FINAL

MANAGEMENT PLAN
FOR NAPL FIELD EXPLORATION

McCormick and Baxter Superfund Site
Stockton, California

June 16, 1999

Prepared for

EPA
REGION 9

U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California 94105-3901

Prepared by

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98134

URS Greiner Woodward Clyde
2401 4th Avenue, Suite 808
Seattle, Washington 98121-1459
53F0072166

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June 16, 1999

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EXECUTIVE SUMMARY

This Management Plan describes the activities associated with the nonaqueous-phase liquid (NAPL) field exploration to be conducted for the McCormick and Baxter Superfund Site, Stockton, California. Soil and groundwater at the site are contaminated with creosote, pentachlorophenol, and metals that were used to preserve wood at this former wood-treating facility.

The primary objective of this field work is to better characterize the concentration, composition and extent of NAPL in the subsurface that is a source of organic contamination. Secondary objectives of this project are to document the extent of groundwater contamination, evaluate the potential for sidewall soils along the slough to contaminate the sediment cap, and investigate the possibility of polychlorinated biphenyl (PCB) contamination in the Cellon process area.

The components of the exploration include a geophysical survey; use of the U.S. Army Corps of Engineers (USACE) Site Characterization and Analysis Penetrometer System (SCAPS) for mobile data collection; installation of soil borings, monitoring wells, and microwells; collection of soil, NAPL, and groundwater samples for analysis; and soil treatability testing.

The primary purpose for additional data collection at the site is to evaluate the feasibility of using in situ thermal treatment methods to enhance removal of NAPL from the site and develop an effective groundwater cleanup strategy.

The Management Plan presented here consists of a Work Plan, Sampling and Analysis Plan (which includes a Field Sampling Plan and a Quality Assurance Project Plan), Investigation-Derived Waste Plan and a Site Safety and Health Plan.

FINAL

WORK PLAN
FOR NAPL FIELD EXPLORATION

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ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
bml	below mud line
CIH	Certified Industrial Hygienist
CLP	Contract Laboratory Program
COC	chemical of concern
CPT	cone penetrometer testing
DCQCR	daily chemical quality control report
DHS	Department of Health Services (now DTSC)
DNAPL	dense nonaqueous-phase liquid
DO	dissolved oxygen
DQO	data quality objective
DTSC	Department of Toxic Substances Control (State of California)
EPA	U.S. Environmental Protection Agency
FASP	Field Analytical Support Program
FSP	field sampling plan
GC/FID	gas chromatography/flame ionization detector
GC/MS	gas chromatography/mass spectroscopy
GSA	General Services Administration
ICP	inductively coupled plasma
LCS	laboratory control sample
LIF	laser-induced fluorescence
LIMS	Laboratory Information Management System
LNAPL	light nonaqueous-phase liquid
MCL	maximum contaminant level
MDL	method detection limit
MQL	method quantitation limit
MRL	method reporting limit
MS/MSD	matrix spike/matrix spike duplicate
NAD	North American Datum
NAPL	nonaqueous-phase liquid
NGDV	National Geodetic Vertical Datum of 1929
NPL	National Priorities List
NPSC	Newark-Sierra Paper Corporation
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzodioxin
PCDF	polychlorinated dibenzofuran
PCP	pentachlorophenol

ABBREVIATIONS AND ACRONYMS (Continued)

PE	performance evaluation
PEM	performance evaluation mixture
PID	photoionization detector
PM	project manager
POL	petroleum, oil, and lubricants
PRG	preliminary remediation goal
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QLS	quantitation limit standard
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RPD	relative percent difference
RSD	relative standard difference
RWQCB	Regional Water Quality Control Board
SAP	sampling and analysis plan
SCAPS	Site Characterization and Analysis Penetrometer System
SDG	sample delivery group
SOP	standard operating procedure
SVOC	semivolatile organic compound
TAL	target analyte list
TCDD	tetrachlorodibenzo-p-dioxin
TEQ	toxicity equivalent concentration
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TPH-Dx	total petroleum hydrocarbon – diesel extended
TRPH	total recoverable petroleum hydrocarbon
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

UNITS OF MEASURE

µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
ng/kg	nanograms per kilogram
pg/L	picograms per liter (1 x 10^{-12} grams per liter)

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is assisting the U.S. Environmental Protection Agency (EPA) Region 9 in conducting a pre-remedial design field exploration for the former McCormick and Baxter Creosoting Company, located at 1214 West Washington Street in Stockton, California. This Work Plan defines the objectives of the investigation and provides details of the work to be performed to meet the project objectives.

1.1 OBJECTIVES

Soil and groundwater at the McCormick and Baxter Superfund site are contaminated primarily with creosote, pentachlorophenol (PCP), and metals that were used as wood preservatives. Free-phase product is known to exist in the subsurface as well as dissolved contaminants in groundwater and adsorbed contaminants on the solid phase. The primary objective of this field exploration is to collect data required to better define the type and extent of nonaqueous-phase liquid (NAPL) contamination and evaluate the geologic restraints to assess appropriate in situ thermal treatment technologies that will enhance the removal of contaminants from the subsurface. Site-specific factors that might impact the effectiveness/deployment of in situ thermal technologies include vertical and horizontal distribution of NAPL with varying compositions; physical and chemical characteristics of the NAPL; depth of NAPL penetration; type, thickness, and heterogeneity of subsurface geologic material; and the presence of manmade subsurface structures/materials. Thermal treatment methods under consideration include steam injection/stripping and electrical heating.

Secondary objectives of this project are to document the extent of groundwater contamination, evaluate the potential for sidewall soils along the slough to contaminate the sediment cap, and investigate the possibility of polychlorinated biphenyl (PCB) contamination in the Cellon process area.

1.2 SCOPE

A dynamic approach to this field exploration has been developed to take into account the evolution of the conceptual site model as new data are collected. Several initial sampling locations have been selected for each of the exploration methods; however, the majority of the locations will be selected in the field based on the initial results of chemical and physical analyses conducted on site material. The scope of work for this field exploration consists of the following components:

- Conducting preliminary surveying of the site and salient features

- Conducting a geophysical investigation to delineate the location and shape of subsurface structures and metal debris

- Conducting Site Characterization and Analysis Penetrometer System (SCAPS) cone penetrometer testing (CPT) and laser-induced fluorescence (LIF) data collection to provide geotechnical and stratigraphic information as well as estimate the extent of petroleum hydrocarbon contamination in support of selecting a final groundwater remedy

- Performing SCAPS soil and groundwater sampling to verify and assist with interpretation of SCAPS LIF data and to delineate contaminant extent and characterize contaminant composition in support of selecting a final groundwater remedy

- Installing SCAPS microwells to collect groundwater elevation data and potentially to be used for NAPL collection

- Installing soil borings and monitoring wells to collect physical and chemical data

- Evaluating light nonaqueous-phase liquid (LNAPL) and dense nonaqueous-phase liquid (DNAPL) to characterize composition, evaluate movement and assist with final groundwater remediation alternative evaluation

- Analyzing soil in the Cellon process area for PCBs

- Performing sampling of Old Mormon Slough to evaluate the potential for sloughing of sidewall soil to recontaminate the cap above sediment cleanup standards thereby providing data to determine the need for bank protection

- Sampling groundwater monitoring wells to monitor contaminant migration and obtain information on natural attenuation potential and the capacity of the system

Details of these work items are provided in the overview of the sampling and analysis program (Section 6.4).

1.3 WORK PLAN CONTENTS

In accordance with USACE guidance EM 200-1-3 (U.S. ACE 1994), this Work Plan is intended to serve as the “umbrella” document for the site investigation. It addresses each of the topics listed in EM 200-1-3 and the scope of work for this project. This Work Plan has been organized in the following sections:

1. Introduction
2. Project Organization and Responsibilities
3. Background Information
4. Previous Investigations
5. Conceptual Site Model
6. Investigation Rationale and Approach
7. Data Review, Presentation and Interpretation
8. Communications, Data Management and Reporting
9. Schedule
10. References

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Key positions and personnel assigned to this project are described in this section.

2.1 EPA REMEDIAL PROJECT MANAGER (RPM): MARIE LACEY (EPA REGION 9)

The Remedial Project Manager (RPM) is the EPA authority for this project. All recommendations regarding cost and scope variations will be approved by Ms. Lacey prior to implementation. The RPM is the recipient of all project documents and will provide comments on draft versions of the documents to the USACE. Changes to documents and final versions will be approved by the RPM.

2.2 USACE PROJECT MANAGER (PM): CHERYL BUCKEL (ALBUQUERQUE DISTRICT USACE)

The USACE Project Manager (PM) will maintain specific project management authority throughout the life of the project, and is responsible for overall management and execution of the project to include project quality, cost and schedule. Specific tasks include:

- Providing the project team with funding for each task
- Tracking and reporting to EPA financial expenditures, obligations and schedule
- Facilitating the resolution of issues arising during the project
- Obtaining feedback from the team and customer, and ensuring that feedback, both positive and negative, is used to improve the project

2.3 PROJECT TECHNICAL TEAM LEADER/CHEMIST: KIRA LYNCH (SEATTLE DISTRICT USACE)

The Technical Team Leader is the primary liaison with EPA for this field program, and is responsible for keeping both the USACE PM and EPA RPM informed of project schedule, budget, and changes. Ms. Lynch has overall responsibility for achieving the technical objectives of this project. As Project Chemist, she, along with other core team members will be responsible for decisions regarding sampling locations and evolution of the dynamic work plan in the field.

Responsibilities will also include development of data quality objectives, selection of analytical methods and laboratories, approval of QA/QC procedures and review of daily field reports.

She will work closely with the other task managers, will be immediately notified if problems occur, and will approve changes to the Sampling and Analysis Plan if such changes are warranted. In the event that changes are needed, she will immediately notify and discuss the proposed changes with the RPM and furnish a description of the changes to the USACE PM prior to implementing those changes. Changes in the Sampling and Analysis Plan will not be made without prior approval from the Technical Leader and RPM unless conditions require immediate response in the field or laboratory. Any changes that involve additional funding beyond the existing slope must be approved by the USACE PM.

2.4 FIELD INVESTIGATION MANAGER: KIRA LYNCH, RICHARD SMITH, RANDY OLSEN, FRED HART

This role will be filled by one of the listed individuals at different intervals of the field work. The Field Investigation Manager is responsible for on-site performance of the field work, including adherence to the Sampling and Analysis Plan, change orders, scheduling, liaison with Technical Team Leader, sample logging, and custody. The Field Investigation Manager will also function as the Site Health and Safety Officer, and will be responsible for the safe operation of the field and laboratory teams. She/he will be responsible for implementation of the Health and Safety Plan, review of its contents with all personnel, confirm that all personnel have received the required health and safety training, determine personal protection levels, provide necessary personal protective equipment and supplies, and correct any unsafe work practices.

During fieldwork when the Technical Leader and/or RPM is not present, the Field Investigation Manager will be responsible for responding to direct requests from members of the community or others for information on current field activities at the site. A record of such communication shall be maintained and forwarded to the Technical Leader.

2.5 PROJECT SENIOR GEOLOGIST: RICHARD SMITH (SEATTLE DISTRICT USACE)

The Project Senior Geologist is responsible for planning site intrusive activities designed to fill geology data gaps and for the design and installation of new wells at the site. Mr. Smith will be on site during at least part of the SCAPS and sonic drilling activities. He also has responsibility for management, display, and interpretation of geologic data and revisions to the geologic and hydrogeologic conceptual site model.

2.6 SEDIMENT CAP TEAM LEADER/QA/QC OFFICER: JOHN WAKEMAN (SEATTLE DISTRICT USACE)

This position is the sediment cap point of contact. Mr. Wakeman will review soil results from slough sampling and evaluate the potential for recontamination of the sediment cap.

As QA/QC Officer, Mr. Wakeman is responsible for the quality of all sampling and analysis activities associated with the field exploration. He will oversee all aspects of the sampling and analysis events to ensure that the appropriate procedures and methods are used to meet the programs' QA objectives.

2.7 CERTIFIED INDUSTRIAL HYGIENIST (CIH): DAVID ELSKAMP (SACRAMENTO DISTRICT USACE)

The CIH will prepare the Health and Safety Plan for all field activities being performed between April and October 1999 for Sacramento and Seattle District USACE personnel. The CIH works directly with the Technical Leader and other project personnel. The CIH has the responsibility to monitor and verify that the work is performed in accordance with the Health and Safety Plan. The CIH will advise the Technical Leader regarding health and safety issues, but will function independently.

2.8 TREATABILITY TESTING LAB MANAGER: EVA DAVIS (EPA KERR LABORATORY)

Ms. Davis is responsible for the design and implementation of the laboratory treatability tests. She will also participate in selecting appropriate sampling locations and sample types, and will help refine the conceptual site model.

2.9 USACE PERSONNEL FOR FIELD EVENTS

Table 2-1 contains a list of USACE personnel and responsibilities during the field activities. Table 2-2 lists the Tulsa District SCAPS team supporting this exploration.

2.10 CONTRACTOR SERVICES

Table 2-3 is a list of all supporting groups and subcontractors and the services they will be providing for this project**.** These subcontractors are not on the General Services Administration (GSA) List of Parties Excluded from Federal Procurement or Non-Procurement Programs.

Table 2-1
McCormick and Baxter Superfund Site
USACE Personnel for Field Events

Name[a]	Role/Responsibility	USACE District
Kira Lynch Technical Leader Environmental Scientist 206-764-6918 (ph) 206-764-6795 (fax)	Groundwater Team Leader and Chemist Primary POC for NWS Responsible for decisions regarding sampling locations and evolution of dynamic work plan in the field Present throughout field activities drilling activities (SCAPS and sonic drilling), groundwater sampling, NAPL sampling, and slough soil sampling	Seattle District
Richard Smith Geologist 206-764-3309 (ph) 206-764-6795 (fax)	Senior Geologist for the Seattle District Geology POC during field events Lead responsible for data management and GMS Present during part of the drilling activities (SCAPS and sonic drilling)	Seattle District
John Wakeman Biologist 206-764-3430 (ph) 206-764-6795 (fax)	Sediment Cap Team Leader Sediment Cap POC for NWS Present during slough soil sampling	Seattle District
Glenn Terui/Joe Marsh	Groundwater Sampling	Seattle District
Fred Hart Geologist 916-557-6975 (ph) 916-557-5307 (fax)	Senior Geologist during sonic drilling for SPK	Sacramento District
Randy Olsen Environmental Engineer 916-557-5285 (ph) 916-557-5307 (fax)	Field Investigation Manager	Sacramento District
Jessica Hardy Geologist 916-557-7416 (ph) 916-557-5307 (fax)	Second Geologist during sonic drilling Assist in measurement of water levels, groundwater sampling, and drilling activities.	Sacramento District
Meegan Galie/Melissa Kieffer/Tim Crummett Engineers/Geologist	Will serve as backup personnel for field crew.	Sacramento District
Pam Wehrmann Chemist 916-557-6662 (ph) 916-557-5307 (fax)	SPK District Chemist SPK POC for chemistry	Sacramento District
Kenneth Regalado Survey Team Leader 916-557-7155 (ph) 916-557-6803 (fax)	Survey the entire McCormick and Baxter site on a 50' grid, survey the onsite wells to a 100th of a foot, and survey the sheet pile wall at 50' intervals.	Sacramento District

Table 2-1 (Continued)
McCormick and Baxter Superfund Site
USACE Personnel for Field Events

Name[a]	Role/Responsibility	USACE District
David Elskamp Industrial Hygienist 916-557-7903 (ph) 916-557-5307 (fax)	Prepare the Site Safety Health Plan for all field activities being performed between April and October 1999 for both Sacramento and Seattle District personnel.	Sacramento District

[a] Other McCormick and Baxter team members may visit site periodically; however, they do not have a primary role in field sampling activities.

