted Well Points

The mill-slotted well point is a 2- or 3-foot length of hollow steel tubing with 15-millcut slots in it, each 2 inches long and 0.020 inches wide. Once in place, groundwater enters the tube through these slots. To prepare the mill-slotted well point, use the following procedures:

1. Screw a solid drive point into the female end of the sampler.

2. If a 2-foot well point is being used, screw the sampler to a 1-foot length of drive rod.

3. Screw a drive cap to the other end of the well point or 1-foot drive rod.

4. Place the sampler and rod into the hydraulic punch by raising the punch as much as necessary and turn hydraulic system off.

5. Install the anvil within the hydraulic punch's hammer by lifting the hammer latch and inserting it.

6. Place the mill-slotted well point sampler under the anvil with the drive cap near the anvil and the point aimed at the sampling location.

Geoprobe Screen Point Sampler

The Geoprobe screen point sampler has a 19-inch screen encased in a perforated stainless-steel sleeve. The screen remains encased in the sleeve until the screen point sampler reaches the desired depth. The rod is then pulled back approximately 19 inches, leaving the screen exposed to the formation. Flexible tubing can be pushed through the drive rod and attached to the sampler using the adapters for the PRT soil gas system, enabling groundwater to be removed without touching the drive rod. Decontaminating the drive rod is subsequently easier.

To prepare a Geoprobe screen point sampler, use the following procedures:

1. Close the screen on the sampler.
2. Attach its expendable point.
3. Attach the sampler to a shortened drive rod so that the assembly is nearly 30 inches long.
4. Place the sampler into the hydraulic punch using the methods detailed for mill-slotted well points (see Procedures 4, 5, and 6 above).

2.3 SAMPLING

Sampling procedures for the Geoprobe hydraulic punch are similar for all samplers and sampling media. This section presents general procedures that apply to all samplers and sample types, and specific operating procedures for soil, soil gas, and groundwater.

2.3.1 General Procedures

All control panel switches have a slow and fast position. All switches should initially be set at the slow position when positioning the punch and the sampling tools. In all cases, the hydraulic system should be shut off when not in operation and when adapters and additional drive rods are put into place. The hydraulic punch should be turned off any time it is not actually in operation.

The Geoprobe hydraulic punch is designed with a key safety feature that will shut it off if the controls are released. If the operator senses that something is wrong, he or she must release the controls and stop operating the punch until all is well. At no time should the foot of the punch be allowed to lift higher than 6 inches off the ground because the punch will destabilize and may bend the drive rod or sampling tube.

Also, at no time should part of a human body be placed on top of a drive cap while the cap is near the anvil or under the foot of the hydraulic punch.

Once the assembled sampler or drive rod is under the anvil, both it and the hydraulic punch should be vertical. Positioning the drive rod and sampler is critical in order to drive the rod vertically. Not positioning the sampler or drive rod vertically will result in problems when attaching subsequent drive rods needed to reach the proper depth and with rod retrieval.

To begin probing in soils of normal texture, use the following procedures:

1. Activate the hydraulic punch and push down on the probe lever on the control panel so that the probe slowly lowers itself. Always use the slow control on the first rod or sampler.

2. Continue to press on the probe lever until the rod or sampler is completely forced into the soil. The point of the rod will then be nearly 3 feet into the soil.

Soils and other materials are often too hard for the hydraulic punch's probe mechanism to penetrate. When this occurs, the hammer on the hydraulic punch should be used in accordance with the following procedures:

1. Ensure that the hammer rotation valve is closed.

2. Use the hydraulic punch to put pressure on the rod, sampler, and soil. When the probe rod refuses to move, the foot of the hydraulic punch will begin lifting off the ground. Never allow the foot to lift more than 6 inches off the ground, but never use the hammer with the foot resting on the ground surface.

3. If the probe foot lifts off the ground, the hydraulic punch may no longer be perpendicular. If this occurs, use the machine's fold lever, which is located on the control panel, to correct the punch's position.

4. Press the hammer lever on the control panel. The rod should now advance. Never use the hammer unless there is downward pressure on the drive cap because doing so may damage the equipment.

5. Stop hammering periodically and check to see if the probe rods can be advanced using the probe mechanism only.

When samples are to be taken at depths of greater than 3 feet, additional drive rods must be added to those already in the ground. Shelby tube soil sampling procedures for adding rods are discussed in Section 2.3.2. For all other sampling methods, use the following procedures to add drive rods:

1. Using the probe lever, raise the hydraulic punch off the portion of the drive rod protruding from the ground.
2. Unscrew the drive cap from the drive rod.
3. If using the standard method of collecting soil gas or other sampling methods that will draw the sample through the length of the entire drive rod, wrap the threads of the drive rod with Teflon tape or push an O-ring over the threads to make the drive rod string air- and water-tight.
4. Screw another drive rod onto the first drive rod protruding from the ground. Tighten the rods together with a pipe wrench.
5. Screw a drive cap onto the top of the new drive rod.
6. Place the hydraulic punch over the new drive rod and push the rod farther into the ground.

As the rod string is pushed farther into the ground, it will sometimes begin to loosen. The rods should remain tight so that the threads are not damaged. Occasionally, stop probing and twist the rod string with a pipe wrench to ensure that all of the joints remain tightly sealed.

2.3.2 Soil Sampling

This section presents procedures used to sample soils using either the Shelby tube sampling method or any of the probe-drive systems. In all cases, sampling tools should never be advanced farther than their length once they are opened because the sampler will overfill. If the sampler overfills, it could be damaged or expand, causing it to fall off the drive head.

<u>Shelby Tube Sampling Procedures</u>

Because the Shelby tube does not remain closed until it reaches the desired sampling depth and because it is not connected to a drive rod but to a Shelby drive head, sampling procedures for Shelby tubes differ greatly from soil sampling with other methods. New drive rods cannot be continuously added. Sampling at depths of greater than 30 inches requires a step-like procedure. For example, to sample to a depth of 90 inches, three Shelby tubes are needed. The first is advanced from 0 to 30 inches and then removed. The second is pushed through the hole made by the first and advanced to a depth of 60 inches and removed. The third is also pushed through the 60-inch deep hole and advanced from 60 to 90 inches.

Samplers must be ready to change sampling methods if necessary. For example, if soils are not cohesive, they tend to drop out of the Shelby tube as it is pulled from the ground. Also, if the soils are not cohesive, they tend to collapse into the hole left by the initial tube before the second and third tubes can be pushed into place. For this reason, use of the Shelby tube method is impractical at depths of greater than 10 feet. Rocky soils are also difficult to sample with a Shelby tube sampler because they tend to destroy the sampler while it is being driven into the ground.

To sample using the Shelby tube method, use the following procedures:

1. Turn on the hydraulic system and slowly press the Shelby tube into the soil using the probe lever on the control panel.
2. Once the tube has reached the sampling depth or has been extended to nearly its full 30-inch length, stop the hydraulic punch and raise it off the drive cap and Shelby tube drive head.
3. Unscrew the drive cap.
4. Screw on a pull cap.
5. Lower the hydraulic punch and lift the hammer latch. Remove the anvil. Place the latch around the pull cap so that the latch will hold the cap to the hydraulic hammer.
6. Using the probe lever, raise the hydraulic punch to pull the Shelby tube from the ground.

If the desired sampling depth is greater than 30 inches, additional Shelby tubes and probe rods must be used. The tubes are then prepared for probing using the methods presented in Sections 2.2.1 and 2.3.1 above. To advance the Shelby tube deeper, the tubes are pushed through the hole left by the first tube using the method detailed above.

Once a Shelby tube core has been retrieved from a sampling point, it must be extruded from the Shelby tube sampler using the following procedures:

1. Lower the hydraulic punch using the probe lever so that its mast will not strike the top of the van as it is folded.

2. Lift the foot of the hydraulic punch using the foot lever.

3. Slowly and carefully fold the hydraulic punch using the fold lever.

4. Once the punch is horizontal, the Shelby tube extruder bracket can be placed onto the punch's foot. This bracket will hold the Shelby tube in place and allow the punch to push the soil out of the tube.

5. Screw an extruder piston onto a drive rod and a drive cap on the drive rod's other end.

6. Place the drive rod into place under the horizontal drive punch.

7. Place the full Shelby tube into the extruder rack and secure it with the extruder latch.

8. A pan or container should be held at the end of the Shelby tube to collect sample material as it is extruded.

9. The probe lever activates the hydraulic punch and pushes the soil from the Shelby tube.

Tetra Tech's SOPs on packaging and documenting samples, SOPs Nos. 016, 017, 018, and 019, should be used to prepare the sample for analysis.

Probe-Drive System Sampling Procedures

All three types of probe-drive samplers work in essentially the same way. The sampler is advanced to just before the proper sampling depth and then the drive point is released by removing a stop pin using solid extension rods that have been dropped through the hollow drive rod. The point is then pushed back into the body of the sampler as the sampler fills with the soil sample.

In addition to the general procedures listed in the Section 2.3.1, the probe must be stopped at just before the desired sampling depth so that the stop pin can be removed. Pushing the probe too far will require starting over.

To use the probe-drive sampling system to sample soil, use the following procedures:

1. Attach additional drive rods as discussed in the general procedures in Section 2.3.1.

2. Stop the hydraulic probe just before the desired sampling depth.

3. Raise the hydraulic punch, turn off the hydraulic system, and remove the drive cap.

4. Insert an extension rod into the drive rod and screw additional extension rods together until the assembly reaches the same depth as the sampler.

5. Attach a small extension rod handle to the top of the extension rod.

6. Rotate the extension rod handle clockwise until the leading extension rod has turned the stop pin and disengaged it.

7. Pull and unscrew each extension rod from the hollow drive rod. The stop pin should be attached to the bottom of the extension rod string. If not, repeat Procedures 1 through 6.

8. To sample, mark the drive rod with tape or chalk about 10 inches above the ground if a 10-inch sampler is used or 24 inches from the ground if a 24-inch sampler is used.

9. Replace the drive cap and start the hydraulic system.

10. Drive the rod until the tape or chalk mark touches the ground. Be careful not to overdrive the sampler. Doing so could compact the soil in the sampler or cause it to balloon outward, making soil removal and extrusion difficult.

11. Raise the hydraulic punch and replace the drive cap with the pull cap. Remove the anvil.

12. Latch the pull cap underneath the hydraulic hammer latch and pull the rods out of the ground, disassembling the rod as needed.

13. Check to ensure that a soil sample is now in the sampler.

Once a soil sample has been removed from the ground, it can be extruded using the Geoprobe. The tools supplied by Geoprobe Systems for extruding soil from probe-drive samplers do not require the Geoprobe to be folded and horizontal. If liners are used with large-bore samplers, extrusion is usually unnecessary. When extrusion is necessary for probe-drive samplers, use the following procedures:

1. Raise the foot of the hydraulic punch off the ground using the foot lever on the control panel.

2. Attach the extruder rack onto the foot of the punch so that its crossbeam rests on top of it.

3. Completely disassemble the sampler. In all cases, remove the piston, point, and drive head of the sampler. If using the Kansas and large-bore samplers, unscrew the removable cutting shoe as well.