Table 2-2
McCormick and Baxter Superfund Site Field Exploration
Tulsa District SCAPS Team

Name	Role/Responsibility	Location	Phone No.
Jim McDonald CESWT-EC-EI	Investigation Section Manager: Manages SCAPS field personnel and equipment, and addresses fieldwork issues as needed.	Office	Office: 918-832-4122 Cell: 918-760-6128 Fax: 918-832-4121
Steve Brewer CESWT-EC-EI	SCAPS Manager: Prepares and tests field equipment prior to mobilization, Site and Safety Health Officer and lead person during fieldwork.	Office and Field	Office: 918-832-4122 Cell: 918-625-6463 Fax: 918-832-4121
Jeff Lacquement CESWT-EC-EI	SCAPS Operator	Field	Office: 918-832-4122 Fax: 918-832-4121
Carl Sloan CESWT-EC-EI	SCAPS Assistant Operator	Field	Office: 918-832-4122 Fax: 918-832-4121
Greg Snider CESWT-EC-EI	Health and Safety Officer and substitute for Assistant Operator.	Office and Field	Office: 918-832-4122 Cell: 918-629-1927 Fax: 918-832-4121
Jeff Powell CEWES	SCAPS Technical Support - Electrical Engineer: Provides technical support for the SCAPS prior to mobilization and addresses equipment emergency situations during fieldwork.	Office and Field	Office: 601-634-3407
Bill Davis CEWES	Chemistry Technical Support: Provides technical support for the LIF equipment and TRPH analysis prior to mobilization, provides onsite technical support, and reviews data and provides input for the final reports.	Office and Field	Office: 601-634-3786
Jed Constanza	GMS/Data Management Support: Provides support and training of GMS prior to fieldwork, provides onsite technical support, and reviews data and provides input for the final reports.	Office and Field	Home: 615-699-5033 e-mail: jed64@hotmail.com
Angie Burckhalter CESWT-EC-ER	Tulsa District SCAPS Coordinator: Provides supervision and technical oversight for the project, and provides technical support as needed.	Office and Field	Office: 918-669-4957 Fax: 918-669-7508
Cliff Murray CESWT-EC-ER	SCAPS Manager/GMS POC: Reviews workplans, prepares GMS software and equipment prior to field work, downloads data to GMS during the field work, provides GMS data to the web site, substitutes for the SCAPS manager during field work, and develops final reports.	Office and Field	Office: 918-669-7573 Cell: 918-605-5789 Fax: 918-669-7508
Eddie Mattioda CESWT-EC-ER	Chemist: Prepares chemistry supplies, reviews workplans, collects field samples, conducts the TRPH analysis, supports SCAPS field crew, develops final reports.	Office and Field	Office: 918-669-7445 Fax: 918-669-7508
Frank Roepke CESWT-EC-ER	Chemist: Substitutes for Eddie Mattioda	Office and Field	Office: 918-669-7444 Fax: 918-669-7508
Chris Kennedy CESWT-EC-EA	Chemist: Substitutes for Eddie Mattioda	Office and Field	Office: 918-669-7072 Fax: 918-669-7508
Lori Kruse CESWT-EC-ER	Technician: Provides technical support for Cliff Murray concerning the input of data to the GMS software and supports data management needs.	Office	Office: 918-669-7151 Fax: 918-669-7508
SCAPS Truck			Cell: 918-688-5243

Table 2-3
McCormick and Baxter Superfund Site Field Exploration Supporting Groups and Subcontractors

Contractor	Service	Address and Contact
USACE – Tulsa District, Site Characterization and Analysis Penetrometer System (SCAPS)	Cone penetrometer and LIF measurements, TRPH	1645 South 101 East Ave. Tulsa, OK 74128 Contact: Angela Burckhalter Phone: 918-669-4957
EPA Region 9 FASP	Soil and groundwater analyses for TPH-Dx	1337 S. 46th St. Building 201 Richmond, CA 94804-4698 Office Contact: Liza Finley Phone: 510-412-2334 Field Contact: Jeff Mays Phone: 510-412-2367
EPA Region 9 Laboratory	Soil and groundwater analyses for TPH-Dx, SVOCs, PCBs, metals	1337 S. 46th Street, Building 201 Richmond, CA 94804-4698 Contact: Nancy Wilson Phone: 510-412-2377 Backup Contact: Rich Bauer Phone: 510-412-2312 Fax: 510-412-2300
EPA Region 9 Quality Assurance Management Section (QAMS)	Soil and groundwater analyses for dioxins/furans	75 Hawthorne St. San Francisco, CA 94105 Contact: Gail Jones Phone: 415-744-1498
Pacific Analytical Laboratories	Old Mormon Slough bank soil for PCDD/PCDF	6349 Paseo del Lago Carlsbad, CA 92009 Contact: Steven Parsons Phone: 760-931-1766 Fax: 760-931-9479
EPA Robert S. Kerr Environmental Research Laboratory (Kerr Lab)	Groundwater analyses for density NAPL analyses for TPH-Dx, SVOCs, solubility, oil-water interfacial tension, wettability, density, and viscosity Soil analyses for permeability, metals speciation, and treatability testing	919 Kerr Research Drive Ada, OK 74820 Contact: Eva Davis Phone: 580-436-8548 Fax: 580-436-8703
Columbia Analytical Services	NAPL analyses for TPH-Dx and SVOCs	1317 S. 13th Ave. P.O. Box 479 Kelso, WA 98626 Contact: Diane Wiegle Phone: 360-577-7222 Fax: 360-636-1068
Drilling Contractor	To be determined	
Environmental Resources	Performance evaluation samples	5540 Marshall Street Arvada, CO 80002 Contact: Joe Holtz Phone: 303-431-8454 Fax: 303-431-0159
Geophysical Contractor	To be determined	

Table 2-3 (Continued)
McCormick and Baxter Superfund Site Field Exploration
Supporting Groups and Subcontractors

Contractor	Service	Address and Contact
PTS Laboratories, Inc.	Soil analyses for grain size, cation exchange capacity, density, NAPL saturation, porosity, and TOC NAPL analysis for boiling point distribution	8100 Secura Way Santa Fe Springs, CA 90670 Contact: Richard Young Phone: 562-907-3607 Fax: 562-907-3610
IDW Disposal Contractor	To be determined. (Will be in compliance with CERCLA Off-Site Rule)	

3.0 SITE BACKGROUND AND SETTING

3.1 SITE LOCATION, DESCRIPTION, AND TOPOGRAPHY

The McCormick and Baxter Superfund site occupies approximately 32 acres in a predominantly industrial area near the Port of Stockton and the junction of Interstate 5 and State Highway 4 (Figure 3-1). The site is bordered by Old Mormon Slough to the north, which connects to the Stockton Deepwater Channel on the San Joaquin River. The site is also bordered by Washington Street to the south, the Interstate 5 freeway to the east, and an industrial facility to the west (located on the Port of Stockton Turning Basin). An 8-acre parcel in the southeastern portion of the site is owned by the Union Pacific Railroad (UPRR). The boundaries of the UPRR property shown on Figure 3-1 have been approximated from parcel maps.

The former processing areas and tank farm are paved. The rest of the site surface is unpaved with limited vegetative cover. A layer of gravel between 1 and 3 feet thick is found across most of the site. Railroad tracks are located on many areas of the site. Most of the former structures have been removed. The office building, two storage sheds, and a stormwater collection system lift station are the only remaining aboveground structures. Underground sump-like basement foundations and associated piping for the former pressure treatment units remain in the central portion of the site. Site entry is controlled by a perimeter fence and 24-hour security service.

The site is located on the margin of the Sacramento River-San Joaquin River Delta in the Great Valley geomorphic province of California. The site terrain is relatively flat and near sea level, ranging from 5 to 10 feet above mean sea level (msl). Surface water bodies in the vicinity of the site include Old Mormon Slough, New Mormon Slough, the Stockton Deep Water Channel, and the San Joaquin River. Old Mormon Slough is approximately 2,500 feet long and 180 feet wide. Most of the slough is approximately 10 feet deep, although the western portion of the slough near the mouth has historically been dredged for barge access. Old and New Mormon Sloughs are tidally influenced, with a maximum tidal range of approximately 3 feet. Stockton Channel, the Port of Stockton Turning Basin, and Old Mormon Slough are areas of net sediment deposition, and all but the inner portion of Old Mormon Slough are periodically dredged to maintain depths appropriate for ship traffic.

3.2 GENERAL SITE HISTORY

The McCormick and Baxter Creosoting Company operated at 1214 West Washington Street in Stockton, California from 1942 until 1991. Various wood preservation processes were used at the site during its operational history. The wood-treated products were used primarily by power utilities, railroads, and in construction. The preservatives included creosote, pentachlorophenol (PCP), arsenic, copper, chromium, and zinc. Solvents or carriers for these preservatives included petroleum-based fuels such as kerosene and diesel, butane, and ether. A list of wood preserving chemicals used at the site follows:

Common Name	Chemical Components	Period of Use
Creosote	Creosote and fuel oil	1942-1990
PCP	Pentachlorophenol and oil	1946-1990
Bouliden Salts	Chromium, copper, and arsenic	1949-1952
CCA	Chromated copper arsenic	1952-1970
Cellon	Pentachlorophenol, butane, and ether	1965-1988
ACA	Ammoniacal copper arsenate	1970-1986
Flamescape	Diammonium phosphate, ammonium sulfate, and boric acid	1976-1988
ACZA	Ammoniacal copper-zinc arsenate	1986-1990

Most treatment processes consisted of pressure impregnation of the preservative solutions in retorts. Pressure treated wood was removed from the retorts and allowed to dry in various wood storage areas throughout the site. As will be further described in Section 5, the following primary facility areas have been identified as the probable sources of contamination at the site: main processing area, oily waste ponds, and treated wood storage.

3.3 REGULATORY HISTORY

In late 1977 after a major storm event, the California Department of Fish and Game investigated a fish kill in the New Mormon Slough and the Port of Stockton. The report concluded that PCP-contaminated stormwater from the site, which discharged to the slough via the City of Stockton stormwater system, was responsible for the fish kill. Prompted by this action, the California Regional Water Quality Control Board (RWQCB) issued a Cleanup and Abatement Order in 1978 requiring McCormick and Baxter to prevent further releases of wastewater to receiving waters and to construct a stormwater runoff containment and disposal system. McCormick and Baxter closed the earthen oily waste ponds and replaced them with a concrete oily wastewater tank, installed a stormwater collection system, and constructed a perimeter levee around the site. All of the storm drains were also sealed. Since mid-1978 through the present, the only discharge of stormwater from the site has been through the permitted stormwater control system.

The California Department of Health Services (DHS) (now the Department of Toxic Substances Control [DTSC]), issued a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit to McCormick and Baxter in 1984 for the company’s concrete oily wastewater treatment tank and for the drum storage area. McCormick and Baxter completed clean closure of the concrete oily wastewater tank and the drum storage area in 1990.

In 1984, McCormick and Baxter entered into an agreement with DHS and the RWQCB to investigate and clean up contamination at the site. Under state oversight, McCormick and Baxter installed monitoring wells and conducted soil and groundwater sampling. McCormick and

Baxter filed for Chapter 11 bankruptcy in 1988 and continued operating the facility under the Bankruptcy Plan of Reorganization. Soil and groundwater investigation reports, a Baseline Public Health Assessment, draft Feasibility Study, and draft Remedial Action Plan were submitted to the regulatory authorities; however, none of these were approved by the state before the facility ceased operations in 1991. The site was proposed for inclusion on the National Priorities List in February 1992, at which time the site was formally transferred from state to EPA lead.

3.4 GEOLOGY

The city of Stockton is located on the margin of the Sacramento-San Joaquin delta near the axis of the Great Valley geomorphic province. The Great Valley is a sedimentary basin consisting of a series of homoclinal beds of clay, silt, sand, and gravel with a gently dipping east flank and more steeply dipping west flank (ICF Kaiser Engineers 1998a).

The California Department of Water Resources (DWR) mapped the surface geology of the McCormick and Baxter site as undifferentiated recent alluvium and Victor Formation. The Quaternary Victor Formation is a heterogeneous assemblage of low-sloping alluvial fan and fluvial floodplain deposits derived from the Sierra Nevada (DWR 1967). The deposits consist of silty clay, clayey silt, and micaceous silt that interfingers with coarser-grained sands and gravels. In the vicinity of the site, the thickness of this unit was shown to be approximately 170 feet (DWR 1967). The coarse-grained fluvial deposits of the Victor Formation reportedly grade laterally and vertically into the clays and silts in a manner that “provides little correlation of material between wells” (DWR 1978).

The Plio-Pleistocene Laguna Formation underlies the Victor Formation. The Laguna Formation consists of abundant beds of clayey silt and silty sand with some poorly graded sand in relatively thin zones and scarce well-graded gravel beds. It is lithologically similar to the Victor Formation, which makes the contact between the two formations difficult to discern visually. In the vicinity of the site the Laguna Formation occurs between depths of approximately 170 to 1,000 feet bgs (DWR 1967).

3.5 HYDROGEOLOGY

The following hydrogeological information is summarized from the soil and groundwater remedial investigation report (ICF Kaiser Engineers 1998a).

The upper 200 feet of sediments are collectively referred to as the shallow aquifer. Groundwater in this zone occurs primarily in the discontinuous sand layers and lenses of fine to coarse-grained greenish-gray sand. Individual sand layers are typically less than 20 feet thick and may constitute 15 to 20 percent of the total thickness of the shallow aquifer. The permeable layers within depth-defined intervals in the shallow aquifer are designated the A, B, C, and D zones. The locations of two geologic cross sections are shown in Figure 3-2 and the cross-sections depicting the aquifer zones are presented on Figures 3-3 and 3-4. The E zone is a sand and gravel bed, 10 to more than 50 feet thick that occurs below a depth of approximately 200 feet throughout the site. The E zone and unnamed deeper water-bearing layers are collectively known as the deep aquifer. Below the E zone, the deep aquifer consists of alternating layers of sand and clay. This aquifer appears to extend to at least 1,000 feet bgs in the vicinity of Newark-Sierra Paper Corporation (NSPC) located approximately 1,500 feet southeast of the site (Figure 3-1). The deep aquifer supplies industrial water to NSPC. Prior to 1993, three NSPC wells pumped 2 to 3 million gallons of water per day. Only two of the wells are still operational and currently pump 400,000 to 500,00 gallons per day. The results of a survey of local supply wells conducted by the USACE Sacramento District are provided in Table 3-1.

Based on historical water-level measurements from zones A through E, groundwater flow at the site is generally towards the east-southeast. Vertical hydraulic gradients were also calculated from water level measurements collected in 1996 and 1997. In general, there is a vertical downward gradient from the A zone to the E zone, with localized deviations from this general trend. The greatest vertical gradients were noted between and the A and B zones and ranged from –0.32 foot/foot to –0.02 foot/foot (negative gradient suggests downward movement). The vertical gradients between the B, C, and D zones ranged from 0.13 foot/foot to negligible. The vertical gradients between the D and E zones ranged from –0.020 to –0.021 foot/foot.

The transmissivity and storativity of the various water-bearing zones (except for the unconfined A zone) were calculated from pumping tests conducted at the site in 1986, 1988, and 1996. Transmissivities for the B zone ranged from 411 to 880 feet^2/day. Storativity values for the B zone ranged from 2.5 to 4.9 x 10^{-4}. The transmissivities calculated for the E zone were much higher than those calculated for the B zone and ranged from 930 to 4,400 feet^2/day. Storativity in the E zone ranged from 5.8 to 7.3 x 10^{-4}.

Based on the geochemistry and the eastward-directed hydraulic gradients at the site, it is suspected that the delta is contributing to groundwater recharge at the site. It is likely that the places of recharge are the Port of Stockton Turning Basin and Old Mormon Slough. Infiltration of water from the ground surface is anticipated to provide a limited amount of recharge. Nearby alluvial fans may also contribute to groundwater recharge at the site.

To evaluate the extent to which tidal fluctuations in Old Mormon Slough affect groundwater levels at the site, a tidal influence study was conducted for the A zone aquifer in 1995. The results of the study concluded that there was insufficient response in water levels to show the effects of tidal ranges, and tidal effects were likely masked by daily changes in barometric pressure.

Figure 3-1 Site Location

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Figure 3-1 (Continued)

Figure 3-2 Geologic Profile Locations

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Figure 3-2 (Continued)

Figure 3-3 Geologic Profile A-A′

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Figure 3-3 (Continued)

Figure 3-4 Geologic Profile B-B′

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Figure 3-4 (Continued)

Table 3-1
Water Supply Well Survey—Interviews and Findings

Agency/Company	Contact	Status
City of Stockton 209-937-7037	Doug Jones 209-937-8782	The water for the City of Stockton is supplied by three sources: 1) City of Stockton - Their wells are over 3 miles away from the McCormick and Baxter Superfund site. 2) California Water Service - Supplies the majority of the drinking water for the City of Stockton. - The majority of their wells are over 2 miles away from the McCormick and Baxter Superfund site (see below). 3) San Joaquin County - Supplies less than 1% of Stockton's water. - Their wells are over 3 miles away from the McCormick and Baxter Superfund site.
California Water Service 209-466-8971	Eric Marr 209-464-8311	One supply well in proximity to site; all other wells greater than 2 miles away. The supply well has been inactive for 25 years (it has no pump on it), due to the high salinity of the groundwater. Water levels were measured until 1990.
Department of Water Resources (DWR)	Bob Niblack, Engineering Geologist 916-227-7601	They have well log information but an appointment must be made to research the information (Brian, 255-3076). Bob worked on the McCormick and Baxter site 10 years ago and suggested reviewing the Regional Water Quality Control Board's files for supply well data instead of DWR. Bob also suggested contacting San Joaquin County Flood Control and Water Conservation, located in Stockton.
San Joaquin County Flood Control and Water Conservation	209-468-3000	They claimed no active pumping wells are in the area and referred us to DWR.
Regional Water Quality Control Board (RWQCB)	Pat Leary 916-255-3023	On February 10, 1999, a USACE person went through the RWQCB McCormick and Baxter files. No updated information was found, calls were made from an outdated list of companies that once had wells in the surrounding area. The information gathered from these calls is located in this table.
U.S. Naval Reservation	Jim Pinasco 916-255-3719	No response to phone call.
Newark-Sierra (formerly Gold Bond Wood Products)	Mark Vincent 209-466-5251	Newark-Sierra has four supply wells 0.3 mile from the site but only two wells pump at any one time. The other two wells are used as backup wells. Combined the two wells pump 500,000 gallons of water per day. The wells are deeper than 200 feet and could potentially be pumping from the E zone. The wells have been chemically tested and no contamination has ever been detected in these wells. Up until December 1994, Newark Sierra was pumping 2.3 to 3.0 million gallons of water per day and before that, in the late 1980s Newark was pumping 4.5 million gallons of water per day. Mark Vincent is faxing over any well data they have on file including a site map showing the location of the wells. He indicated that there were several other

Table 3-1 (Continued)
Water Supply Well Survey—Interviews and Findings

Agency/Company	Contact	Status
Newark-Sierra (continued)		“wet” industries southeast of the McCormick and Baxter site that may have supply wells: H.J. Hines, Valley Tomato, Del Monte, Corn Products, and Campbell Soup. Only two of those “wet industries” appeared to be active in the area, Valley Tomato and Del Monte.
Port of Stockton	Jay Jagary 209-946-0246 (ext. 290)	The Port of Stockton has no active supply wells and did not know of any in the area.
Valley Tomato	Tom Halloway 209-982-4586 (ext. 405)	Valley Tomato has two supply wells that pump from July 1 through October 1, during tomato harvest. The wells pump approximately 750,000 gallons per day combined. The wells are located adjacent to the Stockton Metropolitan Airport, which is 2 miles from the site.
Del Monte	John Furr 209-466-9011 (ext. 374)	No response to calls.
City of Stockton Haggin Museum	Todd Ruhstaller 209-462-4116	No response to calls.
Nelson Ready Mix Concrete	Russ Nelson 209-466-2884	The company owns one well, 320 feet deep, with the average pumping rate at 6,000 gallons per day, which can vary depending on business. The well is located 4,500 feet southwest of site on West Charter Way.
Ogden Food Products		No longer in business in the Stockton area.
Union Ice/Storage Co.	Larry Titsworth 209-948-0793	Based on past information from Union Ice, there are 12 shallow monitoring wells on this property, but no extraction wells. Union Ice informed EPA that it has used well water in the past, but discontinued such use in approximately 1986.
Stockton Police Department	Jenny Herder, Public Works Director 209-937-8339	The Police Department owns one well 5,400 feet east of the site. The well has been closed at least 5 years with no pumping taking place.