4. Insert the sample tube into the extruder with its cutting end up.

5. Insert a disposable wooden dowel or the reusable steel piston above the soil and below the hydraulic punch so that pressure on the dowel or piston from the punch will push the soil out of the bottom of the sample tube.

6. Position proper sampling jars or trays under the sample tube and very slowly use the probe lever to force the soil out of the tube. Injury can result if the soil is quickly forced from the tube.

The soil sample is now ready for packaging or on-site laboratory analysis. For large-bore samplers, the soil may be contained in a plastic sleeve that can be sliced away once the soil is to be packaged or in a brass sleeve that may be capped on both ends and shipped to the laboratory as is. Tetra Tech's SOPs on packaging and documenting samples for analysis should be followed when collecting samples using the Geoprobe System.

2.3.3 Soil Gas Sampling Procedures

The standard method and the PRT system are used for collecting soil gas using the Geoprobe System. The standard method requires the drive rods to be sealed together with either O-rings or Teflon tape to ensure an air-tight seal so that soil gas from depths other than the bottom of the drive-rod string cannot penetrate the system.

The PRT system draws soil gas through continuous tubing that is dropped through the drive rod after the drive rod has reached the desired level. The tubing is then attached directly to the point holder at the end of the drive-rod string.

For both methods, the drive rod should be driven to the desired depth. The drive cap should be replaced by the drive pull cap, and the rod should be pulled back out of the hole approximately 6 inches. This 6-inch void is the area where the soil gas sample is collected from. A pipe wrench or vise-grip pliers should be attached to the pipe just above the foot of the hydraulic punch so that the wrench or pliers rests on the foot to stop the drive rod from working its way back down into the hole.

Tygon tubing should be replaced between each sample for both sampling methods to avoid cross contamination.

The standard method and the PRT system sampling procedures are presented below. In addition, procedures for collecting soil gas in Tedlar bags, glass bulbs, and adsorption tubes is also presented below.

Standard Method

To gather a sample using the standard method, raise the hydraulic punch as mentioned above and replace the drive cap with a gas sampling cap. This cap is designed to fit the drive rods and is used to connect them by tube to a vacuum supply. Once the tubing has connected the gas sampling cap to the vacuum supply, remove the volume of air necessary to ensure that none of the gas being drawn was in the rod during probing, and then collect the sample in either Tedlar bags, glass bulbs, or adsorption tubes as discussed below.

PRT System

To use the PRT system (with either an expendable or a retractable point) to collect soil gas samples use the following procedures:

1. Secure the PRT adapter to the end of a piece of polyethylene tubing 1 to 2 feet longer than the total length of the drive-rod string. The adapter must fit tightly within the tubing. If it does not, tape it into place. Also, ensure that the O-ring is in place on the threaded end of the adapter.

2. Remove the drive cap from the probing rod and lower the adapter into it, holding on to the tubing.

3. Grasp the excess tubing and apply downward pressure. Turn the tubing counter-clockwise to engage the adapter threads on the sampler holder.

4. Pull up lightly on the tubing to test engagement of threads. If the adapter has not engaged, try again. If it repeatedly does not engage, soil may have intruded into the drive rod either during probing or, in the case of the retractable point, when the rod was pulled back to leave the point opening. Use the threaded extrusion rods to clean out the threads.

5. In most cases, the adapter will easily screw into place. The sampler is now ready to collect samples in either Tedlar bags, glass bulbs, or adsorption tubes using the procedures presented below. After the sample is collected and the sampler and tube is removed from the ground, the O-ring should be checked to ensure that a good seal exists between the sampler and adapter. If the O-ring is tightly smashed, the seal should be good.

6. Discard polyethylene tubing and use new polyethylene tubing for each sample.

Tedlar Bags

Soil gas can be collected for chemical analysis in a 500-cubic-centimeter Tedlar gas sampling bag by inducing a vacuum on the exterior of the bag. The following procedures should be used to collect soil gas samples in Tedlar bags:

1. For the PRT system, connect a short (6- to 12-inch) piece of Tygon tubing to the free end of the polyethylene tubing protruding out of the drive rod. For the standard method, connect the Tygon tubing to the soil gas sampling cap.

2. Attach the other end of the Tygon tubing to one end of the Tedlar bag chamber. Tetra Tech uses modified, plastic, air-tight kitchen containers for these chambers. They are inexpensive and work well.

3. Connect another piece of Tygon tubing 2 feet to 3 feet long to the other end of the Tedlar bag chamber and to the nipple on the bottom of the vacuum system panel.

4. Place the lid on the Tedlar bag chamber.

5. Turn the vacuum/volume (vac/vol) pump switch on and allow pressure to build in the vacuum tank. Make sure that the vacuum line valve is closed before turning on the pump switch.

6. Open the vacuum line valve and purge three times the volume of ambient air out of the Tedlar bag chamber and PRT tubing or probe rods. The equations for determining purge volumes are as follows:

   Probe rods or tubing

   $$V = \pi r^2 H$$

   where

   V = Volume
   π = 3.14159
   r = Radius of tube or rod
   H = Length of tube or rod

Vacuum chamber

$$V = LWH$$

where

V = Volume
L = Length of chamber
W = Width of chamber
H = Height of chamber

7. Close the line valve.

8. Clamp the Tygon tubing shut with hemostats.

9. Remove the lid from the Tedlar bag chamber.

10. Connect a Tedlar gas sampling bag to the fitting inside the Tedlar bag chamber and open the valve on the gas sampling bag.

11. Place the lid back on the Tedlar bag chamber, seal it tightly, and remove the hemostats.

12. Turn the vac/vol pump switch on and open the vacuum line valve to create a vacuum in the chamber. The Tedlar bag should fill once the vacuum is created. The rate at which the Tedlar gas sampling bag fills depends on the permeability of the soil. The minimum amount of soil gas needed for analysis is approximately 0.5 liter. If less than 0.5 liter is collected after 4 minutes of sampling, raise the soil gas probe 0.5 foot and continue to evacuate the vacuum chamber for another minute. If the minimum required volume of soil gas is not collected, repeat the procedure. If the minimum required volume of soil gas is still not collected, abandon the collection process. All steps conducted should be accurately recorded in the logbook even if no samples are satisfactorily collected.

13. After the soil gas sample is collected in the Tedlar bag, clamp the Tygon tubing with hemostats.

14. Turn off the vacuum pump.

15. Remove the vacuum chamber lid.

16. Close the valve on the Tedlar gas sampling bag and remove the bag from the chamber. Label the Tedlar bag with the appropriate information.

Glass Bulbs

The following procedures should be used to collect soil gas in glass bulbs:

1. Turn the vac/vol pump switch on and allow pressure to build in the vacuum tank. Make sure that the vacuum line valve is closed before starting the vacuum pump. The inside scale of the vacuum tank gauge is calibrated in inches of mercury. The outside scale is calibrated for volume in liters (at standard temperature and pressure). Obtain the desired vacuum and turn the vacuum pump off.

2. Connect a short (6- to 12-inch) piece of Tygon tubing to the sample cap or PRT protruding from the drive rod.

3. Connect one end of the labeled glass bulb to the Tygon tubing.

4. Connect another piece of Tygon tubing 3 feet to 5 feet long to the other end of the glass bulb and to the nipple on the bottom of the vacuum system panel.

5. Open the two stopcocks on the glass bulb.

6. Turn off the vacuum pump.

7. Turn the vacuum line valve to its open position.

8. Purge three times the volume of ambient air within the rods, bulb, and tubing. Equations for figuring out volumes are presented in the Tedlar bag discussion.

9. Turn the vacuum line valve to its closed position. Allow the pressure in the sample train to equalize (the sample line gauge should read zero).

10. Close the stopcocks on the glass bulb.

11. Remove the glass bulb and label it with the appropriate information.

Adsorption Tubes

The following procedure should be used to collect soil gas in adsorption tubes:

1. Connect a short (6- to 12-inch) piece of Tygon tubing to the sample cap or PRT protruding from the drive rod.

2. Connect this piece of tubing to the nipple on the bottom of the vacuum system panel and purge three volumes of air from the drive rod or PRT system as described in the discussion of the Tedlar bag method.

3. Use hemostats to clamp the Tygon tubing attached to the drive rod or PRT.

4. Insert the adsorption tube between the Tygon tubing from the drive rod or PRT and the Tygon tubing attached to the vacuum system panel.

5. Remove the hemostats and draw the required volume of air through the adsorption tube.

6. Remove the adsorption tube and place the appropriate caps on the tube ends.

7. Clearly label package, and ship the samples as required by the laboratory or Tetra Tech and U.S. Environmental Protection Agency (EPA) SOPs.

Soil Gas Sampling Pointers

If the needle on the vacuum line valve does not move, the soil at the sampling depth may be saturated, pore space may be too tight to yield a sample, or sampling train may be plugged. If the needle moves back to zero very quickly, either the soil at the sampling depth is very permeable or a leak is present in the sampling train.

In some soils, the needle may return to zero very slowly. The time it takes for the needle to return to zero is called the "recovery" time. Recovery time should be noted for each sample taken. This information will allow relative comparison of soil permeability. Recovery times of greater than 10 minutes should be considered suspect. The effect of leakage in the sampling system increases with longer recovery times. After 10 minutes, the operator should consider either changing the sampling depth, location, or length of pullback from the sampling tip, or switching entirely from soil gas sampling to grab sampling and analysis of soil.

2.3.4 Groundwater Sampling

The two options for sampling groundwater using the Geoprobe System follow procedures similar to those presented in Sections 2.3.2 and 2.3.3 above. The sections below detail procedures for using mill-slotted well point samplers and Geoprobe screen point samplers to sample groundwater.

Mill-Slotted Well Point Sampler

Once the mill-slotted well point reaches groundwater, the water will begin to flow through the slots. When the sample is to be analyzed for volatile organic compounds, do not use a vacuum to suck groundwater from the drive rod. If the sample is to be analyzed for other parameters such as metals, semivolatiles, pesticides, or explosives, using a vacuum on the drive rod is acceptable. In all cases, polyethylene tubing can be used as a thieving rod by lowering its end into the drive rod, capping or sealing the tube's top, and then removing it. The preferred method for collecting samples for volatile organic analysis is to use a well mini-bailer. To collect groundwater samples with a mini-bailer, use the following procedures:

1. Raise the hydraulic punch, turn off the hydraulic system, and remove the drive cap.

2. Lower a well mini-bailer into the drive rod until it reaches the bottom. As it reaches the bottom, the check ball on the bailer's end will float in the groundwater and then slowly sink to the bottom.

3. Allow a couple of seconds for the ball to sink and set.

4. Pull the well mini-bailer out of the drive rod. The bailer should contain about 20 milliliters of groundwater.

5. Package and document the samples in accordance with Tetra Tech SOPs No. 016, 017, 018, and 019, or a similar EPA-approved procedure.

If a bailer is not required and volatile organic samples are not being collected, a foot valve sampler, vacuum trap, or peristaltic pump can be used to collect samples. Once the sample has been removed and packaged, the mill-slotted well point can be removed and decontaminated.

Geoprobe Screen Point Sampler

The Geoprobe screen point sampler contains a screen and screen plug that allows water to enter the rod. To collect groundwater samples with a Geoprobe screen point sampler, use the following procedures:

1. Push the sampler below the depth necessary to reach groundwater.

2. Raise the hydraulic punch and replace the drive cap with a pull cap. Also, remove the anvil.

3. Latch the pull cap under the hammer latch, and use the probe lever to lift the drive rod about 18 inches. Because the sampler has a expendable point, the point should stay at the deepest depth, and the screen and screen connector should fall out of the bottom of the sampler. Sometimes, however, the screen stays within the sampler and is lifted the 18 inches with the drive rod.

4. To ensure that the screen is exposed, attach a vice grip or pipe wrench to the rod above the foot of the hydraulic punch and raise the hydraulic punch. Then remove the pull cap

and place an extension rod through the tubing to push the screen into place. Additional extension rods can be attached to reach the desired depth.

To remove the groundwater sample for volatile organic analysis, with a well mini-bailer, follow steps 1 through 5 under the mill-slotted well point section above. Tubing can be used as a thieving rod with or without a check valve to collect groundwater samples as well. If the sampler is supplied with the optional PRT expendable point holder, then a PRT adapter can be pushed through the drive rod and threaded into place by following the PRT system Procedures previously discussed. A vacuum trap system or peristaltic pump can then be used to withdraw the sample. The PRT system method, however, should never be used when the sample is to be analyzed for volatile organic compounds because it involves using a vacuum to remove the sample.

3.0 PIEZOMETER AND VAPOR SAMPLING IMPLANT INSTALLATION PROCEDURES

The Geoprobe System's ability to quickly probe into soil allows for easy installation of both piezometers and vapor sampling implants. Both installation procedures are discussed below.

3.1 PIEZOMETER INSTALLATION

Piezometers are tubes that extend to groundwater and enable easy sampling of groundwater on a routine basis (see Figure 10). In addition to installing the piezometer, piezometers must be protected from the weather and from contamination. A well-head protector must therefore be installed around them. In some soil types, preparing the well-head protector may be the first step to installing a piezometer. For this reason, the directions below should be read completely before beginning piezometer installation. If a post-hole digger is to be used for well-head protector installation, Procedure 5 should be performed first. The piezometer should then be advanced through this hole.

To install temporary or permanent piezometers, use the following procedures:

1. Use the hydraulic punch to drive the temporary casing to the desired piezometer installation depth. Use the general procedures outlined in Section 2.3.1 above for details on driving the piezometer casing. The different temporary casings that can be used are described below. Geoprobe Systems also manufactures special drive caps, expendable points, and pull caps that fit these types and sizes of pipe.

a) 1-7/16-inch outside diameter by 1-3/16-inch inside diameter, RW-flush threaded pipe can be used as a temporary casing. This casing can be driven to an approximately 25- to 30-foot depth. Two sizes of piezometer wells can be installed inside of the temporary casing: (1) 3/4-inch outside diameter by 1/2-inch inside diameter, polyvinyl chloride (PVC) pipe, or (2) 1-inch outside diameter by 3/4-inch inside diameter, PVC pipe.

b) 1-13/16-inch outside diameter by 1-1/2-inch inside diameter, EW-flush threaded pipe can be used as a temporary casing. This casing can be driven to an approximately 15- to 20-foot depth. Three sizes of piezometer wells can be installed inside of the temporary casing: (1) 3/4-inch outside diameter by 1/2-inch insider diameter PVC pipe, or (2) 1-inch outside diameter by 3/4-inch inside diameter, PVC pipe, or (3) 1-1/2-inch outside diameter by 1-inch inside diameter, PVC pipe.

c) 1-1/4-inch outside diameter by 1-inch inside diameter, NPT-threaded pipe can be used as a temporary casing. This casing can be driven to an approximately 25- to 30-foot depth. Only 3/4-inch outside diameter by 1/2-inch inside diameter, PVC pipe piezometer wells can be installed inside of the temporary casing. If using NPT-threaded pipe, couplers are needed to attach each section of pipe.

2. Once the piezometer casing is at the proper depth, remove the drive cap and install the selected size piezometer pipe inside of the temporary casing.

3. Using a pull plate, remove the temporary casing.

4. If the hole stays open, attempt to install a sand pack around the slotted portion of the piezometer, and then place dry granular bentonite on top of the sand pack as a seal. One foot of bentonite is recommended for a good seal.

5. Dig an 8-inch nominal-diameter hole around the piezometer pipe. This hole should extend to a depth of 1.5 to 2 feet. A post-hole digger can be used for this procedure if the hole is dug prior to driving the temporary casing. The bottom 6 inches of this hole should be filled with dry granular or slurry bentonite. The remainder of the hole should be filled with concrete. A steel, locking, aboveground or flush-mount well protector should be inserted into the wet concrete to provide well-head security. A concrete pad can also be constructed around the steel well-head protector.

3.2 VAPOR SAMPLING IMPLANT INSTALLATION

Figure 11 presents diagrams of vapor sampling implants. To install vapor sampling implants, first punch a drive rod to the desired depth using an expendable point holder and an expendable point. Once at the desired sampling depth, use the following procedures:

1. Disengage the expendable point and retract the probe rod about 1 foot by raising the hydraulic punch, replacing the drive cap with a pull cap, removing the anvil, latching the pull cap onto the hydraulic hammer using its latch, and raising the hydraulic punch again using the probe lever.

2. Lock the rod into place so that it does not sink back into the hole by using vice grip pliers or a pipe wrench.

3. Unlatch the pull cap and raise the hydraulic punch again, leaving room to work freely.

4. Remove the pull cap.

5. Attach appropriate stainless-steel tubing to the vapor implant. If tubing is precut, allow 48 inches more than the required depth of the implant.

6. Insert the implant and tubing down the inside diameter of the probe rods until it stops. Note the length of the tubing inserted to ensure that the desired depth has been reached. Allow the excess tubing to extend out of the drive rod's top.

7. Pour glass beads down the inside diameter of the probe rod using a funnel to create a permeable layer around the implant.

8. Use the tubing extending from the drive rod to stir the beads into place. Do not lift up on the tubing while doing so.

9. Position the remaining tubing through the hole on a rod pull plate, and then place the drive rod through that hole.

10. Attach the plate to the hydraulic punch using its chain and slowly pull the rod up another 18 to 24 inches. While the punch pulls the rod, push down on the tubing so that it stays in place.

11. Pour bentonite seal mixture down the inside diameter of the probe rod. Stir the mixture using the tubing as before. The initial mixture may also be topped with distilled water to initiate the bentonite seal depending on the site and on the role the vapor implant is to play.

12. Pull the drive rod from the hole using the probe rod pull plate already attached, and then plug the hole using granular bentonite or a bentonite slurry mixture.

The vapor sampling implant should now be in place and the stainless steel tubing connected to it should be protruding from the ground. The vapor implant tubing should be protected by a well-head protector in the same manner as the top of the piezometer. Procedure 5 in Section 3.1 describes well-head protector installation.

4.0 ROD REMOVAL PROCEDURES

Throughout the above discussions, it has occasionally been necessary to remove drive rods and samplers. The standard removal procedures involve raising the hydraulic punch, turning off the hydraulic system, replacing the drive cap with a pull cap, removing the anvil, and then latching the pull cap under the hammer latch. The hydraulic punch can then be used to pull the rod from the ground.

Two deviations to this procedure often occur. The first deviation is necessary when sampling tubes are to be left inside the hole as the drive rod is removed, especially when soil gas implants or piezometers have been installed. Because of the presence of these sampling tubes, a pull cap cannot be screwed onto the top of the drive rod. Instead, a rod pull plate is used. This plate is a piece of steel with a hole in it large enough for a drive rod to fit through it. The plate has a hook on one end. The tubing and rod are pushed through the plate, and the pull plate is attached to the latch on the hydraulic punch by a chain. As the punch pulls up, the plate shifts, and the inside of the hole binds on the rod. This binding usually holds the rod to the plate and results in the rod being pulled up as the punch is raised.

The second deviation occurs when the rods have not been pushed perpendicular to the ground. In these cases, a specially designed chain-assisted pull cap is used. This cap looks like a pull cap but has a chain on it that fits under the latch of the hammer. Once the cap is screwed to the drive rod and latched to the probe, raising the probe raises the rod.

In a few cases, drive rods break while in the ground. To retrieve these rods, a rod extractor is used. This extractor looks something like a drill bit and is screwed to the end of a probe rod. A hammer is then used to pound the extractor into the top of the broken rod. The extractor joins the broken rod to the second drive rod so that they can be pulled out together.

5.0 BACKFILLING PROCEDURES

Unless otherwise specified in the site-specific sampling plan, holes made by sampling with Geoprobe System tools are to be backfilled with dry, fine, granular bentonite. Water may be added to activate the bentonite. Tops of the holes may then be filled with soil or concrete as necessary for each particular site.

6.0 DECONTAMINATION PROCEDURES

Between holes, the probe rods and sampling tools must be decontaminated. Because no provisions for decontamination are included in the Geoprobe System, a separate decontamination station must be provided. A wire brush, a barrel brush for reaming out the rods, and soft brushes will clean sticky soil from the probe rods and sampling tools. Follow Tetra Tech SOP No. 002 decontamination procedures when sampling soil or groundwater.

When sampling for soil gas by the standard method, Geoprobe rods and samplers are heated approximately 15 to 20 minutes by a 100,000-British thermal unit heater until they are too hot to touch with the bare hand. They are then allowed to cool before reuse. Do not heat the rods too much or the rod metal will fatigue.

When sampling for soil gas by the PRT method, the probe rods do not have to be decontaminated. However, the PRT expendable point holder and PRT adapter do need to be decontaminated. They can be heated on the dash of the vehicle with the defrost system or scrubbed in Alconox and water. Equipment blank samples can be collected, if necessary, as part of the quality control process.

Sampling plans may have different decontamination requirements. Most plans also require rinsate sample collection as part of the quality control process.