Source: U.S. Army Corps of Engineers Sacramento District, May 10, 1999.

4.0 PREVIOUS INVESTIGATIONS AND REMEDIATION EFFORTS

Previous investigations at the McCormick and Baxter site have focused on upland soils and groundwater (ICF Kaiser Engineers 1998a, 1998b) as well as surface water and sediment contamination (CH2M HILL 1988, Petreas and Hayward 1994, and U.S. EPA 1994a). The primary past sources of contamination in the upland area of the site include:

- Old oily waste ponds area
- Concrete oily waste tank
- Paved pole washing area
- Track pit
- Underground and aboveground storage tanks (USTs and ASTs)
- Oil/water separators (O/WS)
- Condensate storage tanks
- Stormwater collection sumps

The primary sources of contamination to Old Mormon Slough were process spills, direct discharges of industrial waste and stormwater to the slough, and subsurface migration of contaminants from the upland area.

Site investigations of the upland area have identified PCP, polycyclic aromatic hydrocarbons (PAHs), arsenic, copper, chromium, and dioxin in soils. PCP has been detected primarily in the 0 to 5 feet bgs zone, and its concentration decreases with depth. The maximum PCP concentration (2,400 mg/kg) was detected in the former oily waste ponds area at 2 feet bgs. Subsurface hot spots were detected in the main processing area, track pit, and former oily waste ponds. PCP has been reported at 50 feet bgs in the track pit area. PCP contamination in the eastern portion of the site is limited to the upper 10 feet or less.

Carcinogenic PAHs (cPAHs) have been measured above the cleanup standard, primarily in the main or central process area, Cellon process area, oily waste ponds, and the track pit areas. Benzo(a)pyrene was measured at 2.6 to 3.6 mg/kg. The highest levels of PAH contamination (60 to 170 mg/kg) are found primarily in the 0 to 15 feet bgs zone; however, concentrations greater than the cleanup standard have been reported to a depth of 60 feet in the track pit area and former oily waste pond areas. In the eastern half of the site, contamination is mostly found in the surface and near surface soils.

Based on the site risk analysis, arsenic has been identified as the only metal contaminant of concern. (Copper, chromium, and zinc have also been detected in site surface soils, but their concentrations decrease below 10 feet bgs.) Arsenic contamination above the cleanup standard of 30 mg/kg appears to be limited to the 0- to 10-foot bgs zone, and is located primarily in the main processing area and the former oily waste ponds.

Polychlorinated dibenzodioxins/polychlorinated dibenzofurans (PCDD/PCDF) have been detected in surface soil throughout the site at concentrations that exceed the cleanup standard of 1 µg/kg tetrachloro-dibenzo-p-dioxin (TCDD) toxicity equivalent concentration (TEQ). The highest concentrations have been measured in surface soil at the track pit (143 µg/kg) and the former oily waste ponds (115 µg/kg). In the main process area concentrations above the cleanup standard have been measured at a depth of 20 feet bgs, and in the track pit area they have been measured at 65 feet bgs. In the eastern portion of the site, dioxin contamination above the cleanup standard has only been detected in the 0- to 4-foot bgs zone.

The presence of NAPLs has been reported in the subsurface at the site (ICF Kaiser Engineers 1998a). Two types of NAPLs were reported: one containing PCP in oil, which is less dense than water (i.e., LNAPL), and another containing PAHs derived from creosote, which is more dense than water (DNAPL). The presence of NAPL was attributed to the oily waste ponds and track pit. Section 5.2.1 provides a more detailed description of NAPL occurrence.

Previous investigations have also focused on the evaluation of sediments at the site. Sediment samples were collected from below the mudline at the Old and New Mormon Sloughs (U.S. EPA 1994a, Petreas and Hayward 1994). These studies identified PAHs and PCDD/PCDFs as the primary contaminants of concern in the sediments. The sediment cleanup standard for total PAHs is 333 mg/kg (organic carbon normalized). The standard for PCDD/PCDF (TEQ) is 21 nanograms per kilogram (ng/kg).

EPA conducted several phases of removal actions once the site was added to the National Priorities List (NPL) in 1992. Since EPA became the lead agency at the site, EPA activities have included stabilizing site conditions, improving site security, demolishing structures and equipment, and addressing contaminant releases into Old Mormon Slough. In 1992, EPA conducted a chemical/sludge inventory and sampling of tanks, sumps, and retorts. Laboratory chemicals were inventoried, and neutralized or consolidated for disposal. Fencing was also installed along Old Mormon Slough.

Beginning in 1994, EPA mitigated asbestos hazards at the site prior to demolition of the facility buildings. EPA then dismantled the retort vessels, pipes, boiler rooms, foundation, tanks, sumps, berms, and other structures and buildings. A final removal action was begun in 1996 to demolish the three remaining tanks at the site and address oily seeps into Old Mormon Slough. Soil was excavated from the oily waste pond area and sheetpiling was installed along the southwestern shoreline of Old Mormon Slough to control oily seepages from the former oily waste pond area (Figure 3-1).

The material used to backfill on the landward side of the sheetpile wall was primarily from off-site areas. The area was not completely backfilled because the wall could not support the weight of the soil without additional tieback support.

The second phase of the 1996 removal action included the excavation of approximately 15,000 cubic yards of contaminated soil from the oily waste pond area. A lined repository was constructed in the main processing area to contain the excavated soil. The perimeter of the repository is approximately 10 to 15 feet inside of the edge of the asphalt cap (Figure 3-1). The repository extends to a depth of approximately 20 feet bgs and has a plastic liner approximately 20 mils thick. Cement-lined basements in the main process area were filled with debris and investigation-derived waste. The main basement was 10 feet deep. Following filling of the repository and the basements, the main process area was covered with 1 to 1.5 feet of contaminated soil followed by a minimum of 1 foot of clean material. Some areas were covered by additional clean soil to achieve the required slope. The western edge of the cap has approximately 3 feet of clean fill in some areas. The asphalt cap covers an area of 93,000 square feet and is 2 inches thick.

On March 31, 1999, EPA issued a Record of Decision (ROD) for the McCormick and Baxter site. The ROD presented final remedies for vadose zone soils and sediments, and an interim remedy for groundwater. The major components of the ROD remedies are as follows:

- Selected vadose zone remedy: Excavation of soil, and consolidation and capping

- Contingency vadose zone soils remedy: Placement of an asphalt cap over the entire site (without excavation and consolidation of soil). The soils contingency remedy would be triggered if EPA determines that a potentially responsible party or a prospective purchaser has sufficiently agreed in writing to undertake the contingency soils remedy, including long-term operation and maintenance, and compliance with use restrictions regarding the soils remedy.

- Selected sediment remedy: In-place capping of sediment in Old Mormon Slough

- Interim groundwater remedy: Installation and operation of a groundwater extraction and treatment system, with dedicated NAPL recovery wells, where appropriate. Treatment will be by oil/water separation to remove NAPL, biotreatment, filtration, and carbon adsorption. Treated groundwater will be discharged into nearby surface water, in combination with reuse for irrigation or industrial purposes at or near the site, if possible.

- Monitoring of the affected aquifer zones to verify that the extraction system is effective in containing the groundwater plume until a final groundwater remedy is selected.

- [illegible]ermal treatment technologies will be evaluated during the remedial design phase to determine if they are an appropriate final groundwater remedy for the site.

- Access rights that permit EPA and the state to monitor and maintain the selected remedies and land use restrictions that prohibit interference with the selected remedies that run with the land, to the extent available.

5.0 CONCEPTUAL SITE MODEL

This section provides a conceptual model of the fate and transport of contaminants based on sources of contamination, type and extent of contamination, and mechanisms impacting contaminant migration. The site model is based on the data currently available, and will be revised on completion of this field exploration. A discussion of upland the nature and extent of upland contamination may be found in the soils and groundwater remedial investigation report (ICF Kaiser, Inc. 1998a) and in the EPA ROD.

5.1 SOURCES OF CONTAMINATION

Areas identified as the probable sources of contamination presently found at the site include the main (central) processing area (operational from 1942 through 1990), the oily waste pond area (operational from 1942 through 1980), and the treated wood storage areas (operational from 1942 through 1990). In the main processing area, the primary sources of contamination were the retorts and associated sumps and piping, track pit, pole washing area, USTs and ASTs, oil/water separator (O/WS) systems, and condensate storage tanks (Figure 5-1).

All wood treatment process units and storage tanks at the site have been emptied of the chemicals they contained, cleaned, and removed from the site. The remaining contaminant source areas at the site developed from the past release of wood-treating chemicals to surface soils, deeper soils and groundwater through past processing operations, spills, chemical handling practices, and drippage from treated wood. The sediments of Old Mormon Slough have also become contaminated as a result of chemical process spills, surface runoff, direct discharge of stormwater through outfalls, and/or subsurface migration from other operable units (i.e., seepages from the former oily waste pond area).

As described in Section 4, the 1996 removal action resulted in the development of a landfill in the main processing area and the filling of cement-lined basements in the same area. The landfill was used as a repository for 15,000 cubic yards of contaminated soil from the oily waste pond area, and the basements were filled with tank bottom sludge, investigation-derived waste, and other debris. These areas, which are within the most heavily contaminated area of the site, have been covered with an asphalt cap, but remain as potential contaminant sources to the subsurface.

5.2 DESCRIPTION OF CONTAMINATED PHYSICAL SYSTEM

The wood-preserving process at this site used the preservatives creosote, PCP, copper, chromium, and arsenic. Creosote is a blend of various coal tar distillates that may contain up to 90 percent PAHs mixed with other hydrocarbons. Technical-grade PCP contains 85 to

95 percent PCP; the remainder is a mix of other polychlorinated phenols and about 0.1 percent dioxins and furans. Both creosote and PCP were mixed with an aromatic carrier oil such as No. 2 fuel oil prior to use for wood preservation. In addition, creosote was also mixed with butane and ether as carrier fluids to create Cellon. Metals were typically mixed with ammonium.

Chemicals detected in LNAPL and DNAPL are consistent with the products historically used on site (i.e., creosote, PCP, and aromatic carrier oils). These two liquid phases generally contain varying concentrations of PAHs, polychlorinated phenols, and various other semivolatile and volatile organic compounds (SVOCs and VOCs). Detected chemical concentrations in LNAPL and DNAPL are similar, except that PCP is more prevalent in LNAPL. The process and contaminant source areas are shown on Figure 5-1.

The primary chemicals of concern (COC) for the site are PCP, carcinogenic PAHs, non-carcinogenic PAHs (acenaphthene, anthracene, fluorene, naphthalene, and pyrene), arsenic, and dioxins/furans. Dioxins/furans are believed to have originated as manufacturing impurities contained in the PCP solutions. Although relatively nontoxic, naphthalene is included as a COC because it is widely distributed throughout soil and groundwater at the site in relatively high concentrations and it serves as an indicator for the presence of noncarcinogenic PAHs. The soil and sediment cleanup standards stipulated in the ROD are listed in Table 5-1.

5.2.1 Description of Soil Contamination

In general, elevated chemical concentrations in site soils appear to be present primarily in the western portion of the site, mainly the former main process area, the Cellon process area, the oily waste pond area, and the track pit. The estimated areal extent of subsurface NAPL is shown in Figure 5-2. Areas containing lower levels of contaminants in the western portion of the facility are the former pole wash, tank farm, and butt tank areas. Concentrations of COCs in soils generally decrease with increasing depth. Section 4 provides a detailed summary of contaminant distribution based on previous investigations.

Geologic cross-sections depicting the distribution of NAPL contamination are presented on Figures 5-3 and 5-4. These figures were prepared by reviewing soil logs for visible evidence of NAPL. As reported in the RI report (ICF Kaiser Engineers 1998a), the chemical compositions of the LNAPL and DNAPL are similar. The DNAPL contains relatively more PAHs and less PCP than the LNAPL. The greater percentage of PAHs in the DNAPLs (20 to 24 percent) relative to LNAPL (6 percent) may be an indication that the mass of PAHs in the oil affects the products' density and may be a controlling factor in determining whether the product sinks or floats. All NAPL samples contained a substantial portion of miscellaneous hydrocarbons that were not identified. These likely derive from the various fuel oils and petroleum products used as carriers in the original PCP and creosote solutions.

The USACE Seattle District used available NAPL data to estimate the distribution of NAPL at the site and quantify the potential volume. The data used for this analysis and the calculation technique are provided in Appendix A. The results show that NAPL may be restricted to the western area of the site associated with the oily waste pond and Cellon process area and the main process area (Figure 5-5). The total calculated volume of NAPL is approximately 950,000 gallons, which is considered a conservatively high estimate. There is considerable uncertainty in the estimate of NAPL extent and volume because of the limited amount of available data and the number of assumptions required to make the calculations.

To identify general response actions and focus the formation of remedial alternatives for the purpose of the feasibility study, EPA divided the site soils into three sub-areas (Figure 5-6): Sub-area X, Sub-area Y, and Sub-area Z. These designations are based on the lateral and vertical extent of COCs above preliminary cleanup levels. The table below summarizes the maximum concentration of principal COCs and volumes of contaminated soil at the three sub-areas.

Maximum Concentration of COCs in Soils

Chemical of Concern	Sub-area X Eastern Site (0-1 ft. bgs)	Sub-area Y Western Site (0-13 ft. bgs)	Sub-area Z Western Site (13-39 ft. bgs)
PCP (mg/kg)	44 (surface)	2,400 (2 ft. bgs)	480 (20 ft. bgs)
Benzo(a)pyrene (mg/kg)	3.2 (surface)	176 (2 ft. bgs)	92.4 (30 ft. bgs)
Dioxin (µg/kg)	11.1 (surface)	143.4 (surface)	22.9 (65 ft. bgs)
Arsenic (mg/kg)	728 (surface)	1,206 (surface)	14.2 (26 ft. bgs)
Volume of Contaminated Soil (yd^3)	37,100	212,500	26,806

5.2.2 Description of Groundwater Contamination

Groundwater contamination at the site is limited to SVOCs and, to a lesser degree, dioxins. Arsenic levels are consistent with naturally occurring background levels with the exception of elevated levels in one well within the main processing area. The SVOCs naphthalene, benzo(a)pyrene, and PCP serve as indicators of site-related contamination because they are compounds known to have been used in former processes and they occur at greater concentrations than other SVOCs. Groundwater contamination above the maximum contaminant level (MCL) does not extend beyond the site fenceline. However, naphthalene, for which there is no MCL, has been detected beyond the fenceline at levels exceeding the Region 9 preliminary remediation goal (PRG) of 6.2 µg/L.

This indicates that the leading edge of the plume may be moving off site because naphthalene is the most mobile PAH compound.

e extent of PCP and PCDD/PCDF contamination at levels above their respective MCLs is currently limited to the central portion of the site. For PCP, contamination is present primarily in the A zone, with concentrations in several wells (A-3, A-4, A-5, A-6, and A-8) well above the MCL of 1 µg/L, ranging from 26 to 36,000 µg/L. PCP concentrations greater than 1 µg/L have also been measured in the B and C zone wells (DSW-4B, DSW-4C, DSW-5B, DSW-6B, ONS-1B, and ONS-1C). PCDD/PCDF contamination in groundwater extends vertically from the A zone to the C zone. PCDD/PCDF concentration ranges from 30 picograms per liter (pg/L) TCDD TEQ to 27,038 pg/L TCDD TEQ, compared to an MCL of 30 pg/L (ICF Kaiser, Inc. 1998a).

5.2.3 Description of Sediment Contamination

Sediment contamination at the site appears to be limited to Old Mormon Slough, which is directly adjacent to the facility. The primary COCs identified in the sediments are PAHs and dioxin. PCP is not widely distributed. In describing sediment contamination, the reaches of Old Mormon Slough have been divided into the following areas shown in Figure 5-6: (1) mouth of the slough (MTH), (2) the area adjacent to the oily waste ponds (OWP), (3) the area adjacent to the main or central processing area (CPA), and (4) the eastern end (END). The following general sediment contamination patterns have been identified:

PAHs

- Concentrations are generally greater at depth in Old Mormon Slough except at the OWP. At the pond, contamination is worse near top due to run-out.
- Concentrations are highest in sediments 2 to 8 feet bml in the CPA, exceeding 1,500 mg/kg.
- The highest concentration is 1,811 mg/kg at 6 to 8 feet bml in a composite sample collected at the CPA.
- Sediments deeper than 8 feet bml at the OWP, CPA, and END are visibly contaminated with petroleum hydrocarbons.
- The maximum depths sampled at two stations at the CPA (29.2 feet bml and 18 feet bml) had PAH concentrations of 87.1 and 1,573 mg/kg, respectively, so contamination may extend beneath those depths.