FIGURE 1

GEOPROBE SYSTEM

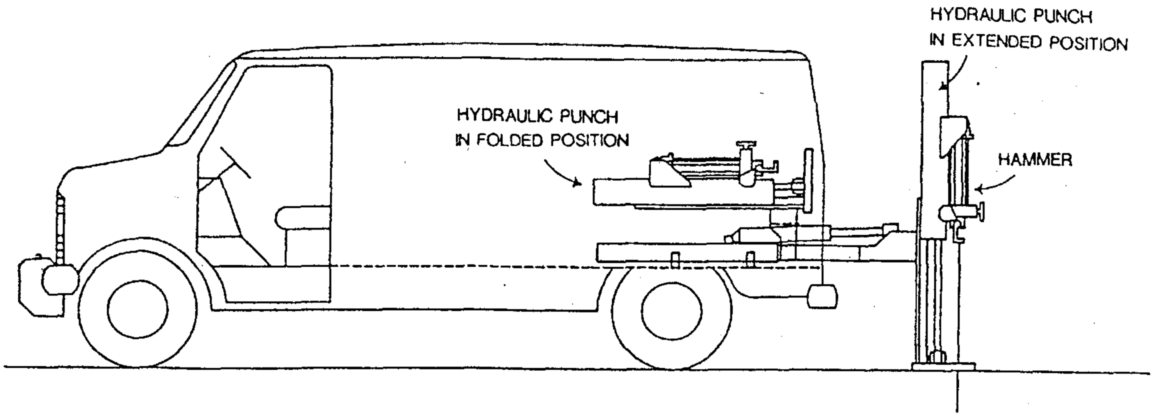
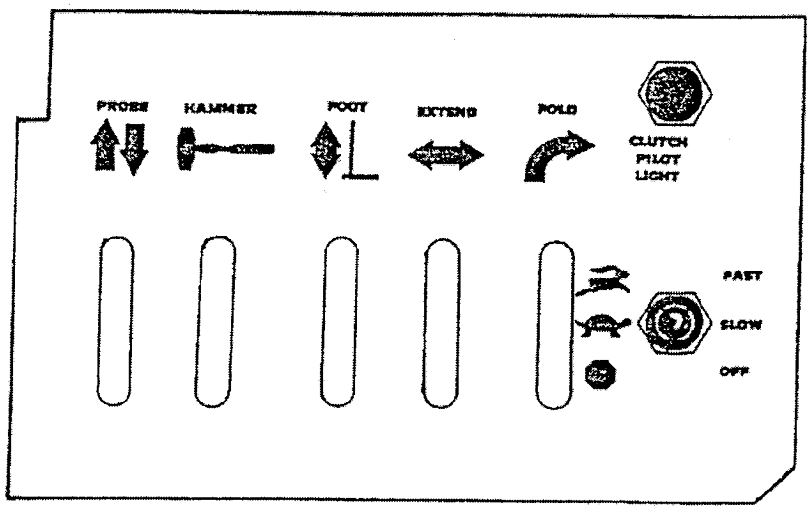
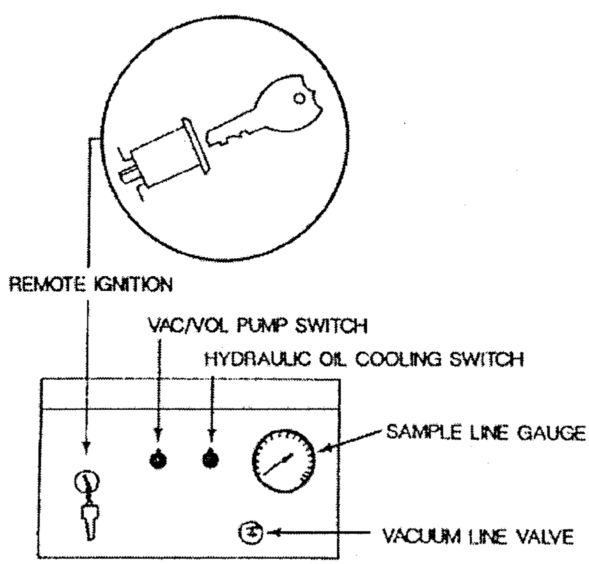


FIGURE 2

CONTROL AND VACUUM SYSTEM PANELS



CONTROL PANEL



VACUUM SYSTEM PANEL

FIGURE 3

GENERAL ACCESSORY TOOLS

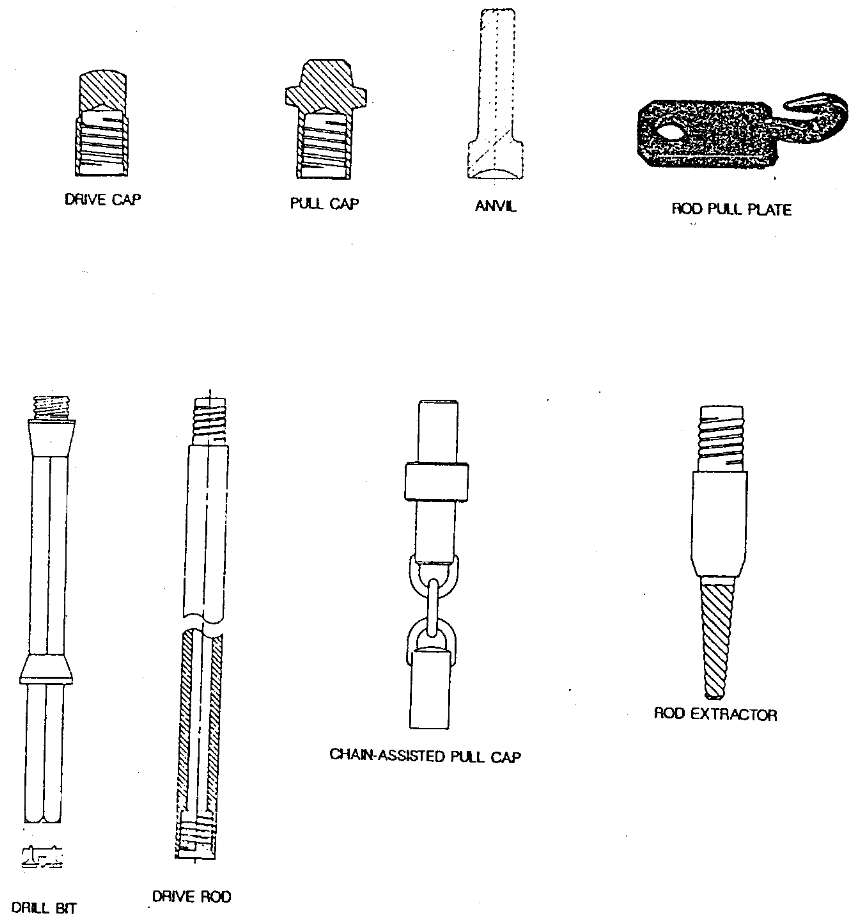
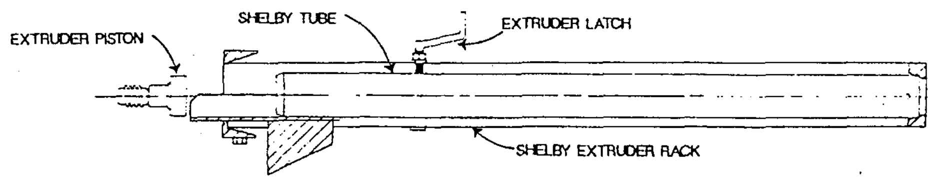


FIGURE 4

SHELBY TUBE ACCESSORIES



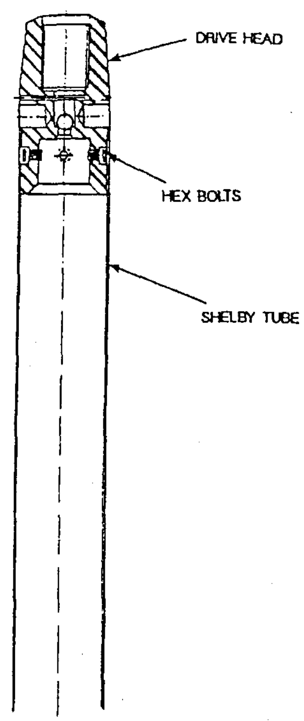


FIGURE 5

PROBE-DRIVE SYSTEM

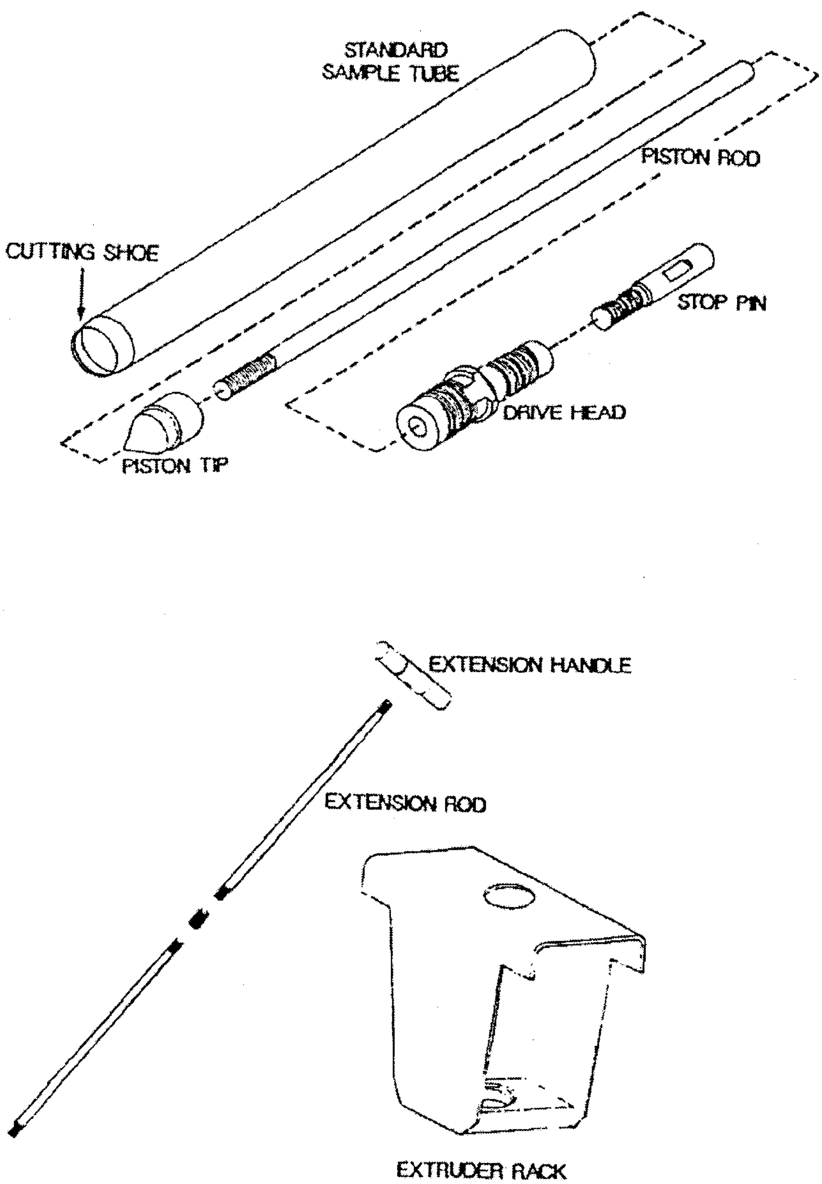


FIGURE 6

STANDARD SOIL GAS TOOLS

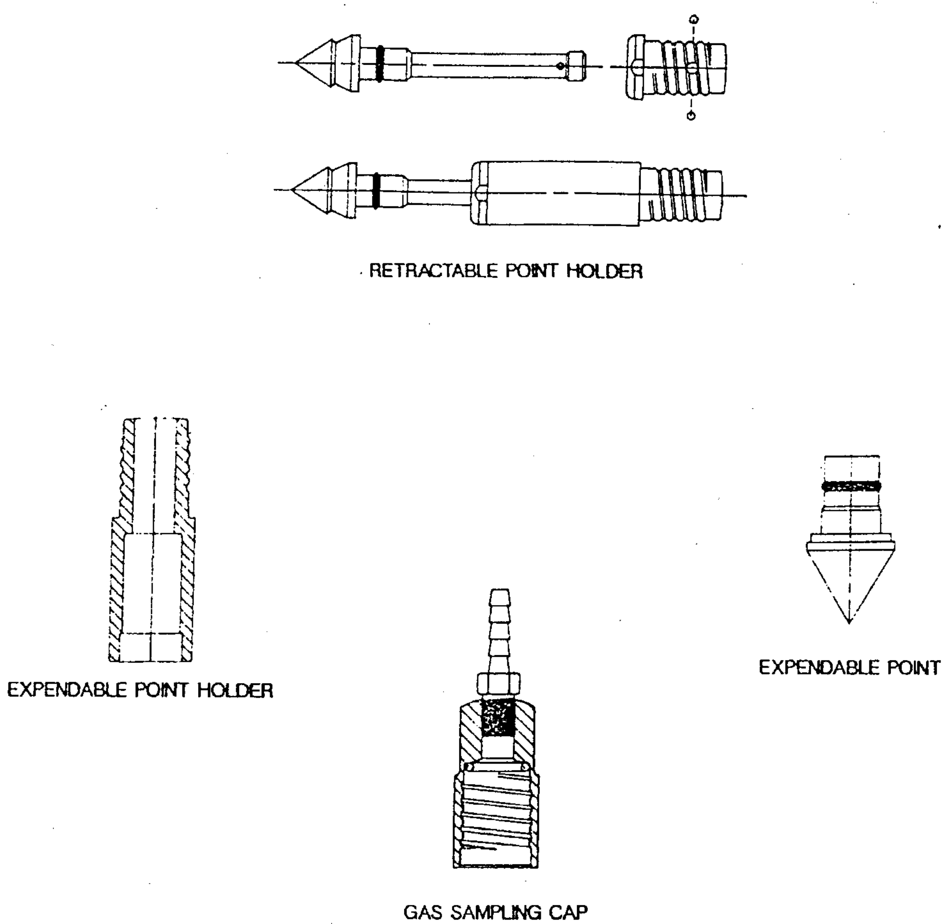


FIGURE 7

POST-RUN TUBING (PRT) SYSTEM

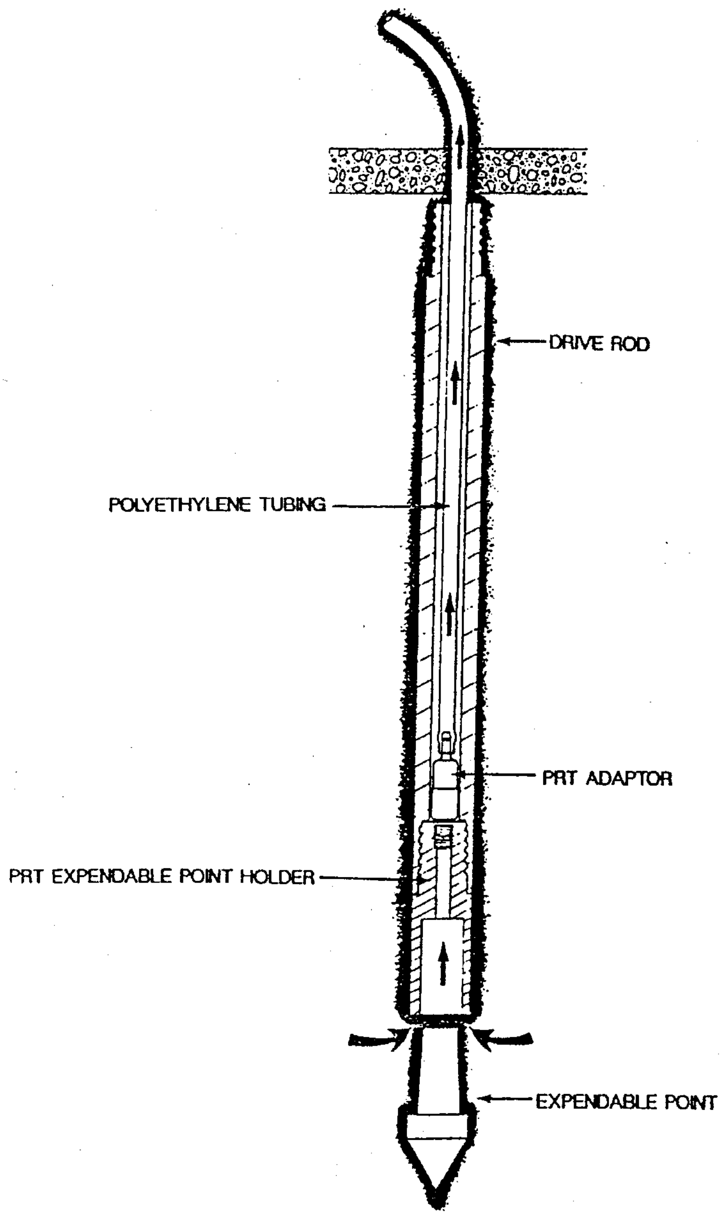
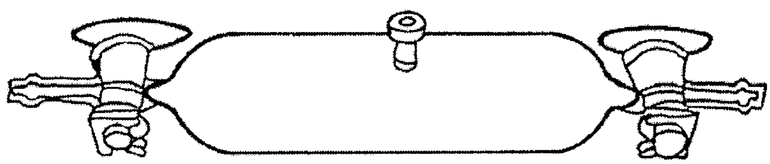


FIGURE 8

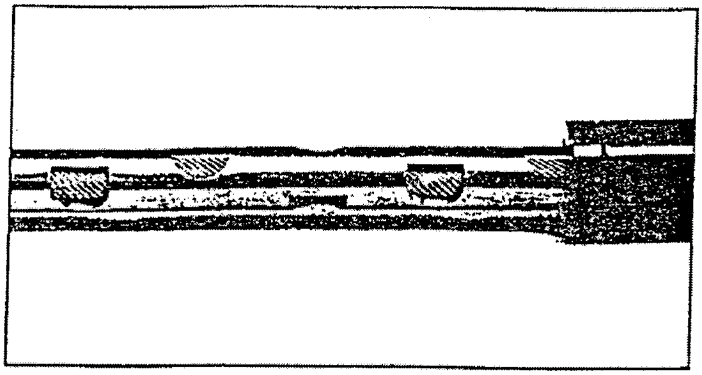
SOIL GAS SAMPLE CONTAINER



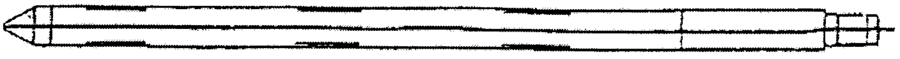
Note: Tedlar bags are also used for collection of soil gas samples; however, they are not shown on this figure.

FIGURE 9

GROUNDWATER SAMPLING TOOLS



SCREEN POINT SAMPLER IN OPEN POSITION



MILL-SLOTTED WELL POINT

FIGURE 10

PIEZOMETER INSTALLATION

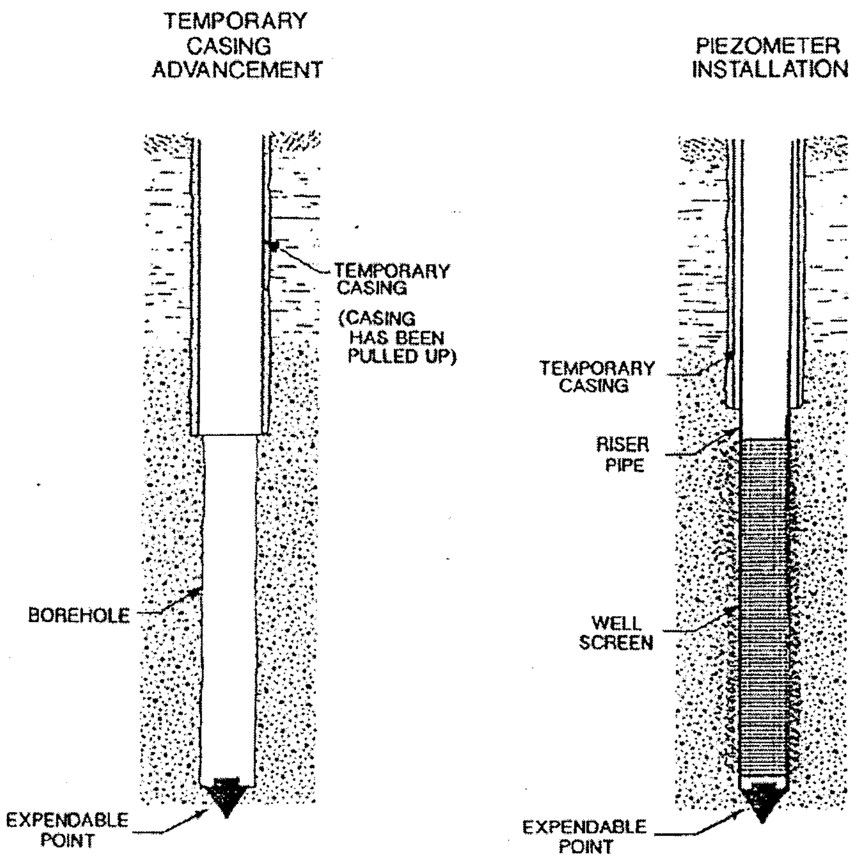
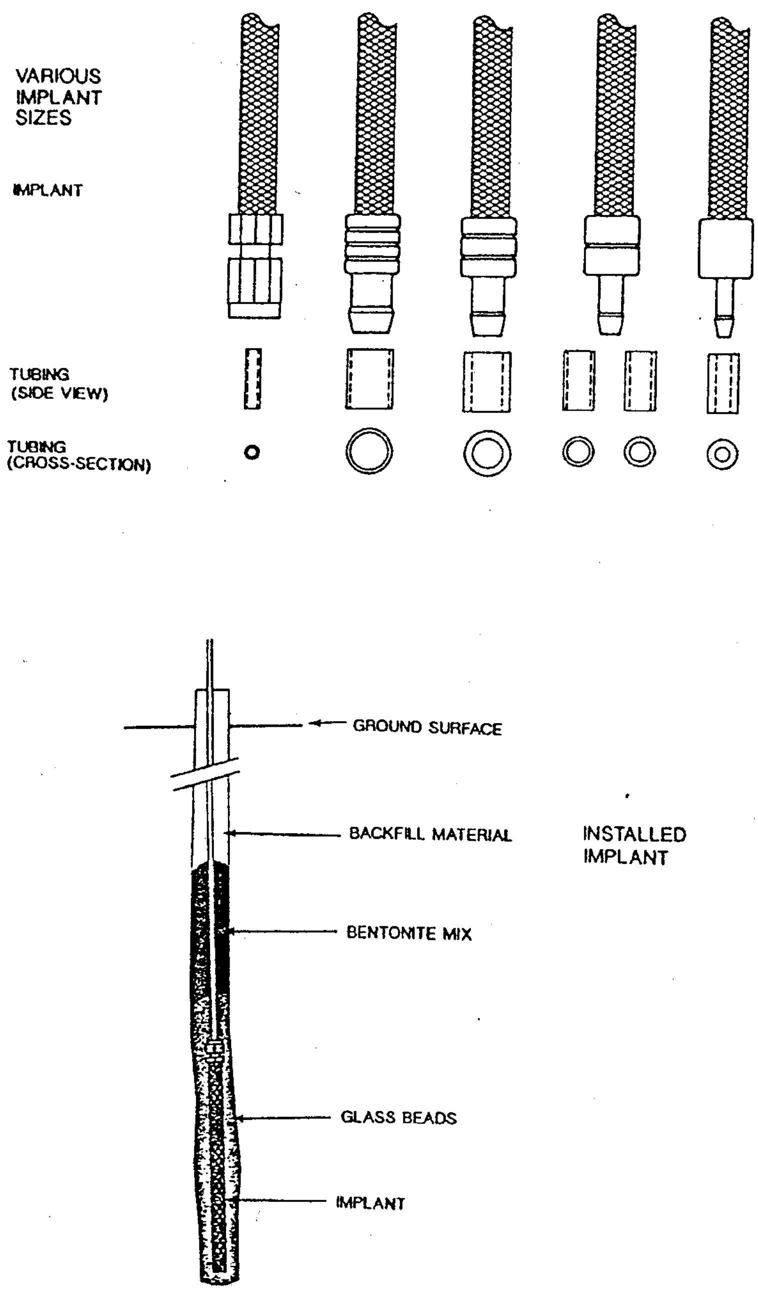


FIGURE 11

VAPOR SAMPLING IMPLANTS



APPENDIX C
FIELD FORMS

Chain of Custody

Extended Chain of Custody

Tetra Tech EM Inc.