PCDD/PCDF

- The dioxin TEQ is often above 1 ppb.
- TEQs exceeded the Stockton Channel reference concentration (87.7 parts per trillion) at the following locations and depths:

  0 to 4 feet bml at the east END
  0 to 6 feet bml at the CPA
  0 to 2 feet bml at the OWP

PCP

- PCB is not widely distributed in Old Mormon Slough; it degrades over time.
- Concentrations are restricted to upper 4 feet bml in the END and upper 8 feet bml at the CPA.
- The CPA was most contaminated, up to 5.6 mg/kg in a 6- to 8-foot bml composite sample.
- Shallow sediment concentrations correlated with concentrations of PCDD/PCDF.

5.3 CONTAMINANT FATE AND TRANSPORT

Based on the data obtained to date, LNAPL and DNAPL are considered to be the principal sources of groundwater contamination at the site. Both are present at the site in unsaturated soil and below the water table. Wood-preserving chemicals that are only slightly soluble in water may travel greater distances when dissolved in a carrier solvent such as LNAPL or DNAPL. Contaminants in the vadose zone move as a mobile NAPL phase, adsorb onto soil, volatilize into soil gas, and dissolve into pore water. Except for the volatilization pathway, similar partitioning occurs below the water table. Compared with many other contaminants, the PAHs exhibit very low aqueous solubilities and are strongly adsorbed to particulate surfaces. Volatilization is a dominant release mechanism for the lower-molecular-weight PAHs with higher vapor pressures. Table 5-2 lists chemical and physical properties that affect fate and transport of PAHs, PCP, and dioxin at this site. The data provided in this table are for pure compounds under ideal conditions. Site conditions are not ideal and the compounds are present in mixtures. These conditions must be considered in using the data to evaluate contaminant movement. Table 5-3 provides the physical characteristics of NAPL collected and analyzed during the RI and Table 5-4 summarized NAPL detections in monitoring wells during the RI.

Mobile NAPL migrates downward through the vadose zone until it reaches the water table. NAPL phase separation occurs when the NAPL encounters the water table; LNAPL accumulates at the water-table surface and continues to migrate laterally (Figure 5-7). DNAPL continues migrating downward until it encounters an underlying less permeable stratum. The DNAPL then builds up above this layer until it stabilizes, migrates laterally, or continues further downward migration through pore spaces and fractures in the low-permeability layer (Figure 5-7).

The NAPL also undergoes dissolution as it encounters water in the pore spaces and in the aquifers, resulting in dissolved contaminants in the groundwater (Figure 5-7). The contaminants are then transported with the groundwater laterally and vertically downward, when gradients allow, into underlying groundwater through pore spaces and fractures in the low-permeability layer. The mobility of contaminants in groundwater will be affected by adsorption/desorption processes.

The transport mechanism(s) leading to the presence of dissolved contaminants in the deeper zones is unclear. Based on physical and chemical evidence, known migration routes identified in the RI report (ICF Kaiser Engineers 1998a) include:

- Migration of NAPL from soils to groundwater
- Dissolution of chemicals from the NAPL and subsequent migration as a dissolved contaminant plume

Probable migration routes affecting other media may include:

- Migration of chemical compounds adsorbed onto particles in sediment, if disturbed, into surface waters
- Uptake of chemicals in sediment and surface waters by biota

Potential migration routes that may not be a major contributing factor to contaminant migrations include:

- Leaching of residual chemicals in soils by infiltrating water due to precipitation; migration of soluble chemicals from soils to groundwater
- Migration of contaminated slough surface water to A zone groundwater via recharge
- Migration of NAPL from Old Mormon Slough sediments to groundwater

- Release of nonvolatile chemicals in surface soils to ambient air via wind entrainment or mechanical disturbances

- Migration via overland flow of residual chemicals adsorbed onto surface soil particles into local surface waters and sediment

Figure 5-1 Process/Source Areas Identified in the RI

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Figure 5-1 (Continued)

Figure 5-2 NAPL Observations and Estimated NAPL Extent

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Figure 5-2 (Continued)

Figure 5-3 Subsurface NAPL Contamination Along Geologic Profile A-A′

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Figure 5-3 (Continued)

Figure 5-4 Subsurface NAPL Contamination Along Geologic Profile B-B′

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Figure 5-4 (Continued)

Figure 5-5 Estimated Extent of NAPL

Figure 5-6 Soil Sub-areas and Sediment Contamination

Figure 5-7 Basic Fate and Transport Processes of Organic Compounds in the Saturated Zone

Table 5-1
Soil and Sediment Cleanup Standards

Contaminant of Concern	Vadose Zone Soil[a] (mg/kg)	Old Mormon Slough Sediment[b] (mg/kg)
Carcinogenic PAHs		
Benzo(a)pyrene	3.6	NA
Noncarcinogenic PAHs		
Acenapthene	1,100	NA
Anthracene	57	NA
Fluorene	900	NA
Naphthalene	190	NA
Pyrene	1,000	NA
Total PAHs	NA	333[c]
Pentachlorophenol	150	NA
2,3,7,8-TCDD (Dioxin)[d]	1 µg/kg	21 ng/kg
Inorganics		
Arsenic	30	NA

[a] Based on EPA Region 9 preliminary remediation goals (PRGs) adjusted to a 1.0E-05 risk
[b] Site-specific sediment cleanup levels based on the risk-based maximum sediment concentrations (PNNL 1997)
[c] Dry weight, organic carbon normalized
[d] "Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites" (OSWER Directive 9200.4-26)

Notes:
µg/kg - microgram per kilogram
mg/kg - milligram per kilogram
ng/kg - nanogram per kilogram
NA - not applicable
PAH - polycyclic aromatic hydrocarbon

Table 5-2
Chemical and Physical Properties Affecting Fate and Transport of PAHs and PCP

Compound	**Molecular Weight (g/mole)**	**Melting Point (°C)**	**Water Solubility (mg/L)**	**Vapor Pressure (mm Hg)**	**Henry's Law Constant (atm-m^3/mol)**	**Log K_{ow}**
Low-Molecular-Weight PAHs[a]						
Fluorene	116	116	1.69E+00	7.10E-04	6.42E-05	4.2
Naphthalene	128	80	3.10E+01	2.34E-01	4.82E-04	3.1/3.3
Acenaphthylene	152	92	3.93E+00	2.90E-02	1.48E-03	3.7
Acenaphthene	154	96	3.42E+00	1.55E-03	9.20E-05	4
Phenanthrene	178	101	1.00E+00	6.80E-04	1.59E-04	4.46
Anthracene	178	218	4.50E-02	1.95E-04	1.02E-03	4.45
High-Molecular-Weight PAHs[a]						
Fluoranthene	202	111	2.06E-01	5.00E-06	6.46E-06	4.9
Pyrene	202	156	1.32E-01	2.50E-06	5.04E-06	4.88
Benzo(a)anthracene	228	162	5.70E-03	2.20E-08	1.16E-06	5.6
Chrysene	228	254	1.80E-03	6.30E-09	1.05E-06	5.61
Benzo(b)fluoranthene	252	168	1.40E-02	5.00E-07	1.19E-05	6.06
Benzo(k)fluoranthene	252	217	4.30E-03	5.10E-07	3.94E-05	6.06
Benzo(a)pyrene	252	179	1.20E-03	5.60E-09	1.55E-06	6.06
Benzo(g,h,i)perylene	276	277	7.00E-04	1.03E-10	5.34E-08	6.51
Indeno(1,2,3-c,d)pyrene	276	163	5.30E-04	1.00E-10	6.86E-08	6.5
Dibenz(a,h)anthracene	278	270	5.00E-04	1.00E-10	7.33E-08	6.8
PCP and 2,3,7,8-TCDD[b]						
PCP	266.32	190-191	1.40E+01 20°C	1.10E-04 20°C	2.75E-06	5.01
2,3,7,8-TCDD	321.9	302-305	2.00E-04 20°C	1.00E-06 25°C	2.10E-03	5.16

[a] PAHs are sorted in this table by increasing molecular weight.
[b] Source: U.S. EPA 1986, 1985

Notes:
PAH - polycyclic aromatic hydrocarbon
PCP - pentachlorophenol
TCDD - tetrachloro-dibenzo-p-dioxin

Table 5-3
Physical Characteristics of NAPLs

Well ID	Specific Gravity (60/60°F)	Density (g/cm^3)	Degree API	Kinematic Viscosity[a] (cst)	Dynamic Viscosity (cp)
A-8	0.9600	0.9592	15.90	8.3916	8.0493
A-10	1.0129	1.0120	8.20	11.5685	11.7073
DSW-6B	1.0064	1.0055	9.10	6.6914	6.7282
DSW-4C[b]	1.0043	1.0034	9.39	0.7053	0.7077

[a] Viscosity at 100°F determined by American Society for Testing and Materials Standard Method D-445.
[b] Sample is more a water sample than a NAPL sample.

Notes:
API - American Petroleum Institute
cp - centipoise
cst - centistokes
NAPL - nonaqueous-phase liquid

Source: ICF Kaiser Engineers 1998a

Table 5-4
Summary of NAPL Detections in Monitoring Wells

Well ID	LNAPL Thickness (feet)		DNAPL Thickness (feet)	
	August 1995	June 1997	August 1995	June 1997
A-4	NT	a	NT	ND
A-5	NT	a	NT	ND
A-6	NT	ND	NT	ND
A-8	0.37 to 0.4	0.08	ND	ND
A-10	ND	ND	2	1.15
DSW-1D	ND	ND	ND	NT
DSW-4B	ND	0.1	ND	ND
DSW-4C	0.01 b	c	NM	ND
DSW-4D	NT	ND	NT	ND
DSW-4E	NT	ND	NT	ND
DSW-5B	ND	ND	ND	ND
DSW-6B	ND	c	0.9	ND
DSW-6C	NT	c	NT	ND
OFS-4D	NT	ND	NT	ND
OFS-4E	NT	ND	NT	ND
ONS-1B	NT	d	NT	ND
ONS-1C	NT	ND	NT	ND
ONS-2A	NT	ND	NT	ND

[a] Oil sheen on water surface
[b] Measured in purge water, not in well
[c] Probe oily when retracted from well
[d] Light oily film on probe when removed
░ - Denotes presence or likely presence of NAPL

Notes:
ND - not detected
NM - not measured, but suspected to be present
NT - not tested

Source: ICF Kaiser Engineers, Inc. 1998a

6.0 INVESTIGATION RATIONALE AND APPROACH

6.1 CHEMICALS OF CONCERN

Although a wide variety of contaminants have been detected at the site, as discussed in Section 5.2, the most widespread COCs are PAHs (from creosote and petroleum hydrocarbon carrier oils) and PCP. These contaminants are present primarily in soil and groundwater as constituents of mobile NAPL and as residual NAPL held in the soil pore spaces. The focus of this field exploration is to locate this NAPL and measure the concentrations of PAHs and PCP. Metals (primarily arsenic, chromium, copper, and zinc) and dioxin have also been detected in soil, groundwater, and sediment at the site. Soil samples will be collected and analyzed for PCBs in the Cellon process area because previous soil analyses in this area indicate the presence of hydraulic fluid.

6.2 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are quantitative and qualitative statements specified to ensure that data of appropriate quality are collected during field activities. The DQO process ensures that sufficient data are collected to make required decisions within a reasonable certainty and that only the minimum amount of necessary data are collected (U.S. Army 1998). It is difficult to determine the amount of data that will be sufficient to characterize the extent and composition of a material like NAPL in the subsurface because of subsurface heterogeneities, variable flow paths, and diverse modes of occurrence. Therefore, instead of establishing numerical "DQO decision rules" and "decision error tolerances" for this investigation, the number of sampling locations and the depth of the investigation have been chosen based on professional judgment using existing data and the current conceptual site model (CSM). However, the dynamic nature of this investigation allows for changes in the number of locations/samples as the investigation progresses, and results from the early stages will be utilized in refining the site conceptual model. Additional data collection will continue until the project team decides that further data would not provide information that would help in substantially reducing the uncertainty in the CSM or that would not be necessary for the development/design of a cost-effective thermal remedy. In this manner the investigation has been designed as an iterative approach allowing for new information, as it becomes available, to be evaluated and integrated into the CSM in order to help guide the characterization of areas with NAPL contamination.

The DQO process for the McCormick and Baxter field exploration is illustrated in Figure 6-1. This investigation focuses on collecting data that may be used to aid in the conceptual design of an in situ thermal treatment system that will enhance removal of contaminants from the subsurface. These data include the following:

- Chemical composition of contaminated soil, water, and NAPL phases
- Physical characteristics of the contaminated media and NAPL
- Geologic/hydrogeologic properties of the subsurface

A variety of intrusive measurements and sample collection methods will be used, ranging from in situ sensors to soil borings and monitoring wells. In each case, the performance specification for the investigation method is based on the need to locate and characterize very high levels of contamination (in NAPL) and to aid in the conceptual design of a method for successfully removing NAPL from the subsurface. Secondary objectives for this field work include (1) groundwater monitoring to document boundary conditions, (2) slough sidewall sampling for sediment cap design, and (3) soil PCB contamination evaluation in the Cellon process area.

6.3 FIELD EXPLORATION APPROACH

A phased approach has been developed for this site investigation. Initially, preliminary surveying will be conducted to prepare a map(s) locating salient site features in NAD83 state plane coordinates. In addition, the banks along Old Mormon Slough will be surveyed to develop a comprehensive stabilization design and to calculate required quantities of material to implement the final design. A geophysical survey will then be performed at the site to delineate the location and shape of subsurface structures and metal debris to locate acceptable areas for SCAPS penetration and may be used to aid in the development of an in-situ thermal treatment system conceptual design. Following the geophysical survey, a SCAPS equipped with a laser-induced fluorescence (LIF) sensor will be used to characterize the horizontal and vertical extent of NAPL and petroleum, oil, and lubricants (POL) exceeding site-specific threshold concentrations in the vadose zone, capillary fringe, and saturated zone. Hydrocarbon fingerprinting will be performed on soil and groundwater samples collected from target intervals based on the SCAPS LIF results. The fingerprinting will be performed by an on-site laboratory. The SCAPS geotechnical sensors will be used simultaneously to provide continuous geotechnical and stratigraphic information that will aid in interpreting contaminant distribution. If refusal is met before contamination is fully characterized, a drill rig will be used to complete these initial borings.

Following the LIF and geotechnical data collection, soil and groundwater samples will be collected using the SCAPS to accomplish the following objectives:

- To obtain LIF verification samples representative of different soil types, different emission spectra, and different emission intensity selected throughout the site within SCAPS depth limitations
- To obtain soil samples to verify apparent anomalous LIF sensor responses
- To identify locations for continuous soil borings
- To confirm the maximum depth of POL, PAH, and PCP contamination
- To assess the percent saturation of NAPL contamination
- To evaluate the potential presence of PCB contamination in the Cellon process area
- To perform permeability analysis on soil samples across the site
- To analyze soil samples for total organic carbon (TOC) analysis from areas that have not been impacted by contamination
- To collect data on the chemical makeup and magnitude of NAPL at the site to allow for conceptual design of an in situ thermal treatment system

Contingency soil borings will be drilled at up to 15 locations where the SCAPS rig met refusal before soil contamination was sufficiently characterized. Soil samples will be analyzed for SVOCs and TPH-Dx. Permeability may also be measured on soil intervals that require additional characterization.

Microwells will be installed at the corners of the site for the purpose of obtaining water elevations that will help establish boundary conditions for a groundwater flow model. Additional microwells may be installed to collect NAPL in locations where monitoring wells are not available.

After the SCAPS and the microwell investigations are completed, two soil borings will be completed to 250 feet bgs. The placement of the soil borings will be selected based on the SCAPS LIF, and soil and groundwater sampling data. The borings are expected to be placed in areas with significant NAPL contamination representative of different contaminant signatures and where representative stratigraphic information can be obtained. Soil samples from the borings will be used for chemical, physical, and treatability tests. Once the borings are advanced to their final depth, 2-inch-diameter monitoring wells will be installed to enable groundwater sampling.

Because of the data obtained to date at the site, it is believed that the NAPL composition varies across the site and is present in different phases. As a result, NAPL samples will be collected to fill these data gaps, evaluate NAPL movement, and assist with the final groundwater remediation alternative evaluation. Samples for NAPL analysis may be collected from the soil and groundwater samples collected during the SCAPS investigation, from microwells, and/or from groundwater samples collected from previously existing monitoring wells.

Soil samples will be collected from the sidewall of Old Mormon Slough to evaluate the potential for sloughing of sidewall soils to have a negative impact on the cap. Sampling is being performed to obtain information on soil contaminant concentration that will be compared against cleanup standards above which there is a concern for recontamination of the sediment cap.

To obtain data regarding potential off-site migration and the natural attenuation potential and capacity of the system, groundwater samples will be collected from 15 existing monitoring wells. The wells selected for sampling have shown an historic upward trend in PCP or TCDD contaminant concentration.

6.4 OVERVIEW OF SAMPLING AND ANALYSIS PROGRAM

To accomplish the objectives of the field exploration at the site, the sampling and analysis program will include the following tasks:

- Preliminary site survey
- Analysis of subsurface conditions using geophysics
- Collection and analysis of soils from slough sidewalls
- Collection of NAPL from existing monitoring wells
- Analysis of groundwater from monitoring wells
- Analysis of soil using the LIF sensor and cone penetrometer on the SCAPS
- Analysis of physical and chemical parameters in the soil and groundwater from a SCAPS and/or drilling rig
- Installation of microwells to monitor groundwater elevations

- Analysis of soil from contingency and continuous soil borings

These components are summarized in this section. The Sampling and Analysis Plan contains specific field and laboratory procedures.

6.4.1 Preliminary Surveying

The Sacramento District USACE survey crew will be responsible for surveying 32 acres of the McCormick and Baxter Superfund site. The survey will take place in the month of May and a topographic map will be produced using Intergraph by June 15, 1999. The components of the general survey include the following:

- Horizontal and vertical controls will be established for the survey. The horizontal control will be in NAD83 state plane coordinates and the vertical control will be in NGVD88.

- A minimum of four monuments will be placed and surveyed on site. The monuments should be placed along the fenceline or by a building since future use of the site for field activities is not clear at this time.

- The survey will be performed on a scale of 1 inch = 50 feet. Readings will be taken on a 50-foot grid using a total station.

- The survey crew will be responsible for surveying all pertinent site features. At a minimum the pertinent site features will include all existing aboveground structures, the repository pit, the sheetpile wall along the slough, the perimeter security fence, the two stormwater holding ponds, the corners of the asphalt cap, buildings, paved areas, and the well pumphouse.

- All on-site monitoring wells will be surveyed to a vertical control of 0.01 foot on the north side of the casing/monument. GPS will be used for the control points when surveying in the well casings.

Two hard copies of the topographic map will be supplied displaying all pertinent site features and on-site monitoring wells. The map will display contours to an accuracy of 0.5 foot and will be produced using Intergraph. These maps will be used to document field activities.

6.4.2 Old Mormon Slough Bank Surveying

As part of the remediation efforts to be implemented at the McCormick and Baxter Superfund site, the bank along Old Mormon Slough may have to be stabilized to curtail the failure of contaminated soils into the waterway and onto the planned contaminated sediment containment cap. A survey of the Old Mormon Slough banks is required to develop a comprehensive stabilization design and to compute required quantities of materials needed to implement the final design.

The survey of the Old Mormon Slough banks will require the following:

- Cross sections at 50-foot intervals beginning at the east end of the sheetpile wall existing immediately north of the oily waste pond area and extending along the south bank to the end of the slough and around the eastern end of the slough to the site boundary (the entire southern and eastern bank of the slough).

- Cross sections will measure vertical elevations to a scale of 1 inch = 1 foot.

- Cross sections will extend a minimum of 100 feet onto the site upland area (measured from the top edge of slough banks). The lower (northern and western ends of the sections) will be completed within 2 hours, plus or minus, of low tide and will extend a minimum of 10 feet into the slough.

- Cross sections will indicate the presence of slope features (concrete blocks, piping, trees, and visible soil tension cracks).

- Cross sections will indicate the location of the site perimeter security fence.

- The survey crew will make note of the general kinds of vegetation (grasses, shrubs less than 4 feet in height, shrubs greater than 4 feet in height, and trees) within 200 feet of the embankment along the transects. This information will be used by a contractor to determine the amount and nature of the clearing for the bank protection.

- Sufficient survey points will be obtained along each survey line to accurately plot the location of each change in slope, the tops and bottoms of all vertical surfaces, and the slope features.

- All surveyed cross sections will be identified on a base map of the site showing the location of each cross section, the orientation of each cross section, the starting point of each cross section, and the ending point of each cross section. The base map will be to a scale of 1 inch = 20 feet. The base map may be plotted on multiple sheets if required.

- All cross sections and the base map will be supplied in electronic format using MICROSTATION. One hard copy will be supplied of the cross sections and base map.

6.4.3 Geophysical Investigation

The next phase of the field exploration will involve conducting a geophysical survey to delineate the location and shape of subsurface features and metal debris. The data obtained will aid in selecting sample locations for the SCAPS investigation and in developing an in situ thermal treatment system conceptual design. The survey will cover approximately 16 acres west of the UPRR property (Figure 6-2). Geophysical equipment will be used to detect both ferrous and nonferrous material to a depth of 15 feet, the depth at which the water table is suspected to have limited burial of debris. At a minimum the geophysical survey will result in locating and marking the corners of buried basements and foundations, the location and dimensions of a railroad car, former AST pipelines, railroad ties, utility lines, and burial pits. (Note: according to Dan Sutter, EPA On-Site Coordinator, the railroad car is believed to be located near A-8 in the main process area as shown in Figure 3-1.) This area was selected because it covers the area of interest within which subsurface structures are suspected.

6.4.4 NAPL Collection from Existing Wells

NAPL collection will be attempted in 18 monitoring wells: A-4, A-5, A-6, A-8, and A-10; DSW-1D, DSW-4B, DSW-4C, DSW-4D, DSW-4E, DSW-5B, DSW-6B, and DSW-6C; OFS-4D and OFS-4E; and ONS-1B, ONS-1C, and ONS-2A.

6.4.5 Slough Sidewall Sampling

To evaluate the potential for sloughing of sidewall soils to contaminate the cap that will be placed on the sediment at the Old Mormon Slough, soil samples will be collected from the north and south sidewalls. Of particular interest is the potential for the sloughing soils to recontaminate the existing cap above the sediment cleanup standards. The sampling locations shown in Figure 6-3 are approximate. Actual locations will be selected in the field based on representative soil that may slide into the slough.

6.4.6 SCAPS Exploration

The next phase of the site investigation will involve characterizing the vertical and horizontal extent of the petroleum hydrocarbon plume using the SCAPS equipped with a LIF sensor. It has been estimated that 40 site locations should be tested with the SCAPS rig to a depth of 200 feet to provide sufficient data on the presence/type of NAPL at the site. This number was based on available data on NAPL distribution and professional judgement. The actual number of locations tested may be more or less than 40, and will be based on the results of initial SCAPS data collected at the site. The depth limitation is based on soil type and equipment capability. It is suspected that the SCAPS will be able to push only to 200 feet at this site. The initial 10 locations of the planned 40 SCAPS penetrations are shown on Figure 6-2. The remaining 30 locations will be chosen based on the initial LIF results. A dynamic approach to selecting sampling locations has been adopted to allow for the incorporation of newly acquired data into the field plan.

The LIF sensor response is based on fluorescence and will be calibrated with a field method for total recoverable petroleum hydrocarbon (TRPH) to define detect versus non-detect of POL constituents above a threshold concentration. Continuous fluorescence measurements will be collected for the entire length of the SCAPS boring to provide an indication of relative concentrations of suspected contaminants.

During installation of the SCAPS probes, continuous geotechnical and stratigraphic data will also be collected to help interpret contaminant distribution and to delineate the continuity of subsurface materials that may influence contaminant movement, such as clay, silt, and cobble zones. The SCAPS LIF and CPT data will also be used to estimate the occurrence and approximate extent of NAPL, differentiate the occurrence of more than one NAPL type requiring treatment, improve the conceptual site model, and determine where soil and groundwater samples should be collected.

6.4.7 SCAPS Soil and Groundwater Sampling

Based on the results of the LIF screening, soil and groundwater samples will be collected to obtain more detailed contamination information. For cost estimates purposes, 20 penetration locations with 3 sampling zones for each push have been assumed. Actual numbers will be determined in the field. Because the SCAPS fluorescence intensity is generally proportional to in situ concentration of contaminants, the LIF data can be used to identify zones of probable high concentrations of contaminants. This proportional feature of the SCAPS LIF data can be used to pinpoint the zones of highest contaminant concentration and estimate the variation in concentration across the site.

At least one SCAPS penetration will be placed in the Cellon process area to collect three soil samples for PCB analysis. In addition, two penetrations will be located in areas determined to be free of contamination to collect samples for TOC analysis.

All SCAPS soil samples will be measured for TRPH using a modified version of EPA Method 418.1 by the SCAPS laboratory. Fingerprinting of soil and groundwater samples will also be performed with an on-site laboratory provided by the EPA Region 9 Field Analytical Support Program (FASP). The FASP laboratory will conduct total petroleum hydrocarbon (TPH) fingerprinting using gas chromatography/flame ionization detector (GC/FID) methods to identify C_{12} to C_{24} (diesel-range) and C_{24} to C_{35} (motor-oil-range) concentrations. The Region 9 laboratory will also perform analysis for PAHs and PCP on soil and groundwater samples using a modified Method 8270 analysis to allow for quick turnaround results. PCB analysis, when required, will be performed by the Region 9 laboratory in accordance with the EPA Contract Laboratory Program (CLP) statement of work. Soil TOC analysis will also be performed by an off-site laboratory. Permeability measurements will be performed by the Kerr Laboratory in Ada, Oklahoma. Field TRPH, TPH, PAH, and PCP data will be used for on-site validation and calibration of the fluorescence response obtained by SCAPS LIF sensor. These data will aid in evaluating the relationship between LIF response and TRPH, TPH, and PAH concentrations over the range of site soil and contaminant types.

6.4.8 Contingency Soil Borings

In the event that the SCAPS rig encounters refusal before the contamination has been fully characterized, a drill rig will be mobilized to the site to complete the investigation initiated by the SCAPS. If a drill rig is required, contingency borings will be drilled, without sampling, to the depth where the SCAPS experienced refusal. Below this depth, soil will be sampled continuously with a 2-inch-diameter split-spoon or USACE barrel sampler until the final depth of 200 to 250 feet bgs is reached. Soil samples from at least every 5 feet will be submitted to the FASP laboratory for TPH and the Region 9 lab for PAHs and PCP. The remaining samples will be archived for potential chemical and physical analysis. The core technical team will determine if the contingency borings are required and the number of samples to be submitted for chemical analysis.

6.4.9 SCAPS Microwell Installation

For the purposes of obtaining groundwater elevation data, two 1-inch-diameter microwells may be installed at the extreme northwest and northeast corners of the site (Figure 6-4). The purpose of these microwells is to help establish boundary conditions for a groundwater flow model. Additional microwells may be installed with hydrophobic screens to permit sampling of NAPL, if present.

6.4.10 Soil Boring/Monitoring Wells

After completion of the SCAPS investigation, including the possible contingency borings, two soil borings will be completed to a depth of 250 feet bgs. The placement of the borings will be based on the results of the SCAPS and other on-site analysis as well as previously installed borings. It is expected that the borings will be completed in areas of significant NAPL contamination, but with different contamination signatures, if possible, and where representative stratigraphic data can be collected. Samples will be tested from each of five aquifer zones and five aquitard zones so that data from different hydraulic zones and depths can be compared. In addition, the continuous cores collected from these soil borings will be archived. After completion of the soil borings, 2-inch-diameter monitoring wells with stainless steel screens and mild steel risers will be installed to permit groundwater sampling. Whether to develop these borings into monitoring wells and the details of well construction will be decided in the field by the core technical team.

6.4.11 NAPL Testing

Because the existing data on NAPL composition from recovered product may not be sufficient for design purposes, additional information on whether NAPL composition varies across the site and in different phases is needed (i.e., DNAPL vs. LNAPL). Samples of LNAPL and DNAPL will be collected from the SCAPS portion of the investigation and from previously existing monitoring wells. NAPL samples representative of locations across the site will be selected in addition to NAPL samples thought to be representative of different chemical composition. These NAPL samples will be submitted for analysis of SVOCs, viscosity, density, solubility, oil-water interfacial tension, wettability, and boiling point distribution. All analyses, with the exception of boiling point distribution, will be conducted by the EPA Kerr Laboratory in Ada, Oklahoma. Columbia Analytical Services will also perform chemical analyses.

6.4.12 Treatability Study

A summary of the treatability study to be conducted for the site is discussed below. A more thorough discussion is presented in Appendix C of the Quality Assurance Project Plan (QAPP).

The primary objectives of the treatability study for the McCormick and Baxter site are to determine the rate of creosote (PAH) recovery as a function of pore volumes of condensed steam injected and to determine the amount of residual creosote remaining after approximately eight pore volumes of steam have been injected. Eight pore volumes has been previously determined to be the approximate limit for economic viability of steam injection, and thus will be used as the approximate cutoff point for steam injection. The effects of steam temperature and pressure on creosote recovery rates will also be determined using pressure cycling. Leachate sampling will be done both before and after steam injection to determine the changes in dissolved creosote composition and concentration. It is also of interest to determine if oxidation of the remaining creosote compounds is likely to occur naturally, providing a “polishing” step after the completion of steam injection.

It is known that the metals arsenic, chromium, copper, and zinc were used during the wood treating operation at the site. Large quantities of arsenic also occur naturally in the soils at the site. It is currently not known if the temperatures and pressures that will be present during steam injection will affect metals by mobilizing them or by changing their form. Thus additional soil columns will be steamed so that soil and effluent samples will be analyzed to determine the initial speciation of the metals, and to determine if the steam injection mobilizes these metals or changes their speciation.

The initial treatability experiments will be performed with creosote-contaminated soils. The treatability studies, and all associated chemistry, will be performed by the EPA Kerr Laboratory.

6.4.13 Monitoring Well Groundwater Sampling and Analysis

To obtain data regarding potential off-site migration, groundwater samples will be collected from seven of the existing monitoring wells shown on Figure 6-5. An additional eight wells will be sampled to evaluate an historic upward trend in PCP or TCDD contaminant concentration. A low-flow sampling method will be used to collect representative groundwater samples. All samples will be analyzed for the following constituents to evaluate natural attenuation potential and capacity in the aquifer:

- Total and dissolved manganese by EPA Method 200.7
- Sulfate, chloride, nitrite, and nitrate by EPA Method 300 Series
- Total organic carbon by EPA Method 9060
- Routine field parameters (redox potential, pH, temperature, specific conductivity, dissolved oxygen, and turbidity)
- Hach field analyses for measuring dissolved oxygen, dissolved carbon dioxide, total alkalinity, total hardness, and total iron

All chemical analyses will be performed by the EPA Region 9 lab.

Figure 6-1
McCormick and Baxter Data Quality Objectives Process

Problem Statement

Subsurface NAPL cannot be efficiently removed without thermally enhanced extraction methods.
Sufficient data are not available to characterize contaminant extent and select a treatment technology

Investigation Objectives	Data Requirements	Investigation Strategy	Field Decision Criteria/ Performance Specifications
SURFACE GEOPHYSICS			
Identify subsurface structures or debris present that might hinder exploratory work or impact the treatment system.	Delineate location and shape of subsurface structures and metal debris that will assist in: locating areas for SCAPS work; developing conceptual design for thermal treatment system	Perform over 16 acre area west of UPRR. Survey to depth of 15 feet on a series of profiles.	Detect ferrous and nonferrous material to a depth of 15 feet.
SCAPS CPT and LIF			
Determine where NAPL exists and the approximate extent (vertical and horizontal).	Horizontal and vertical extent of NAPL. Measure concentration of primarily 3 or more ring aromatic compounds (and some 2-ring compounds) using LIF.	LIF detection threshold: 100 to 500 mg/kg TPH. 40 LIF penetrations estimated; 10 preselected and 30 decided in field. Initial locations will be selected based on current hypothesis regarding NAPL locations. Spacing of penetrations will be determined in the field and will be evaluated against estimated 100-foot treatment unit size. Continuous readings to depth of 200 feet, if possible, final decisions regarding depth of penetration will be made in the field.	Threshold TPH value (reporting limit) determined in field. Approximately 100 to 500 mg/kg. Spatial resolution of 4 cm (0.13 foot) when driven at 1 m/min. LIF penetration locations will be determined on a daily basis by Kira Lynch (team leader/chemist), Richard Smith (hydrogeologist), Fred Hart (geologist), Randy Olsen (environmental engineer), and Steve Brewer (SCAPS team leader). SCAPS penetration locations will be selected to maximize understanding of the site conceptual site model and extent of NAPL contamination.
Identify if there are more than one unit (as defined by contaminant type) requiring treatment.	Spatial distribution of TPH contamination based on soil fluorescence emission spectra. These intervals will be targeted for collection of soil samples with SCAPS and analysis of soil samples for TPH, PAH, and PCP. Chemical data will assist with interpretation of LIF wavelength signature.	Nontarget fluorescence will be evaluated by SCAPS soil sampling and analysis for TRPH. Soil samples TRPH and TPH-Dx results will be used in the field to verify apparent anomalous LIF sensor responses and assist with interpretation of wavelength signature.	Linear range of LIF is estimated to be 100 to 50,000 mg/kg for POL.
Determine how the hydrogeologic conceptual site model can be improved. Determine what natural subsurface features impact movement of NAPL.	Geotechnical and stratigraphic data from cone pressure and sleeve friction sensors. Aquitard topography and continuity.	Soil classification using SCAPS sensors according to ASTM Method D3441.	Soil classification compared to existing soil boring logs. Spatial resolution of 4 cm for soil classification at a rate of 1 m/min.
Determine where soil and groundwater samples will be collected.	Estimated contaminant concentrations in soil across site from LIF.	Select sampling locations where contamination is high and reflects a range of contaminant compositions as defined by wavelength signature.	Locations for SCAPS soil and groundwater samples will be determined in the field by Kira Lynch (team leader/chemist), Richard Smith (hydrogeologist), Fred Hart (geologist), Randy Olsen (environmental engineer), and Steve Brewer (SCAPS team leader). SCAPS soil and groundwater sample locations will be selected by evaluating existing data and SCAPS LIF data.