CHAIN OF CUSTODY RECORD

10670 White Rock Road, Suite 100
Rancho Cordova, CA 95670
(916) 852-8300 FAX (916) 852-8307

DATE	CHAIN OF CUSTODY NUMBER № 6360
LABORATORY NUMBER	PAGE ____ OF ____

PROJECT NAME	PROJECT MANAGER
PROJECT NUMBER	TELEPHONE NUMBER
PROJECT LOCATION	DESTINATION LABORATORY
SAMPLER(S)	ADDRESS
SAMPLER SIGNATURE(S)	CITY STATE ZIP
SITE CONTACT/ TELEPHONE NUMBER	LABORATORY TELEPHONE NUMBER

REQUESTED ANALYSES

SAMPLE IDENTIFICATION	DATE	TIME	MATRIX TYPE	NO./TYPE OF CONTAINERS	TURN AROUND TIME											REMARKS (GRAB, COMPOSITE, ETC.)

SHIPPED VIA:

AIRBILL #: ____________

SPECIAL INSTRUCTIONS:

RELINQUISHED BY (SIGNATURE)	PRINT NAME/ COMPANY	DATE	TIME	RECEIVED BY (SIGNATURE)	PRINT NAME/ COMPANY	DATE	TIME
				RECEIVED AT LAB BY (PRINT AND SIGN):			

DISTRIBUTION: WHITE = LABORATORY YELLOW = PROJECT MANAGER PINK = FILE

10670 White Rock Rd. S-100
Rancho Cordova
California 95670
(916) 852-8300
Tetra Tech EM Inc.

EXTENDED CHAIN-OF-CUSTODY #:

(FOR SOIL BORING AND GROUNDWATER SAMPLES)

DATE: Page of

PROJECT NAME	PROJECT #
SAMPLER(S) PRINTED NAME AND SIGNATURE	SAMPLING TEAM #

THIS FORM IS FOR INTERNAL USE ONLY
DO NOT SEND TO LABORATORY
SEND TO PROJECT CHEMIST

SAMPLE I.D.	FIELD I.D.	COLLECTION DATE	POINT NAME	SAMPLE TYPE*	POINT TYPE*	MATRIX*	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	SAMPLER'S COMPANY

REMARKS: *(Note: Identify equipment rinsates, trip blanks, field duplicates, or other QC samples)*

INSTRUCTIONS: Complete all columns for each row you use. Enter only the codes listed below for columns containing and asterisk (*). Enter the three initials for the field sampler who collected the sample. Draw a vertical arrow down the column if an entry row applies to additional rows in the same column. Consult the project chemist for POINT NAMES prior to beginning field activities.

SAMPLE TYPE
- FB = Field Blank
- TB = Trip Blank
- ER = Equipment Rinsate
- DUP = Field Duplicate
- WC = Waste characterization
- Real = Real Sample
- (Note: For samples collected in triplicate for MS/MSD, place "Real/MS/MSD" in Sample Type)

POINT TYPE
- MW = Monitoring Well
- SB = Soil Boring
- SL = Surface Location
- TANK = Underground storage tank
- EXCV = Excavation pit
- MHSD = Storm drain manhole
- MHSS = Sanitary sewer manhole
- MHI = Industrial waste manhole
- QC = QC sample

MATRIX
- SOIL
- WATER
- SEDIMENT
- SLUDGE
- AIR
- SOIL GAS
- PRODUCT
- TISSUE
- PLANTS

APPENDIX D
PROJECT-REQUIRED REPORTING LIMITS

TABLE D-1: COMPARISON OF PROJECT-REQUIRED REPORTING LIMITS AND PRELIMINARY REMEDIATION GOALS, METALS METHODS 6010B, 7199, AND 7196A

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Analyte	Industrial Soil PRG (mg/kg)	Residential Soil PRG (mg/kg)	Soil PRRL[a] (mg/kg)	Soil PRRL Below PRG?
Soil				
Cadmium	450	37	1.0	Yes
Chromium (total)	450	210	2.0	Yes
Chromium (hexavalent)	64	30	0.05	Yes
Copper	41,000	3,100	0.5	Yes
Lead	NA	150	0.15	Yes
Nickel	20,000	1,600	1.0	Yes
Silver	5,100	390	0.25	Yes

Analyte	California MCL (µg/L)	Groundwater PRRL[a] (µg/L)	Groundwater PRRL Below MCL?
Groundwater			
Cadmium	5	5	Yes
Chromium (total)	50	10	Yes
Chromium (hexavalent)	NA	0.5	NA
Copper	1,000	10	Yes
Lead	15	5	Yes
Nickel	100	8	Yes
Silver	100	10	Yes

Notes:

a The listed PRRL reflects the maximum sensitivity of current, routinely used analytical methods. The listed PRRL will be used as the project screening criteria unless reasonable grounds are established for pursuing nonroutine methods.

µg/L Micrograms per liter
mg/kg Milligrams per kilogram
MCL Maximum contaminant level (California Department of Health Services. 2003. "Maximum Contaminant Levels in Drinking Water." June 12.)
NA Not available
PRG Preliminary remediation goal (EPA. 2002. "Region 9 Preliminary Remediation Goals." October 1. On-line address: http://www.epa.gov/region09/waste/sfund/prg/index.htm)
PRRL Project-required detection limit

APPENDIX E
APPROVED AECRU LABORATORIES

TABLE E-1: TETRA TECH EM INC.-APPROVED AECRU LABORATORIES UNDER BASIC ORDERING AGREEMENT

IWTP 360 Closure Confirmation Sampling, Naval Air Station Alameda

Analytica Group	
Lab Address:	12189 Pennsylvania Street
	Thornton, CO 80241
Point of Contact:	Joe Egry / Mary Fealey
Phone:	(800) 873-8707 X103/X135
Fax:	(303) 469-5254
Business Size:	SWO
E-mail	mfealey@analyticagroup.com

Applied Physics and Chemistry Laboratory	
Lab Address:	13760 Magnolia Avenue
	Chino, CA 91710
Point of Contact:	Dan Dischner / Eric Wendland
Phone:	(909) 590-1828 X203/X104
Fax:	(909) 590-1498
Business Size:	SDB
E-mail	marketing@apclab.com

Columbia Analytical Services	
Lab Address:	5090 Caterpillar Road
	Redding, CA 96003
Point of Contact:	Karen Sellers / Howard Boorse
Phone:	(530) 244-5262 / (360) 577-7222
Fax:	(530) 244-4109
Business Size:	LB
E-mail	lkennedy@kelso.caslab.com

Curtis and Tompkins, Ltd	
Lab Address:	2323 Fifth Street
	Berkeley, CA 94710
Point of Contact:	Anna Pajarillo / Mike Pearl
Phone:	(510) 486-0925 X103/ X108
Fax:	(510) 486-0532
Business Size:	SB
E-mail	mikep@ctberk.com

EMAX Laboratories Inc.	
Lab Address:	1835 205th Street
	Torrance, CA 90501
Point of Contact:	Ye Myint / Jim Carter
Phone:	(310) 618-8889 X121/X105
Fax:	(310) 618-0818
Business Size:	SDB/WO
E-mail	ymyint@emaxlabs.com

Laucks Laboratories	
Lab Address:	940 S. Harney Street
	Seattle, WA 98108
Point of Contact:	Mike Owens / Kathy Kreps
Phone:	(206) 767-5060
Fax:	(206) 767-5063
Business Size:	SB
E-mail	KathyK@lauckslabs.com

Sequoia Analytical	
Lab Address:	1455 McDowell Blvd. North, Suite D
	Petaluma, CA 94954
Point of Contact:	Michelle Wiita
Phone:	(707) 792-7517
Fax:	(707) 792-0342
Business Size:	LB
E-mail	

Notes:

DHS	California Department of Health Services
LB	Large business
SB	Small business
SDB	Small disabled business
SWO	Small woman-owned
WO	Woman-owned

APPENDIX F
SITE-SPECIFIC SAFETY AND HEALTH PLAN (SHORT FORM)

Site Name: Alameda Point	**Site Contact:** Glynis Foulk	**Telephone:** (916) 853-4561
Location: Industrial Waste Treatment Plant (IWTP) 360	**Client Contact:** Doug DeLong	**Telephone:** (415) 743-4713
EPA I.D. No.: CA2170023236	**Prepared By:** Glynis Foulk	**Date:** 1/9/04
Project No. G90160330502	**Date of Proposed Activities:** February 2004	

Objectives:

All personnel working on this site must be trained in accordance with 29 CFR 1910.120 and must have medical clearance to work on a hazardous waste site.

The objective of this short form health and safety plan (HASP) is to list the site-specific hazards and the hazards controls to be used to ensure worker safety for the activities described below.

Tetra Tech employees will conduct oversight activities only.

Site Type: *Check as many as applicable.*

☐ Active	☒ Industrial Waste	☐ Well field
☒ Inactive	☐ Landfill	☐ Underground storage tank
☐ Secure	☐ Confined space **(must use long form)**	☐ Unknown **(must use long form)**
☐ Unsecure	☐ Uncontrolled Waste **(must use long form)**	☐ Other *(specify)* ____

Site Description/History and Site Activities:

IWTP 360 was constructed in 1973 and taken out of service in 1994. IWTP 360 treated chromium and cyanide wastewater generated from metal plating operations in the plating shop within Building 360. All tanks, underground sumps, associated aboveground equipment, and the concrete pad have been decontaminated and removed from IWTP 360. Soil and groundwater sampling has been conducted under previous investigations; however, additional sampling is needed in two areas. IWTP 360 is located within the boundaries of CERCLA Site 4. The groundwater within CERCLA Site 4 is contaminated with chlorinated hydrocarbons.