Investigation Objectives	Data Requirements	Investigation Strategy	Field Decision Criteria/ Performance Specifications
SCAPS SOIL and GROUNDWATER SAMPLING			
Determine accuracy of the SCAPS LIF data. Verify apparent anomolous LIF readings.	Co-located soil samples with SCAPS LIF penetrations.	Visual evaluation of soil cores for NAPL compared with LIF data. Collect soil samples at approximately 20 penetration locations for on-site analysis of TRPH by 418.1. Approximately 3 locations per penetration. Depths decided in field.	Sensitivity for TRPH must be at least as good as LIF threshold. LIF and confirmation TRPH should be in agreement on detect versus nondetect for 80% of the samples; false negative < 5%.
Determine variability of contamination composition. Determine if contaminant extent can be better estimated. Confirm the bottom of POL, PAH, and PCP contamination. Develop the conceptual design of an in situ thermal treatment system.	Soil and groundwater data for TPH-Dx, PAH, and PCP. Compare soil chemical analysis with LIF results representative of different soil types, emission spectra and emission intensity. Chemical makeup, magnitude, and variability of contamination.	Soil samples analyzed by the following methods: SCAPS TRPH by 418.1, FASP TPH fingerprinting by GC/FID, limited SVOC TAL by GC/MS to be run by Region 9 Lab. Groundwater samples analyzed by the following methods: FASP TPH fingerprinting by GC/FID, limited SVOC TAL by GC/MS to be run by Region 9 Lab.	Sensitivity for TRPH, TPH, and SVOC analyses must be at least as good as LIF threshold. Sensitivity for SVOCs and TPH determined based on limitations of analytical instrumentation.
Determine how much NAPL is present. Evaluation of NAPL percent saturation is required to assist with evaluation of areas of mobile NAPL.	Percent saturation of NAPL contamination in soil.	Soil samples analyzed for TRPH. Data will be used to calculate percent saturation.	Sensitivity for TRPH analyses must be at least as good as LIF threshold.
Determine if PCB contamination of soil is encountered in Cellon Process area. This area of the site was targeted because evaluation of TPH GC chromatograms from soil samples previously collected indicate that hydraulic fluid was potentially used as the creosote carrier fluid in this process area.	Biased soil PCB data for locations in cellon process area.	Off-site analysis of soil samples for PCBs by EPA CLP SOW. Sample locations to be selected in the field to be representative of areas suspected to have the highest potential contamination. Samples will be collected from soil zones with higher relative clay content.	
Determine if the movement of dissolved organic contaminants is affected by adsorption onto naturally occurring organic matter.	Soil TOC concentrations in unimpacted areas and representative of soil conditions across the site.	9 to 12 soil samples analyzed for TOC using the Walkley-Black method. Samples will be selected to obtain TOC information representative of different aquifer and aquitard zones.	Detection limit of 1,000 mg C/kg to allow for K_d calculation.
Determine downward migration potential for groundwater and NAPL. Provide input for model.	Permeability (hydraulic conductivity) data on aquitard and aquifer materials. Need site-wide data to evaluate variability.	Collect soil samples from aquitard and aquifer materials for hydraulic conductivity measurements. Locations to be determined in the field.	Permeability measurements will be made on soil cores that may have to be repacked. The purpose of the permeability data is to estimate average permeability so this method should provide adequate permeability data quality.
Identify optimum locations for collecting continuous soil cores.	Soil contaminant concentrations.	Select boring locations in areas of highest contamination based on SCAPS results. In addition borings will be located in areas with different contaminant signatures if possible.	Selection of locations for continuous borings will be made in the field by Kira Lynch, Richard Smith, and Fred Hart. Decisions regarding well construction and design will be made in the field by Richard Smith and Carrie Romine.

Investigation Objectives	Data Requirements	Investigation Strategy	Field Decision Criteria/ Performance Specifications
SCAPS MICROWELL INSTALLATION			
Determine the direction of groundwater flow across the site.	Water level data to establish flow conditions at corners of property.	Install two microwells at extreme NW and NE corners of project. Measure water levels to 0.01 feet.	Decisions regarding installation of microwells for water level measurements will be made in the field by Kira Lynch, Richard Smith, Fred Hart, and Randy Olsen.
Determine the extent and composition of NAPL.	Obtain NAPL samples from areas where no monitoring wells are located.	Install and sample up to ten microwells with hydrophobic screens. If NAPL samples are collected they will be analyzed as described for under NAPL samples.	Decisions regarding installation of microwells for NAPL sample collection will be made in the field by Kira Lynch, Richard Smith, Fred Hart, and Randy Olsen.
CONTINGENCY SOIL BORINGS			
Determine the extent/composition of contamination at depths where SCAPS penetrations are not possible.	Soil characterization where SCAPS met refusal before contamination was fully characterized.	Continuous sampling with a 10 ft core barrel with 5 ft split spoon to below SCAPS refusal to a depth of 200 to 250 feet at 15 locations. Selection of soil samples in field for analysis by: 1) SVOC limited TAL by GC/MS by Region 9 Lab. 2) TPH-Dx by GC/FID by FASP. All soil samples archived for additional chemical or physical testing.	Sensitivity for TRPH, TPH, and SVOC analyses must be at least as good as LIF threshold. Sensitivity for SVOCs and TPH based on limitations of analytical instrumentation.
Determine downward migration potential for groundwater and NAPL. Provide input for model.	Permeability (hydraulic conductivity) data on aquitard and aquifer materials. Need site-wide data to evaluate variability.	10 soil samples collected from locations selected in the field and analyzed for permeability by Kerr Lab. These samples will be collected if intervals of unique stratigraphy are encountered that were not sampled for permeability during SCAPS soil sampling.	Permeability measurements will be made on soil cores that may have to be repacked. The purpose of the permeability data is to estimate average permeability so this method should provide adequate permeability data quality.
SOIL BORINGS/MONITORING WELLS			
Determine how amenable the site and contamination is to treatment by thermal methods.	Soil samples collected for physical and chemical characterization of areas of heavy NAPL contamination and differing contaminant signatures.	2 soil borings to 250 feet bgs. Continuous soil cores will be obtained and archived. The cores will be visually evaluated to estimate NAPL saturation. Soil coring by split spoon or core barrel. Completed as monitoring wells. Soil samples for analysis collected from each of 5 aquifer zones and 5 aquitard zones (10 samples per boring for a total of 20 samples).	Samples will be selected from borings in the field. Selection criteria will be based on identifying unique geologic intervals and visible contamination.
	Chemical characteristics of NAPL contamination.	10 soil samples analyzed for dioxin/furans (1613B) and metals (arsenic, copper, chromium, and zinc by CLP RAS) at the Region 9 Lab.	Samples selected only from most contaminated areas of site to evaluate worst-case scenarios.

Investigation Objectives	Data Requirements	Investigation Strategy	Field Decision Criteria/ Performance Specifications
	Chemical characteristics of NAPL contamination.	20 soil samples for SVOCs full TAL with TICs (GC/MS) by Kerr Lab.	Sensitivity based on soil cleanup levels established in the site ROD (EPA Region 9, March 31, 1999). These samples will be split and also run by the FASP (TPH) and Region 9 (PAH and PCP, Modified 8270) labs to provide data for comparability analysis.
	Geochemistry comparison between zones to provide information to design extraction and treatment system.	20 soil samples for cation exchange capacity by PTS Laboratories.	Sensitivity based on limitations of analytical instrumentation. Samples selected from most sand-rich and clay-rich soils in clean zones.
Determine how amenable the site and contamination are to treatment by thermal methods.	Physical characteristics of soil to determine downward migration potential for groundwater and NAPL. Provide input for model.	Soil classification during drilling. 20 soil samples analyzed for grain size (ASTM D422), density (ASTM D2937) and porosity (API RP40) by PTS Laboratories. 20 samples analyzed for permeability (Kerr Lab SOP) by Kerr Lab.	Soil classification compared to existing soil boring logs. Sensitivity based on limitations of analytical instrumentation. The purpose of the permeability data is to estimate average permeability so this method should provide adequate permeability data quality. Samples collected for physical testing will be from soil zones that appear to have relatively low levels of contamination, using visual inspection, and be representative of different stratigraphic horizons.
	Chemical and physical characteristics of NAPL contamination to provide information to design extraction and treatment system.	Up to 10 samples analyzed for oil and grease (9071A) by PTS Laboratories used with moisture content to calculate NAPL saturation.	Sensitivity based on limitations of analytical instrumentation. Samples selected from visibly contaminated zones.
Determine effect of heat on metals fate and transport.	Natural soil metals speciation data for comparison to treatability study results.	Up to 20 soil samples analyzed for metals speciation by Kerr Lab.	Sensitivity based on limitations of analytical instrumentation.
Determine the rate of creosote (PAH) recovery as a function of pore volumes of (condensed) steam injected, and determine the amount of residual creosote remaining after approximately eight pore volumes of steam have been injected. Determine effect of heat on metals fate and transport.	For feasibility and determination of design parameters of thermal treatment.	Up to 20 steam treatability tests, including steam column tests and leaching tests prior to and following steam treatment, by Kerr Lab. Study will focus on PAHs, but will include metals speciation information as well.	Focus on creosote and PAHs only. Samples for treatability testing will be selected in the field with input from Eva Davis. They will bracket the concentration range and be representative of varying contaminant signatures.
LNAPL and DNAPL TESTING			
Determine if NAPL composition varies across the site and if this will impact thermal treatment.	Chemical characteristics of NAPL across site and in different product phases to provide information for design of thermal treatment system.	10 to 20 NAPL samples will be collected from: 1) SCAPS penetrations, 2) existing monitoring wells, and/or 3) microwells. Chemical analysis for SVOCs (full TAL with TICs) and TPH-Dx (GC/FID) by Kerr Lab and Columbia.	Sensitivity based on limitations of analytical instrumentation. Samples will represent both DNAPL and LNAPL, and different contaminated areas.

Investigation Objectives	Data Requirements	Investigation Strategy	Field Decision Criteria/ Performance Specifications
Determine: 1) the tendency of NAPL to move downward when mobilized, 2) the ability of NAPL to flow to a recovery point, 3) the tendency of NAPL to dissolve in site groundwater, 4) if interfacial tension will effect the amount of residual creosote that will remain in soil, and 5) the potential for fractionation during thermal treatment.	Physical characteristics of NAPL to provide information for design of thermal treatment system.	Physical analyses performed by Kerr Lab for: 1) density from 10 to 90C each 10C, 2) viscosity from 10 to 90C each 10C, 3) solubility of NAPL in site groundwater at 10C and 90C, 4) oil-water interfacial tension from 10 to 90C each 10C using site groundwater, 5) wettability using a bottle test procedure, physical analyses by PTS Laboratories for: 6) boiling point distribution/distillation by ASTM D86.	Sensitivity based on limitations of analytical instrumentation. Density precision is approximately 0.001 gm/cm3.
SLOUGH SIDEWALL SOIL SAMPLING FOR DIOXIN, PAHs, and PCP			
Determine if sidewall sloughing has the potential for contaminating the sediment cap.	Sidewall average soil contaminant levels. Compositing will be used to obtain data representative of average loading scenario.	Total of 6 composited soil samples from three south shore management units (oily water pond, main processing area, and east end of slough). Total of 2 composited soil samples from north shore. Test depth = 1 foot. Test each sample for PCDD/F by 1613B and PAHs/PCP by 8270C.	Critical contaminant concentration = 18.4 mg/kg total PAH (dry weight) or 56.5 ng/kg PCDD/F TEQ (dry weight). Sample specific quantitation limit no greater than 1.5 ng/kg for 2,3,7,8 substituted tetra- and penta-chlorinated dibenzodioxins and furans. PAH reporting limit is 1 mg/kg and PCP is 2.5 mg/kg. Sampling locations will be selected in the field to represent average loading to the slough from slumping.
MONITORING WELL GROUNDWATER SAMPLING AND ANALYSIS			
Determine dissolved naphthalene concentration and extent.	Measure PAHs and PCP in groundwater at perimeter well locations.	Collect samples from eight wells (A-8, DSW-7A, DSW-7B, DSW-7C, OS-3E, 0S-4A, 0S-4B, and OS-4C) and analyze for SVOCs full TAL with TICs by Region 9 Lab. Use low-flow sampling technique.	Sensitivity based on MCLs and PRG for naphthalene. Groundwater cleanup numbers have not been established for the site (EPA Region 9 ROD, March 31, 1999)
Determine if the historic upward trends in PCP and TCDD concentrations are continuing	Measure PCP or TCDD in groundwater from wells that have shown upward trend in dioxin or SVOC data.	Collect samples from seven wells (A-5, DSW-4B, DSW-4C, DSW-4D, DSW-6B, DSW-6C, and OFS-3B) and analyze for dioxin/furans by CLP lab and SVOCs full TAL with TICs by Region 9 Lab. Use low-flow sampling technique.	Sensitivity based on MCLs and PRG for naphthalene. Groundwater cleanup numbers have not been established for the site (EPA Region 9 ROD, March 31, 1999)
Determine if natural attenuation has the potential to impact contaminant migration.	Measure natural attenuation (NA) potential and capacity in groundwater samples.	Measure following parameters in 15 wells listed above: total and dissolved Mn (200), sulfate (300 Series), chloride (300 Series), nitrate/nitrite (300 Series), TOC (9060), Eh, pH, temperature, specific conductance, DO, turbidity and Hach field analysis of DO, dissolved CO2, total alkalinity, total hardness, total iron. Off-site analyses conducted by Region 9 Lab.	Sensitivity based on limitations of analytical instrumentation.

Investigation Objectives	Data Requirements	Investigation Strategy	Field Decision Criteria/ Performance Specifications
Determine the tendency of NAPL to move downward when mobilized.	Groundwater density measurements.	Measure density at 10 to 90C (Kerr Lab SOP) in 15 wells listed above.	Sensitivity based on limitations of analytical instrumentation. Precision is approximately 0.001 gm/cm3. Will provide data representative of density across site and in different zones.

Figure 6-2 Initial SCAPS Locations

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Figure 6-2 continued

Figure 6-3 Slough Soil Sampling Locations

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Figure 6-3 continued

Figure 6-4 Proposed Microwell Installation Locations

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Figure 6-4 continued

Figure 6-5 Groundwater Sampling Locations of Existing Monitoring Wells

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Figure 6-5 continued

Table 6-1
Monitoring Well Groundwater Sampling and Analysis

Monitoring Well ID	Rationale	Analyses to Be Performed
A-5	Dioxin upward trend	1613B/NA parameters
A-8	PCP upward trend	8270/NA parameters
DSW-4B	Dioxin upward trend	1613B/NA parameters
DSW-4C	Dioxin upward trend	1613B/NA parameters
DSW-4D	Dioxin upward trend	1613B/NA parameters
DSW-6B	Dioxin upward trend	1613B/NA parameters
DSW-6C	Dioxin upward trend	1613B/NA parameters
DSW-7A	Naphthalene migration well	8270/NA parameters
DSW-7B	Naphthalene migration well	8270/NA parameters
DSW-7C	Naphthalene migration well	8270/NA parameters
OFS-3B	Dioxin upward trend	1613B/NA parameters
OS-3E	Naphthalene migration well	8270/NA parameters
OS-4A	Naphthalene migration well	8270/NA parameters
OS-4B	Naphthalene migration well	8270/NA parameters
OS-4C	Naphthalene migration well	8270/NA parameters

NA - natural attenuation

7.0 DATA REVIEW, PRESENTATION, AND INTERPRETATION

7.1 QUALITY ASSURANCE REVIEW

The field method review process for this project will include Field Investigation Manager supervision and review of the procedures being implemented in the field for consistency with the established protocols. Field forms will be reviewed on a daily basis by the USACE technical team.

The chemical data review process for this project will include data generation, reduction, and two levels of QA review. The first level of review will be conducted by the analytical laboratory data reviewer. After receipt of data packages, the project QA/QC Officer, or a designee, will conduct an independent data quality review and generate a QA summary report that will evaluate attainment of data quality objectives of the overall project.

7.1.1 Field Measurement Quality Assurance

The Technical Leader and Field Investigation Manager are responsible for field quality assurance. The Field Investigation Manager will review the procedures being implemented in the field for consistency with the established protocols. The Field Investigation Manager is responsible for supervising and checking that samples are collected and handled in accordance with this Management Plan and that documentation of work is adequate and complete. Sample collection, preservation, labeling, etc., will be checked for completeness. Where procedures are not strictly in compliance with established protocol, the deviations will be field documented and reported to the project QA/QC Officer. Corrective actions will be defined and implemented by the Field Investigation Manager and Technical Leader and documented as appropriate.

7.1.2 SCAPS Laboratory Quality Assurance Review

One hundred percent of mobile field laboratory data will be reviewed. The review will include evaluation of method performance as outlined in the SCAPS standard operating procedures (SOPs) and evaluation of threshold limits, replicate analyses, precision and accuracy, representativeness, comparability, and completeness.

7.1.3 Fixed Laboratory Quality Assurance

One hundred percent of the FASP and fixed laboratories’ data will be reviewed against laboratory performance criteria and sample-specific criteria. The quality review on the data will include evaluation of precision, accuracy, representativeness, comparability, and completeness, sampling documentation, holding times, instrument calibration, and tuning. The USACE will evaluate overall completeness and determine if DQOs have been met. After receipt and initial review of all data from FASP and the EPA Region 9 laboratory, CLP-like deliverables will be requested for 10 percent of all data packages. These data will receive a full validation according to EPA functional guidelines (U.S. EPA 1994a and 1994b) and site-specific criteria. All slough data will be provided in a CLP-like deliverable. Validation of these data will be performed by a USACE contractor using the DQOs, the EPA-functional guidelines, and the Region 9 standard operating procedures.

7.2 DATA PRESENTATION

Site investigation results will be presented in text, tables, and graphics. Text will be in Microsoft Word /95 format. Tabular data will be presented in Microsoft Excel 5.0/95 or Microsoft Word 6.0/95 formats. Microsoft Access data will be ported to Excel for preparation of reports and other documents. Schematic graphical data will be presented using Macromedia Freehand 5.0, CorelDraw 8.0, or similar software. Computer-aided drafting of site plans and other scale-intensive graphics will be performed using Intergraph Microstation. Where appropriate, geographic presentation of analytical data will be presented using GMS software. Boring logs will be prepared with appropriate software, such as gINT.

7.3 DATA INTERPRETATION

The primary objectives of this field exploration are to better define the extent/composition of NAPL in the subsurface and to evaluate the geologic constraints to assess appropriate thermal treatment system technologies. Data collected to better define the presence and characteristics of the NAPL include the following:

- Geophysical data
- SCAPS LIF and cone penetrometer data
- Site geology and stratigraphy
- Analysis of soil and groundwater samples collected from SCAPS penetrations, soil borings, and monitoring wells
- Groundwater elevation data from microwells
- Testing of NAPL recovered from monitoring wells and SCAPS

A variety of physical tests will also be conducted on the NAPL and groundwater. These tests include density, viscosity, solubility, oil-water interfacial tension, boiling point distribution, and salinity. The data from these analyses and tests will be used to map the extent of NAPL at the site, estimate the amount, and classify it into groups with similar physical/chemical properties, if possible.

Zones of low permeability in the subsurface provide surfaces upon which NAPL may flow and move from the original source. Geotechnical and stratigraphic data collected by the SCAPS cone penetrometer will be used to identify low permeability zones. Other sources of stratigraphic data include core samples collected from the soil borings. Many of these soil samples will be analyzed for grain size, density, porosity and permeability. The results of the field work and soil testing will be used to develop a stratigraphic map of the subsurface that may help explain the distribution of NAPL at the site.

The NAPL distribution/characteristics data and the subsurface stratigraphy of the site will also be used to evaluate the feasibility of in situ treatment technologies and may be used to aid in the conceptual design of a thermal treatment system.

Slough sidewall soil data will be evaluated to determine the potential for slumping to recontaminate the sediment cap. Concentrations will be compared to critical contaminant loading values.

Groundwater data from monitoring wells will be used to estimate the current extent of the naphthalene plume and to evaluate the concentration trends for PCP and dioxin.

8.0 COMMUNICATIONS, DATA MANAGEMENT, AND REPORTING

This section of the Work Plan describes the important project elements of communications between team members and the flow and management of data that has been collected. The method of reporting project results is also described.

8.1 COMMUNICATIONS STRATEGY

Accelerated approaches to sampling and analysis, as required for this project, integrate various characterization tasks and measurements into a single coordinated effort. Accelerated approaches are conducted by a multidisciplinary group of experienced professionals, working as a team in the field to evaluate the data to further refine the conceptual site model (CSM) and plan the next measurement steps. Project team members and inter-group communication strategies are described below and shown on Figure 8-1.

8.1.1 Project Team

The project team consists of representatives from EPA Region 9; EPA Kerr Laboratory; the Seattle, Albuquerque, and Sacramento Districts USACE; and numerous contractors. The project team provides the overall framework for the sampling and analysis approach by defining project objectives and data quality requirements, and ensuring that both the objectives and data quality requirements are met.

Providing oversight for the project team throughout the process are individuals identified to ensure that project quality assurance/quality control and health and safety issues are addressed. At any time, any individual working on the project may contact the QA/QC Officer or the Health and Safety Officer to discuss project issues or concerns. It is the responsibility of the QA/QC Officer and the Health and Safety Officer to implement corrective actions if project requirements are not being met.

The project team must keep the EPA RPM (Marie Lacey) informed of how the project is proceeding. The approval of EPA is required for any major deviations in the work. Project updates will be given to the EPA RPM and the USACE PM (Cheryl Buckel) by the Project Technical Team Leader (Kira Lynch) during regularly scheduled meetings, phone calls, e-mails or faxes. The USACE Project Technical Team Leader is a member of the core technical team (below) and will be in daily contact with the Field Investigation Manager. All site activities will be coordinated with Bill Catlett, Site Maintenance Manager.

8.1.2 Core Technical Team

Within the project team is a core technical team made up of individuals who have expertise in geologic, hydrologic, and chemical analytical methods appropriate for the site. They provide a continual, integrated, and multidisciplinary presence throughout the process. The members of the core technical team are involved in all steps of the process and are usually present in the field when data collection related to their areas of expertise is taking place. The optimization of field investigation activities and the quality of the evolving and final CSM depend on the interaction among the members of the core technical team and the EPA, each providing their own special perspective on the site.

The core technical team oversees analysis of the raw data, evaluates the data to further refine the CSM, and recommends to the leader of the core technical team next measurements that best test the crucial features of the CSM. Members of the core technical team should have whole-site-systems understanding of geology, hydrogeology, and contaminant chemistry. They work together to evaluate the data as they are obtained. Their most important role is integrating and understanding inconsistencies between the data and the CSM. The ability to integrate their technical expertise with that of the other members of the core technical team is crucial to the success of the project.

During this project, the core technical team will use field-based site characterization methods that will generate data that will be evaluated and integrated into the CSM in the field. The core technical team will follow a dynamic work plan that allows and requires on-site decisionmaking by the project team. Successive steps are based on the evaluation and integration of field data into the CSM.

Core technical team members include:

- Project Technical Team Leader/Project Chemist—Kira Lynch
- Project Environmental Engineer—Randy Olsen
- Project Senior Geologist/Data Leader—Richard Smith
- Sediment Cap Team Leader/QA/QC Officer—John Wakeman
- Health and Safety Officer (Certified Industrial Hygienist)—David Elskamp

The Project Technical Team Leader is ultimately responsible for all decisions related to the design and implementation of this project, within the framework provided by the approved dynamic work plan. She is tasked with informing the USACE PM and EPA RPM about all decisions that may impact project schedule or budget. Final decisions that impact budget and schedule will be made by the USACE PM and EPA RPM.

The Project Technical Team Leader, supported by other core technical team members, is also responsible for ensuring data quality and effective data management and also interprets data and integrates the results into the evolving site model and reports. She has the final authority on site technical decision making concerning field operations. If the Project Technical Team Leader is absent during field operations, another member of the core team will be designated as the technical team leader, who, in telephone consultation with the Project Technical Team Leader, makes decisions concerning the next day's activities. This person will most likely be the Field Investigation Manager. Other core technical team members are in the field for data collection involving their primary area(s) of expertise and are available for telephone consultation when they are not present in the field.

Although data management and QA/QC are specific project support functions, the Project Technical Team Leader, supported by the other core technical team members, is responsible for ensuring that (1) data collection is relevant to the objectives of the project (that is, necessary to satisfy data quality requirements), (2) QA/QC procedures for data collection and processing for respective areas of expertise are strictly followed, and (3) field data reduction and processing do not introduce errors into the data and evolving site model.

The core team will be in daily contact to discuss how the project is proceeding and any changes required by the EPA RPM. Additionally, daily meetings to discuss project technical issues will be held in the field with core technical team members present or linked by conference call. Representatives of subcontractors or project support team members (below) may also be asked to attend these meetings. Daily chemical quality control reports (DCQCRs) will be generated and faxed to the Project Data Leader at the USACE Seattle District office. The DCQCR will include all field data generated on a daily basis, including mobile laboratory data, chain of custody forms, and field sampling forms. The reports will be scanned and posted on the project website.

8.1.3 Project Support Team

The project support team includes technical personnel and equipment operators involved in data collection and sampling and personnel who provide other support functions.

Project support team members include:

- EPA FASP Laboratory Team—Jeff Mays
- USACE SCAPS Team—Steve Brewer
- USACE Survey Team—Kenneth Regalado
- Off-Site Laboratories
  - EPA Region 9 Environmental Laboratory—Nancy Wilson
  - EPA Kerr Laboratory—Eva Davis
  - Columbia Analytical Services—Diane Wiegle

- PTS Laboratories, Inc.—Richard Young
- Pacific Analytical Laboratories—Steven Parsons

The project support team will be in daily contact with the Field Investigation Manager, or designated technical task manager, when they are working on site. They may be asked to attend technical team meetings to present results or other technical issues, if needed. Off-site laboratories will be contacted by the Field Investigation Manager, or designee, as necessary.

8.2 DATA FLOW

Two primary categories of data will be generated for this project: field data and fixed laboratory data. The procedures to be used for each type of data are described below.

8.2.1 Field Data

Field measurements/observations will be recorded by technical support team members in logbooks and on the appropriate field forms. SCAPS and FASP laboratory data will be generated on a daily basis and reported in formats that can be interpreted by the core technical team. SCAPS and FASP data deliverables are described in detail in the QAPP. All field data will be transferred to the Field Investigation Leader at the site field office. A temporary file will be established and maintained at the site field office to ensure proper hard copy storage during field operations. These files will be added to and used by the core technical team as data are generated by the field support team. Daily chemical quality control reports will be generated and faxed to the Project Data Leader at the USACE Seattle District office. The DCQCR will include all field data generated on a daily basis, including mobile laboratory data, chain of custody forms, and field sampling forms. Incoming project-related material, including correspondence, authorizations, chain of custody forms, or other information, will be marked with the date received and the project name.

Upon completion of the field program, the temporary file will be transferred from the site field office and incorporated into the USACE Seattle District office project file. The Project Data Leader will oversee the input of project records. Copies of all field documents may be made and retained by the originator for use in report preparation and later reference. The originals will be filed in the office project file.

On-site field measurements and laboratory data will be input into an electronic database. The data will then be printed out and compared to the original field records to ensure input accuracy. All review documentation will be initialed and dated by the reviewer, then filed with the quality review documentation.

8.2.2 Fixed Laboratory Data

Fixed laboratory data will be transferred from the project laboratories to the Project Technical Team Leader/Chemist in hard copy and electronic formats. The PAH/PCP data produced by the Region 9 lab on quick turn-around will be e-mailed to the Project Technical Team Leader. Data will be loaded into the electronic database. Hard copies of the laboratory deliverables will be used to verify the accuracy of electronic data. The original hard copies of laboratory deliverables will then be stored in the office project file.

The laboratories will maintain and follow their own detailed procedures for laboratory record keeping in order to support the validity of all analytical work. Each data package submitted to the Project Data Manager will contain the laboratory's written certification that the requested analytical method was run and that all QA/QC checks were within established control limits on all samples, with exceptions noted.

8.2.3 Reporting

Information on project status and available data will be posted daily on the project website by the core technical team. These postings will include the SCAPS graphical files described in detail in the QAPP. The GMS support files and plots of site data will be made available on the project ftp site.

Field activities will be documented in preliminary draft, draft and final versions in technical memorandum format. The memorandum will include a discussion of fieldwork, results of soil/NAPL/groundwater sampling and testing, the nature/extent/character of site contamination, stratigraphy, relationship of the chemicals of concern (COCs) to the stratigraphy, and an updated conceptual site model. Field notes, calculations, field forms, analysis results and resultant interpretations will be included. This memorandum will also include an analysis of the results in relation to the purpose and objectives of the field exploration. A review conference will be held to discuss the memorandum and recommendations. Formal, written responses to EPA and project team review comments will be prepared and incorporated into the final reports as necessary.

Figure 8-1 Communication Strategy

9.0 SCHEDULE

The schedule for activities for the NAPL field exploration at the McCormick and Baxter Superfund site is shown in Table 9-1. Figure 9-1 shows the SCAPS schedule for June through August 1999.

Table 9-1
Project Schedule

Project Task	Start Date	Finish Date
McCormick and Baxter Field Work		
Site Location Surveys	5/09/99	5/28/99
Geophysical Survey	5/25/99	5/28/99
Conduct Sidewall Soil Sampling at Old Mormon Slough	6/28/99	6/30/99
SCAPS Mobilization and Field Prep	7/4/99	7/7/99
Conduct Pre-Selected LIF Pushes	7/8/99	7/13/99
Conduct Groundwater Sampling	7/12/99	7/16/99
Conduct Field Selected LIF Pushes	7/13/99	8/11/99
Conduct NAPL Sampling of Monitoring Wells	7/26/99	7/28/99
Contingency Soil Borings	8/2/99	8/31/99
Conduct SCAPS Soil and Groundwater Sampling	8/12/99	8/27/99
Contingency Sampling Days - SCAPS	8/28/99	8/31/99
SCAPS Demobilization	9/1/99	9/1/99
Continuous Soil Borings/Install Monitoring Wells	9/1/99	10/15/99
FASP Field Analysis		
FASP Lab Mobilization	7/26/99	7/30/99
Conduct Field Analysis	8/2/99	8/31/99
FASP Lab Demobilization	9/1/99	9/1/99
Reporting		
SCAPS Report	9/1/99	10/8/99
Preliminary Summary of Data	9/13/99	10/1/99
Draft Investigation Report	10/8/99	11/8/99
Final Investigation Report	12/10/99	12/22/99

Figure 9-1 Tulsa District SCAPS Schedule for Wyckoff (Washington) and McCormick and Baxter (California) Sites

10.0 REFERENCES

Department of Water Resources [California State] (DWR). 1978. *Evaluation of Groundwater Resources, Sacramento Valley*. August 1978.

———. 1967. *San Joaquin Valley Ground Water Investigation.* [Sacramento, California.] July 1967.

ICF Kaiser Engineers, Inc. 1998a. *Soil and Groundwater Remedial Investigation Report, McCormick and Baxter, Stockton, California.* 2 vols. July 1998.

———. 1998b. *Soil and Groundwater Feasibility Study Report, McCormick and Baxter, Stockton, California.* July 1998.

Pacific Northwest National Laboratory (PNNL). 1998. *Surface Water-Sediment Feasibility Study Report for the McCormick and Baxter Superfund Site, Stockton, California.* Prepared for U.S. EPA Region 9. July 1998.

———. 1997. *Ecological Risk Assessment of the Surface Water Operable Unit, McCormick and Baxter Superfund Site.* Prepared for U.S. EPA. Richland, Washington. 1997.

U.S. Army. 1998. *Environmental Restoration Programs Guidance Manual.* April 1998.

U.S. Army Corps of Engineers (U.S. ACE). 1994. *Requirements for the Preparation of Sampling and Analysis Plans.* EM 200-1-3.

U.S. Environmental Protection Agency (U.S. EPA). 1999. *Record of Decision, McCormick and Baxter Superfund Site, Stockton, California.* EPA Region 9. March 31, 1999.

———. 1994a. *Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analyses.* EPA Data Review Work Group. July 1, 1994.

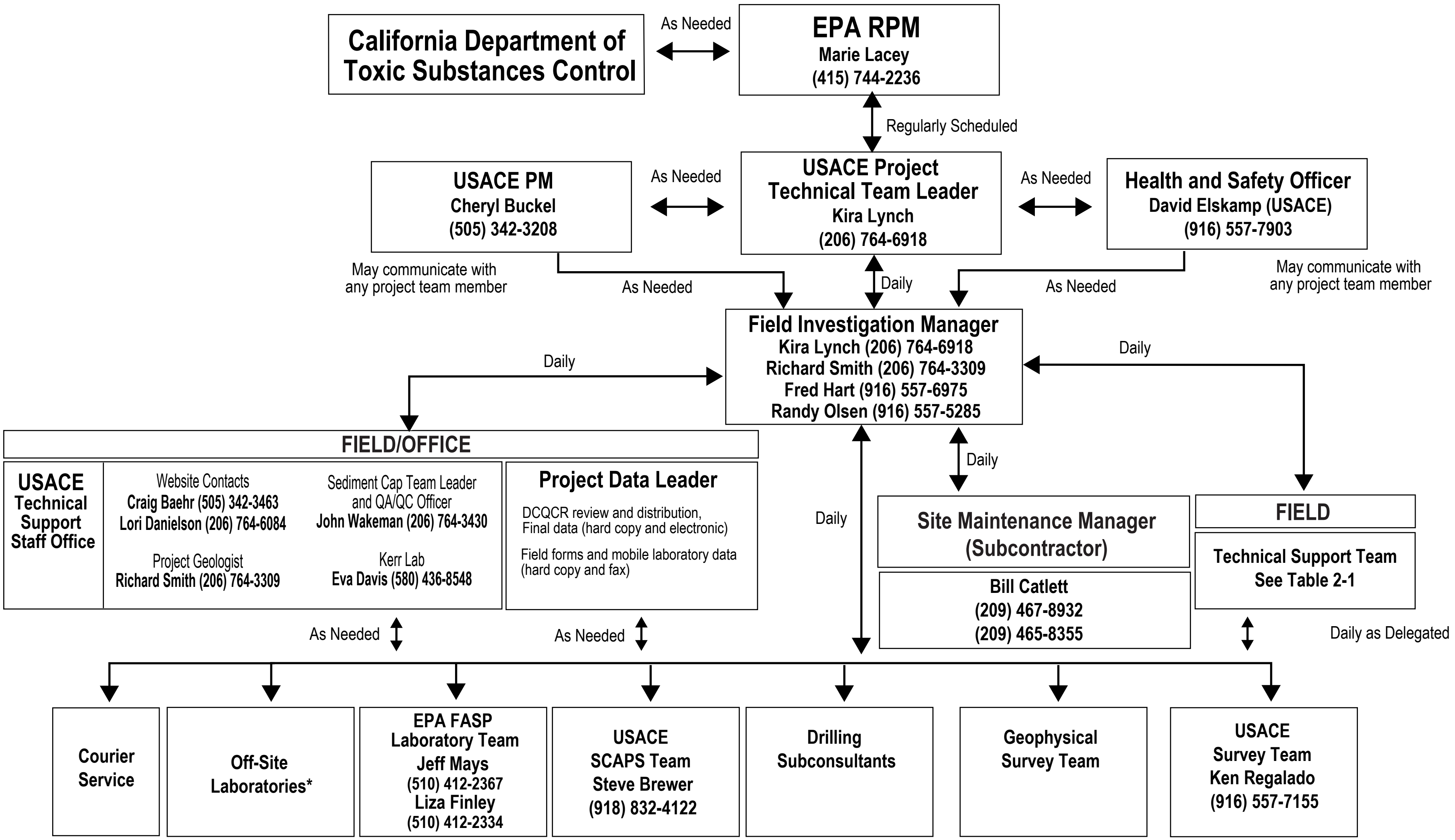
———. 1994b. *Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analyses.* EPA Data Review Work Group. February 1, 1994.

———. 1986. *Guidelines for the Health Risk Assessment of Chemical Mixtures.* Federal Register, vol. 51, pp. 34014-34041. September 1986.

———. 1985. *Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites.* Prepared by Clements Assoc., Arlington, Virginia. September 1985.