One of the suspected source areas is the former location of IWTP 360. Soil and groundwater samples have been collected in the area; however, DTSC has requested that the Navy verify the lateral extent of metals in soil. DTSC has also requested additional groundwater samples in the vicinity of the former IWTP 360 to determine whether IWTP activities have affected groundwater. A concrete surface supported by vertical wood timbers resembling remnants of an old pier was observed at the southern end IWTP 360 and was left in place. Soil and groundwater sampling has been and will continue to be impeded by this underground structure.

The second suspected source area is the area along the waste pipelines from Building 360 to IWTP 360. Soil and groundwater samples were collected along the pipeline in 2002. DTSC has requested collection of additional soil and groundwater samples at 25-foot intervals along the pipeline. Subsurface soil and groundwater characterization data are needed to determine whether the underground pipelines may have leaked and caused soil or groundwater contamination.

The purpose of the closure confirmation sampling at IWTP 360 is to obtain the additional soil and groundwater characterization data that are needed to obtain RCRA closure of IWTP 360 from two areas: (1) in the vicinity of IWTP 360 and (2) along the pipelines from Building 360 to IWTP 360.

The proposed work will consist of collecting soil and groundwater samples from the two areas using direct push equipment in the vicinity of the former IWTP 360 and vacuum excavation equipment (or other boring equipment capable of collecting soil and groundwater samples adjacent to underground pipelines without damaging the pipelines) along the pipelines from Building 360 to the IWTP.

Note: A site map, definitions, and additional information about this form are provided on the last three pages of this form.

Waste Management Practices:

IWTP 360 treated chromium and cyanide wastewater generated from metal plating operations in the plating shop within Building 360. IWTP 360 was constructed in 1973, taken out of service in 1994, and completely demolished by 2000.

Waste Types:	☒ Liquid	☐ Solid	☐ Sludge	☐ Gas
Waste / Chemical Characteristics:	☒ Corrosive	☐ Oxidizer	☐ Flammable	
☒ Toxic	☐ Explosive	☐ Volatile	☐ Radioactive	
☐ Reactive	☐ Inert		☐ Other *(specify)* ____________	

Chemical / Health Hazards of Concern:

☐ Explosion or fire hazard – monitor with combustible gas meter	☒ Inorganic chemicals
☐ Oxygen deficiency – monitor with oxygen meter	☐ Organic chemicals
☐ Landfill gases – monitor with methane and hydrogen sulfide meter	☐ Petroleum Hydrocarbons
☐ Surface tanks	☐ Underground storage tanks
☐ Potential inhalation or skin absorption hazard that is immediately dangerous to life and health (IDLH) – **must use long form**	☐ Other *(specify)* ____________

Explosion or Fire Potential: ☐ High ☐ Medium ☒ Low ☐ Unknown

Radiological Hazards of Concern:

- ☐ Ionizing radiation (Radioactive materials, X-ray) **(must use long form)**
- ☐ Non-ionizing radiation (ultraviolet, lasers)

Safety Hazards of Concern: (Based on anticipated clean-up operations)

- ☒ Heavy Equipment
- ☒ Pinch points
- ☒ Energized and rotating equipment (drill rig)
- ☒ Steam cleaning equipment
- ☐ Excavations
- ☐ Welding or torch cutting (Hot work)
- ☐ Sharp Objects
- ☐ Hazardous energy sources (electrical, hydraulic)
- ☒ Buried utilities
- ☐ Overhead utilities
- ☐ Suspended loads
- ☐ Buried drums
- ☐ Work over or near water
- ☐ Work from elevated platforms
- ☐ Manual Lifting
- ☐ Other *(specify)* ____________

Physical Hazards of Concern:

- ☐ Heat stress
- ☒ Cold stress
- ☒ Slips, trips, falls
- ☐ Illumination
- ☐ Vibration
- ☒ Noise
- ☐ Solar (sunburn)
- ☐ Unstable or steep terrain
- ☐ Other *(specify)* ____________

Biological Hazards of Concern:

- ☐ Poisonous plants (poison ivy, poison oak)
- ☐ Spiders (black widow or brown recluse spiders)
- ☐ Medical waste
- ☐ Snakes (rattlesnakes)
- ☐ Stinging insects (bees, wasps)
- ☐ Animals (feral dogs, mountain lions, etc.)
- ☐ Blood or other body fluids

Unexploded Ordnance:

- ☐ Unexploded Ordnance (UXO) **(must use long form)**
- ☐ Chemical Warfare Materials (CWM) **(must use long form)**
- ☐ Explosive ordnance waste (OEW) **(must use long form)**

Chemical Products Tetra Tech EMI Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- ☒ Alconox® or Liquinox®
- ☐ Hydrochloric acid (HCl)
- ☐ Nitric Acid (HNO_3)
- ☐ Sodium hydroxide (NaOH)
- ☐ Sulfuric Acid (H_2SO_4)
- ☐ Other *(specify)* ______________________
- ☐ Other *(specify)* ______________________
- ☐ Other *(specify)* ______________________
- ☐ Other *(specify)* ______________________
- ☐ Other *(specify)* ______________________
- ☐ Other *(specify)* ______________________

Chemicals Present at Site	Highest Observed Concentration (specify units and media)	Cal-OSHA PEL (specify ppm or mg/m^3)	Exposure Route	Symptoms and Effects of Acute Exposure	Photo-ionization Potential (eV)
Benzene	3,000 µ/L (GW)	1 ppm	Skin Absorption Inhalation	Acute: eye, mucous membrane, throat, and skin irritation; CNS depression (headache, nausea, dizziness, and fatigue); Chronic: carcinogen; damage to bone marrow and known to the State of California to cause cancer and reproductive toxicity under the criteria of Proposition 65	9.24
Cadmium	32 mg/kg (soil) 0.4 µ/L (GW)	0.005 mg/m^3	Inhalation	Acute: eye, skin, and lung irritation; difficulty breathing; pulmonary edema; and nasal ulceration Chronic: lung and prostrate cancer; kidney and liver damage; loss of bone density; and known to the State of California to cause cancer and reproductive toxicity under the criteria of Proposition 65	NA
Chromium (Total)	422 mg/kg (soil) 105 µ/L (GW)	0.5 mg/m^3	Inhalation	Acute: irritant Chronic: none	NA
Chromium (Hexavalent)	1 mg/kg (soil) 10 µ/L (GW)	0.01 mg/m^3	Inhalation	Acute: severe irritant; Chronic: carcinogen (lung cancer) and known to the State of California to cause cancer and reproductive toxicity under the criteria of Proposition 65	NA
Copper	63 mg/kg (soil) 6 µ/L (GW)	0.1 mg/m^3	Inhalation	Acute: GI irritation; and metal fume fever (if welding) Chronic: none	NA
Lead	90 mg/kg (soil) 3 µ/L (GW)	0.05 mg/m^3	Inhalation	Acute: affects CNS; anemia; weakness; weight loss; pallor; tremors; and muscle pain Chronic: accumulation in the body leads to anemia, constipation, and abdominal pain; accumulation in the peripheral nerves leads to wrist and ankle drop; and known to the State of California to cause cancer and reproductive toxicity under the criteria of Proposition 65	NA

Chemicals Present at Site	Highest Observed Concentration (specify units and media)	Cal-OSHA PEL (specify ppm or mg/m^3)	Exposure Route	Symptoms and Effects of Acute Exposure	Photo-ionization Potential (eV)
Nickel	165 mg.kg (soil) 7 µ/L (GW)	1 mg/m^3	Inhalation	Acute: sensitization dermatitis Chronic: carcinogen (lung and nasal cancer) and known to the State of California to cause cancer and reproductive toxicity under the criteria of Proposition 65	NA
Silver	10 mgkg (soil) 5 µ/L (GW)	0.01 mg/m^3	Inhalation	Acute: eye, skin, and lung irritation; local or generalized impregnation of mucous membranes, skin, and eyes with silver Chronic: lung damage	NA
Cis-1,2-dichloroethene	8,600 ug/L (GW)	200 ppm	Inhalation	Acute: eye and respiratory system irritation; CNS depression (headache, nausea, dizziness, and fatigue) Chronic: none	9.65
Trichloroethene	24,000 ug/L (GW)	25 ppm	Inhalation	Acute: CNS depression (headache, nausea, dizziness, and fatigue); skin contact causes defatting of the skin; dermatitis; heart sensitization Chronic: damage to liver and animal carcinogen and known to the State of California to cause cancer and reproductive toxicity under the criteria of Proposition 65	9.45
Vinyl chloride	2,200 ug/L (GW)	1 ppm	Inhalation	Acute: eye and respiratory system irritation; CNS depression (headache, nausea, dizziness, and fatigue) Chronic: Causes liver cancer; known to the State of California to cause cancer under the criteria of Proposition 65	9.99

A = Air
CARC = Carcinogenic
eV = Electron volt
GW = Groundwater (within Site 4)
IDLH = Immediately dangerous to life or health
mg/m^3 = Milligram per cubic meter
ppm = Part per million
S = Soil
SW = Surface water
TLV = Threshold limit value
U = Unknown

Field Activities Covered Under This Plan:

Task Description [1]	**Type**	**Level of Protection**		**Date of Activities**
		Primary	**Contingency**	
1 Conduct oversight of subcontractor; Subcontractor will use direct push and vacuum excavation (or other) equipment to collect soil and groundwater samples	☒ Intrusive ☐ Nonintrusive	☐ C ☒ D	☐ C ☐ D	February 2004
2 *	☐ Intrusive ☐ Nonintrusive	☐ C ☐ D	☐ C ☐ D	*

Site Personnel and Responsibilities (include subcontractors):

Employee Name and Office Code	**Task**	**Responsibilities**
Glynis Foulk	1	Program Manager or Designated Leader: Directs project investigation activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary.
Brad Shelton	1	Site Safety Coordinator (SSC): Ensures that appropriate personal protective equipment (PPE) is available, enforces proper utilization of PPE by on-site personnel, suspends investigative work if he or she believes that site personnel are or may be exposed to an immediate health hazard, implements the health and safety plan, and reports any observed deviations from anticipated conditions described in the health and safety plan to the health and safety representative.
Sub-contractor	1	Field Personnel: Complete tasks as directed by the program manager, field team leader, and SSC and follow all procedures and guidelines established in the Tetra Tech EMI Health and Safety Manual.
Glynis Foulk	1	Alternate Site Safety Coordinator (SSC): See above

[1] ***Make copies of this page if more than 2 tasks are anticipated for the project.***

Protective Equipment: (Indicate type or material as necessary for each task; attach additional sheets as necessary)

Task: ☒ 1 ☐ 2 Level: ☐ C ☒ D ☒ Primary ☐ Contingency	Task: ☒ 1 ☐ 2 Level: ☒ C ☐ D ☐ Primary ☒ Contingency
RESPIRATORY ☒ Not needed ☐ APR: ____ ☐ Cartridge: ____ ☐ Escape mask: ____ ☐ Other: ____	RESPIRATORY ☐ Not needed ☒ APR: Full face ☒ Cartridge: Organic vapor ☐ Escape mask: ____ ☐ Other: ____
PROTECTIVE CLOTHING ☒ Not needed ☐ Tyvek® coveralls: ____ ☐ Saranex® coveralls: ____ ☐ Coveralls: ____ ☐ Other: ____	PROTECTIVE CLOTHING ☐ Not needed ☒ Tyvek® coveralls: ____ ☐ Saranex® coveralls: ____ ☐ Coveralls: ____ ☐ Other: ____
HEAD AND EYE ☐ Not needed ☒ Safety glasses: ____ ☐ Face shield: ____ ☐ Goggles: ____ ☒ Hard hat: ____ ☐ Other: ____	HEAD AND EYE ☐ Not needed ☒ Safety glasses: ____ ☐ Face shield: ____ ☐ Goggles: ____ ☒ Hard hat: ____ ☐ Other: ____
GLOVES ☐ Not needed ☐ Undergloves: ____ ☒ Gloves: Nitrile ☐ Overgloves: ____	GLOVES ☐ Not needed ☐ Undergloves: ____ ☒ Gloves: NItrile ☐ Overgloves: ____
FIRST AID EQUIPMENT ☐ Not needed ☒ Standard First Aid kit ☐ Portable eyewash	FIRST AID EQUIPMENT ☐ Not needed ☒ Standard First Aid kit ☐ Portable eyewash
BOOTS ☐ Not needed ☒ Work boots: Steel-Toe/Steel ☐ Overboots: ____	BOOTS ☐ Not needed ☒ Work boots: Steel-Toe/Steel ☐ Overboots: ____
OTHER ☒ (specify): Hearing protection, if needed.	OTHER ☒ (specify): Hearing protection, if needed.

Note: APR = Air purifying respirator

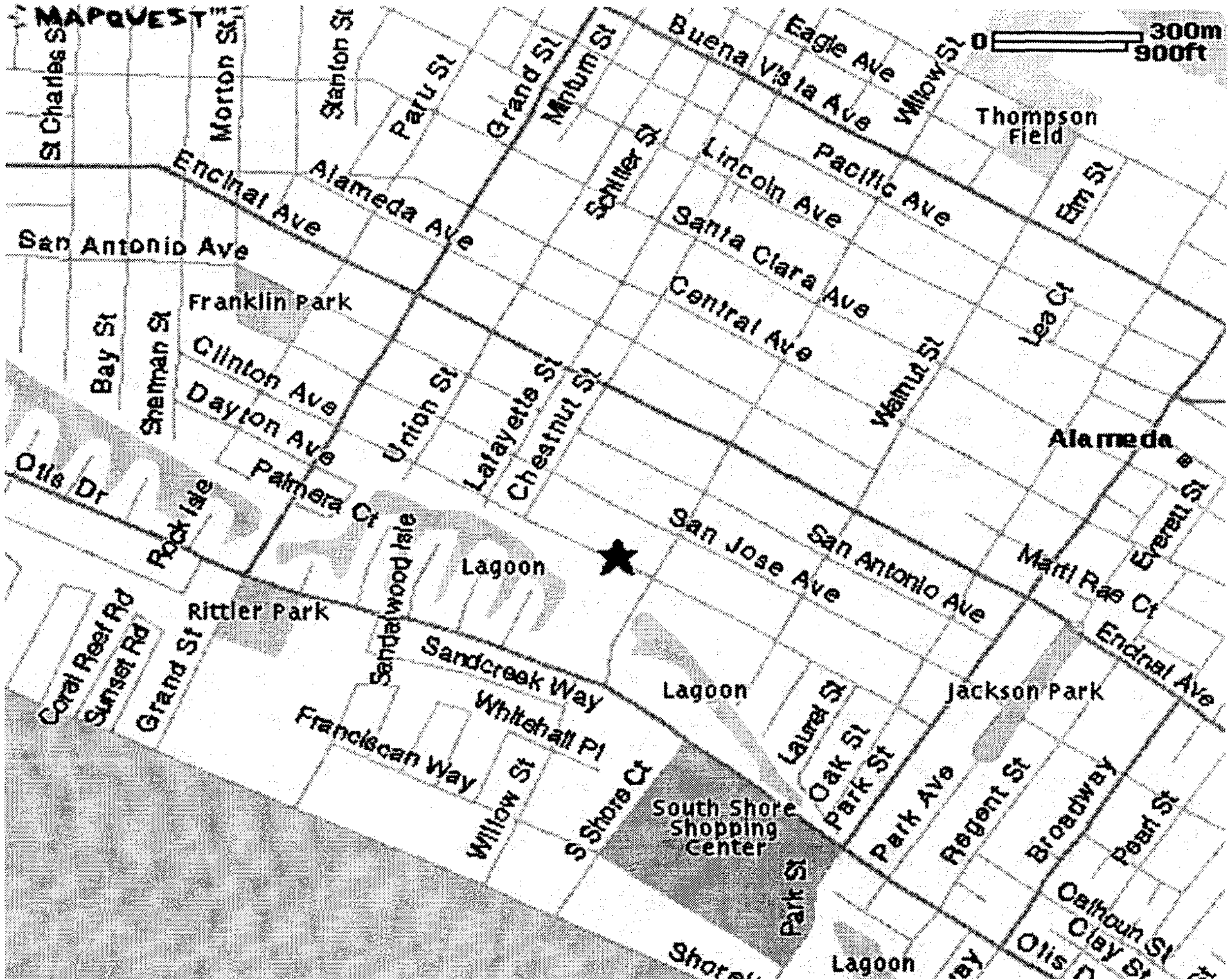
Monitoring Equipment: (Specify instruments needed for each task; attach additional sheets as necessary)				
Instrument	Task	Instrument Reading	Action Guideline	Comments
Combustible gas indicator model:	☐ 1	0 to 10% LEL	No explosion hazard	☒ Not needed
	☐ 2	10 to 25% LEL	Potential explosion hazard; notify SSC	
		> 25% LEL	Explosion hazard; interrupt task; evacuate site, notify SSC	
O2 meter model:	☐ 1	> 23.5% O2	Potential fire hazard; evacuate site	☒ Not needed
	☐ 2	23.5 to 19.5% O2	Oxygen level normal	
		< 19.5% O2	Oxygen deficiency; interrupt task; evacuate site; notify SSC	
Photoionization detector model:	☒ 1	>0 to 5 ppm above background	Level D	☐ Not needed
☐ 11.7 eV ☒ 10.6 eV	☐ 2	>5 to 50 ppm above background	Level C (or leave immediate area and allow vapors to dissipate)	
☐ 9.8 eV ☐ ____eV		>50 ppm above background	Evacuate site; notify SSC	
Flame ionization detector model:	☐ 1	>0 to 5 ppm above background	Level D	☒ Not needed
	☐ 2	>5 to 50 ppm above background	Level C	
		>50 ppm above background	Evacuate site; notify SSC	
Detector tubes models:	☐ 1 ☐ 2	Specify:	Specify:	Note: This action level for upgrading the level of protection is one-half of the contaminant's PEL. If the PEL is reached, evacuate the site and notify the SSC. ☒ Not needed
Respirable dust monitor model:	☐ 1 ☐ 2	Specify:	Specify:	☒ Not needed
Other: (specify):	☐ 1 ☐ 2	Specify:	Specify:	☒ Not needed

Notes: eV = Electron volt
LEL = Lower explosive limit
PEL = Permissible exposure limit
ppm = Part per million
O_2 = Oxygen

Additional Comments:	**Emergency Contacts:** **Telephone**
Tetra Tech EMI site workers will contain and absorb any chemicals used or transferred on site.	U.S. Coast Guard National Response Center 800/424-8802 InfoTrac 800/535-5053 Fire department 911 Police department 911 Tetra Tech EMI Personnel: Corporate Human Resource Manager: Norman Endlich 703/390-0626 Corporate Health & Safety Manager: Judith Wagner 847/818-7192 Office Health & Safety Coordinator: Rich Howell (916) 853-4571 Program Manager: Glynis Foulk (916) 853-4561 Site Safety Coordinator: Brad Shelton (916) 853-4559
Personnel Decontamination and Disposal Method:	**Medical Emergency:**
Personnel will follow the U.S. Environmental Protection Agency's "Standard Operating Safety Guides" for decontamination procedures for Level D personal protection (with modified Level C contingency). The following decontamination stations should be set up in each decontamination zone: • Segregated equipment drop • Boot and glove wash and rinse • Disposable glove, bootie, and coverall removal and segregation station • Safety glasses and hard hat removal station • Hand and face wash and rinse If site conditions require upgrade to Level C, a station must be set up for respirator removal, respirator decontamination, and cartridge disposal. All disposable equipment, clothing, and wash water will be double-bagged or containerized in an acceptable manner and disposed of in accordance with local regulations.	Hospital Name: Alameda Hospital Hospital Address: 2070 Clinton Avenue Hospital Telephone: Emergency - 911 General - 510/522-3700 Ambulance Telephone: 911 Route to Hospital: (see next two pages for route map and directions to hospital)

Note: This page must be posted on site.

Hospital Route Map (if available):



Hospital Route Map (if available):

MEDICAL FACILITIES AND DIRECTIONS
Hospital:

Alameda Hospital
2070 Clinton Avenue
Alameda, CA
Hospital Number: (510) 522 – 3700

Directions from NAS Alameda to Alameda Hospital:
From the main gate:Follow Main Street to Atlantic Avenue. Turn left onto Atlantic Avenue heading east, then follow directions below.

From the east gate:Drive straight onto Atlantic Avenue heading east, then follow directions below.

From Atlantic Avenue heading east:

- Take Atlantic Avenue to Webster Street (California Highway 61). Turn right onto Webster Street heading south.
- Turn right onto Webster heading south.
- Take Webster Street two blocks south to Buena Vista Avenue.
- Turn left onto Buena Vista Avenue heading east.
- Take Buena Vista Avenue for 1.7 miles east to Willow Street.
- Turn right onto Willow Street heading south.
- Take Willow Street nine blocks south to Clinton Avenue.

The hospital is at 2070 Clinton Avenue on the southeast corner of Clinton Avenue and Willow Street.

Note: This page must be posted on site.

APPROVAL AND SIGN-OFF FORM

Project No. G90160330502

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator as well as procedures and guidelines established in the Tetra Tech EMI Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Name	Signature	Date

APPROVALS: (Two Signatures Required)

Brad Shutto — Site Safety Coordinator — Date 1/19/04

Stephen Farell — Program Manager or Designee — Date 1/19/04

DEFINITIONS

Intrusive - Work involving excavation to any depth, drilling, opening of monitoring wells, most sampling, and Geoprobe® work

Nonintrusive - Generally refers to site walk-throughs or field reconnaissance

Levels of Protection

Level D - Hard hat, safety boots, and glasses, may include protective clothing such as gloves, boot covers, and Tyvek® or Saranex® coveralls

Level C - Hard hat, safety boots, glasses, and air purifying respirators with appropriate cartridges, **PLUS** protective clothing such as gloves, boot covers, and Tyvek® or Saranex® coveralls

Emergency Contacts

InfoTrac - For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center - For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Health and Safety Plan Short Form

- Used for field projects of limited duration and with relatively limited activities; may be filled in with handwritten text
- Limitations:
  - No Level B or A work
  - Limited number of tasks
  - No confined space entry
  - No unexploded ordnance work or radiation hazard