APPENDIX A

NAPL Volume Estimate
(Prepared by USACE Seattle District)



*EPA Region 9 Environmental Laboratory – Nancy Wilson (510) 412-2377; Rich Bauer (510) 412-2312
EPA Kerr Laboratory – Eva Davis (580) 436-8548
Columbia Analytical Services – Diane Wiegle (360) 577-7222
PTS Laboratories, Inc. – Richard Young (562) 907-3607
QAMS EPA Lab for Dioxin Analysis – Gail Jones RSCC (415) 744-1498
Pacific Analytical Services – Steven Parsons (760) 931-1766

Figure 8-1
Communication Strategy

MANAGEMENT PLAN
FOR NAPL FIELD EXPLORATION
McCormick and Baxter Superfund Site
Stockton, California

JUNE 1999

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 Mobilization from Tulsa to Bainbridge Island	2	3	4	5
6	7 Work for 11 Days	8	9	10	11	12
13	14	15	16	17	18 Fly Home	19
20 Return	21 Work for 7 Days	22	23	24	25	26
27	28 Contingency Days	29	30	Prep Truck for Drive to Stockton	Fly Home	

WYCKOFF - 4 mobilization days, 18 work days, 3 contingency days, 1 prep day

JULY 1999

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5 Fly to Seattle, Drive to Stockton	6	7	8 Start Work M&B	9	10
11 Work for 10 Days	12	13	14	15	16	17
18	19 Day Off	20 Work for 4 Days	21	22	23 Fly Home	24
25 Return	26 Work for 12 Days	27	28	29	30	31

McCormick & Baxter - 2 mobilization days, 43 work days, 3 contingency days,
3 demobilization days

AUGUST 1999

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 12 Days (continued from July)	4	5	6	7 Day Off
8	9 Work for 5 Days	10	11	12	13 Fly Home	14
15 Day Off	16 Work for 12 Days	17	18	19	20	21
22	23	24	25	26	27	28 Day Off
29	30 Contingency Days			Prep Truck and Drive Home		

McCormick & Baxter (continued) - 2 mobilization days, 43 work days,
3 contingency day, 3 demobilization days

Figure 9-1
Tulsa District SCAPS Schedule for Wyckoff (Washington)
and McCormick and Baxter (California) Sites

MANAGEMENT PLAN
FOR NAPL FIELD EXPLORATION
McCormick and Baxter Superfund Site
Stockton, California

FINAL

SAMPLING AND ANALYSIS PLAN FOR NAPL FIELD EXPLORATION

McCormick and Baxter Superfund Site
Stockton, California

June 16, 1999

Prepared for

EPA
REGION 9

U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California 94105-3901

Prepared by

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98134

URS Greiner Woodward Clyde

2401 4th Avenue, Suite 808
Seattle, Washington 98121-1459
53F0072166

CONTENTS

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APPENDIXES

TABLES

ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
bgs	below ground surface
CLP	Contract Laboratory Program
CPT	cone penetrometer testing
CSM	conceptual site model
DCQCR	daily chemical quality control report
DNAPL	dense nonaqueous-phase liquid
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FASP	Field Analytical Support Program
FSP	field sampling plan
GC/FID	gas chromatography/flame ionization detector
GC/MS	gas chromatography/mass spectroscopy
GPR	ground-penetrating radar
GPS	Global Positioning System
HDPE	high-density polyethylene
LIF	laser-induced fluorescence
LNAPL	light nonaqueous-phase liquid
MS/MSD	matrix spike/matrix spike duplicate
NAD	North American Datum
NAPL	nonaqueous-phase liquid
NGVD	National Geodetic Vertical Datum of 1929
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzodioxin
PCDF	polychlorinated dibenzofuran
PCP	pentachlorophenol
PE	performance evaluation
PID	photoionization detector
POL	petroleum, oil, and lubricants
QA/QC	quality assurance/quality control
QAMS	Quality Assurance Management System
QAPP	quality assurance project plan
RAO	remedial action objective
RAS	routine analytical services
RPM	Remedial Project Manager
SAP	sampling and analysis plan
SCAPS	Site Characterization and Analysis Penetrometer System

ABBREVIATIONS AND ACRONYMS (Continued)

SDG	sample delivery group
SOP	standard operating procedure
SVOC	semivolatile organic compound
TAL	target analyte list
TCDD	tetrachlorodibenzo-p-dioxin
TCL	target cleanup level
TIC	tentatively identified compound
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TPH-Dx	total petroleum hydrocarbon – diesel extended
TRPH	total recoverable petroleum hydrocarbon
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) is an integral part of the Management Plan for the McCormick and Baxter Superfund field exploration. The site, located in Stockton, California, is shown on Figure 3-1 of the Work Plan.

The SAP has two major components: Part I - the Field Sampling Plan (FSP) and Part II - the Quality Assurance Project Plan (QAPP). The FSP presents the detailed scope of work associated with field activities (e.g., sample types, sample locations, etc.) and specifies the procedures to be used for sampling and other field operations. The QAPP describes the analytical data quality objectives (DQOs), laboratory analytical procedures, quality assurance/quality control (QA/QC) procedures, and data quality evaluation criteria.

The purpose of the SAP is to assure production of high quality data that meet the project objectives and requirements and accurately characterize measurement parameters. It provides the protocol for collecting samples, measuring and controlling data, and documenting field and laboratory data so that the data are technically and legally defensible.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The team organizational structure for the site investigation was developed based on the requirements of the field and laboratory activities to help ensure attainment of the project objectives. The following key positions and personnel are described in detail in the Work Plan:

- EPA Remedial Project Manager (RPM): Marie Lacey (EPA, Region 9)
- U.S. Army Corps of Engineers (USACE) Project Manager: Cheryl Buckel (USACE, Albuquerque District)
- Technical Leader: Kira Lynch (USACE, Seattle District)
- Project QA/QC Manager: John Wakeman (USACE, Seattle District)
- Field Investigation Leader: Kira Lynch and Richard Smith (USACE, Seattle District)
  Fred Hart and Randy Olsen (USACE, Sacramento District)
- Project Senior Geologist: Richard Smith (USACE, Seattle District)
- Project Environmental Engineer: Randy Olsen (USACE, Sacramento District)
- Sediment Cap Leader: John Wakeman (USACE, Seattle District)
- Certified Industrial Hygienist: David Elskamp (USACE, Sacramento District)
- Technical Support: Eva Davis (EPA Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma)
- Drilling Contractor: To be determined
- Geophysical Contractor: To be determined
- Field Laboratories:
  - EPA Field Analytical Support Program (FASP)
    EPA Region 9 Laboratory
  - SCAPS Team Laboratory (USACE, Tulsa District)
- Fixed Laboratories:
  - EPA Robert S. Kerr Environmental Research Laboratory (Ada, Oklahoma)

- EPA Region 9 Laboratory
- Columbia Analytical Services
- PTS Laboratories, Inc.
- Environmental Resource Associates
- Pacific Analytical Laboratories

3.0 FIELD ACTIVITIES

A phased approach has been developed for this site investigation. Initially, a preliminary survey will be conducted to prepare a map(s) locating salient site features in NAD83 (horizontal) and NVGD88 (vertical) state plane coordinates. In addition, the banks along Old Mormon Slough will be surveyed to develop a comprehensive stabilization design and to calculate required quantities of materials to implement the final design. A geophysical survey will then be performed at the site to delineate the location and shape of subsurface structures and metal debris to aid in the development of an in-situ thermal treatment system conceptual design and assist with locating areas for SCAPS penetrations.

Following the geophysical survey, a Site Characterization and Analysis Penetrometer System (SCAPS), equipped with a laser-induced fluorescence (LIF) sensor, will be used to characterize the horizontal and vertical extent of the nonaqueous-phase liquid (NAPL) plume and petroleum, oil, and lubricants (POL) contamination above site-specific threshold concentrations in the vadose zone, capillary fringe, and saturated zone. Hydrocarbon fingerprinting will be performed on soil and groundwater samples collected from target intervals based on the SCAPS LIF results. The fingerprinting will be performed by an on-site laboratory. The SCAPS geotechnical sensors will be used simultaneously to provide continuous geotechnical and stratigraphic information that will aid in interpreting contaminant distribution. If refusal is met before contamination is fully characterized, a drill rig will be used to drill contingency soil borings where refusal was met. If contingency borings are necessary, the borings will be drilled, without sampling, to the depth where the SCAPS encountered refusal. Below this depth, the borings will be sampled continuously for potential physical and chemical analysis.

Following the LIF and geotechnical data collection, soil and groundwater samples will be collected using the SCAPS to accomplish the following objectives:

- To obtain LIF verification samples representative of different soil types, different emission spectra, and different emission intensity selected throughout the site within SCAPS depth limitations
- To obtain soil samples to verify apparent anomalous LIF sensor responses
- To identify locations for continuous soil borings
- To confirm the bottom of POL, polycyclic aromatic hydrocarbon (PAH), and pentachlorophenol (PCP) contamination
- To assess the percent saturation of NAPL contamination

- evaluate potential presence of polychlorinated biphenyl (PCB) contamination in the Cellon process area

- To collect samples for permeability analysis on soil samples from across the site

- To analyze soil samples for total organic carbon (TOC) from areas that have not been impacted by contamination

- To collect data on the chemical makeup and magnitude of NAPL at the site to allow for conceptual design of an in-situ thermal treatment system

Microwells may be installed at the corners of the site for the purpose of obtaining water levels that will help establish boundary conditions for a groundwater flow model. Additional microwells may be installed with hydrophobic screens to collect samples of NAPL, if present.

After the SCAPS and the microwell investigations are completed, two soil borings will be completed to 250 bgs. The placement of the soil borings will be selected based on the SCAPS LIF, and soil and groundwater sampling data. The borings are expected to be placed in areas with significant NAPL contamination, representative of different contaminant signatures, and where representative stratigraphic information can be obtained. Once the borings are advanced to their final depth, two-inch diameter monitoring wells may be installed to enable groundwater sampling. Soil samples collected from the borings will be used for chemical, physical, and treatability tests. Samples will be collected from each of five aquifer zones and five aquitard zones so that data from different depths and lithology can be compared.

Based on the data obtained to date at the site, it is believed that the NAPL composition varies across the site and is present in different phases. As a result, NAPL samples will be collected to fill these data gaps, evaluate NAPL movement, and assist with the final groundwater remediation alternative evaluation. Samples for NAPL analysis may be collected from the soil and groundwater samples collected during the SCAPS investigation, microwells, and from groundwater samples collected from previously existing monitoring wells.

Soil samples will be collected from the sidewall to evaluate the potential for sloughing of sidewall soils to have a negative impact on the cap. Sampling is being performed to obtain information on contaminant concentration that will be compared to action levels, above which there is a concern for recontamination of the sediment cap. The objective of the data collection is to evaluate if slough bank materials exceed estimated critical contaminant loading values (loading values that would cause the cap to exceed the cleanup levels).

To obtain data regarding potential offsite migration and natural attenuation potential and the capacity of the system, groundwater samples will be collected from 15 of the existing monitoring wells. The objectives of the groundwater sampling are threefold:

- To monitor the boundary of the naphthalene plume
- To evaluate the natural attenuation potential and capacity of the system
- To evaluate the groundwater quality in six monitoring wells that have shown historic upward trends in PCP and/or tetrachlorodibenzo-p-dioxin (TCDD) contaminant concentration

All samples will be collected using low-flow purging techniques and will be analyzed by the Region 9 laboratory. A summary of the sample types to be collected and the laboratories performing the analyses is presented in Table 3-1.

Throughout field exploration activities, a water truck will be used to control dust generation. The fire hydrant next to the office will be used to fill the water truck.

3.1 SITE RECONNAISSANCE

After completion of the Management Plan, a site reconnaissance will be conducted to review site conditions, mark investigation areas, and refine the specific field program as needed. Coordination with the various contractors will be completed during site reconnaissance, including electrical hookup to provide power during field activities. Utility clearance will be evaluated and performed, if necessary, prior to the commencement of intrusive field activities.

3.2 PRELIMINARY SURVEYING

3.2.1 General Surveying

The Sacramento District in-house survey crew will be responsible for surveying 32 acres of the McCormick and Baxter Superfund site. The survey will take place in the month of May and a topographic map will be produced using Intergraph by June 15, 1999. The components of the general survey include the following:

- Horizontal and vertical controls will be established for the survey. The horizontal control will be in NAD83 and NGVD88 state plane coordinates.

- A minimum of four monuments will be placed and surveyed on site. The monuments should be placed along the fenceline or by a building since future use of the site for field activities is not clear at this time.

- The survey will be performed on a scale of 1 inch = 20 feet. Readings will be taken on a 50-foot grid using a total station.

- The survey crew will be responsible for surveying all pertinent site features. At a minimum the pertinent site features will include all existing aboveground structures, the repository pit, the sheetpile wall along the slough, the perimeter security fence, the two stormwater holding ponds, the corners of the asphalt cap, buildings, paved areas, and the well pumphouse.

- All on-site monitoring wells will be surveyed to a vertical control of 0.01 foot on the north side of the casing/monument. GPS will be used for the control points when surveying in the well casings.

Two hard copies of the topographic map will be supplied displaying all pertinent site features and on-site monitoring wells. The map will display contours to an accuracy of 0.5 foot and will be produced using Intergraph. These maps will be used as the basis for documenting field activities.

3.2.2 Old Mormon Slough Bank Survey

As part of the remediation efforts to be implemented at the McCormick and Baxter Superfund site, the bank along Old Mormon Slough may have to be stabilized to curtail the failure of contaminated soils into the waterway and onto the planned contaminated sediment containment cap. A survey of the Old Mormon Slough banks is required to develop a comprehensive stabilization design and to compute required quantities of materials needed to implement the final design.

The survey of the Old Mormon Slough banks will require the following:

- Cross sections at 50-foot intervals beginning at the east end of the sheetpile wall existing immediately north of the oily waste pond area and extending along the south bank to the end of the slough and around the eastern end of the slough to the site boundary (the entire southern and eastern bank of the slough).

- Cross sections will measure vertical elevations to a scale of 1 inch = 1 foot.

- Cross sections will extend a minimum of 100 feet onto the site upland area (measured from the top edge of slough banks). The lower (northern and western ends of the sections) will be completed within 2 hours, plus or minus, of low tide and will extend a minimum of 10 feet into the slough.

- Cross sections will indicate the presence of slope features (concrete blocks, piping, trees, and visible soil tension cracks).
- Cross sections will indicate the location of the site perimeter security fence.
- The survey crew will make note of the general kinds of vegetation (grasses, shrubs less than 4 feet in height, shrubs greater than 4 feet in height, and trees) within 200 feet of the embankment along the transects. This information will be used by a contractor to determine the amount and nature of the clearing for the bank protection.
- Sufficient survey points will be obtained along each survey line to accurately plot the location of each change in slope, the tops and bottoms of all vertical surfaces, and the slope features.
- All surveyed cross sections will be identified on a base map of the site showing the location of each cross section, the orientation of each cross section, the starting point of each cross section, and the ending point of each cross section. The base map will be to a scale of 1 inch = 20 feet. The base map may be plotted on multiple sheets if required.
- All cross sections and the base map will be supplied in electronic format using MICROSTATION. One hard copy will be supplied of the cross sections and base map.

3.3 GEOPHYSICAL INVESTIGATION

The next phase of the field exploration will involve conducting a geophysical survey to delineate the location, shape, and size of subsurface features and metal debris, and to identify underground utilities. The survey will be conducted within a 16-acre area west of the Union Pacific Railroad (UPRR) property, with the exception of two stormwater ponds. Subsurface features may include utilities and pipes, building basements, railroad tracks and ties, drums, railroad cars, and metal debris.

A minimum of two geophysical methods will be used to obtain subsurface data. The methods will be based on the project requirements, site soil types, the types of objects being identified in the subsurface, and other factors that may affect instrument measurements. A grid will be developed using an appropriate spacing interval to allow clear detection of anomalies. The corners of the survey grid will be correlated with existing survey monuments. The geophysical anomalies will be presented on a map in relation to surface features.

3.4 SLOUGH SIDEWALL SAMPLING

To evaluate the potential for slumping of sidewall soils to contaminate the cap placed on the sediment at the Old Mormon Slough, soil samples will be collected from the north and south sidewalls and analyzed for polychlorinated dibenzodioxin/polychlorinated dibenzofuran (PCDD/PCDF) by EPA Method 1613B by Pacific Analytical Labs, and for PAHs and PCP by EPA Method 8270 by the Region 9 laboratory. The objective of data collection along the sidewalls of the slough is to evaluate if bank materials exceed the estimated critical contaminant loading values; i.e., the loads that cause the target cleanup levels (TCLs) for PCDD, PCDF, and PCDD, PCDF, and PAHs to be exceeded. The site consists of a series of reaches on the south bank and north bank. If contaminant levels exceed the TCLs, bank protection will be incorporated into the capping portion of the project.

Old Mormon Slough is divided into the following four reaches (shown in Figure 5-6 of the Work Plan):

- The mouth reach (MTH)
- The oily waste pond reach (OWP)
- The central or main process area reach (CPA)
- The eastern end (END)

Existing data suggest that there is potential for recontamination by soil slumping on the south embankment from the oily waste pond, main process area, and east end reaches, which comprise approximately 1,600 feet of shoreline. The data also suggest that there is a strong potential for recontamination by PCDD and PDCF, but a weak potential for recontamination by PAHs. Recontamination from the mouth reach is considered to be unlikely since there are relatively low concentrations of contaminants in the sediments and no source areas in the uplands adjacent to the mouth.

The nature of the bank failure is that slabs of soil and concrete intended to stabilize the bank are sliding into the slough or undercutting the bank. The slabs are generally close to 1 foot in thickness. The samples to be collected, including reach, composite sample information, and feet of shoreline represented, are summarized as follows:

Bank, Reach	Number of Composite Samples	Number of Subsamples In Composite	Feet of Shoreline Represented (approximate)
South, OWP	1	2 each, vertical	400
South, CPA	3	2 each, vertical	220
South, END	2	2 each, vertical	400
North, between DUTRA Construction sheetpile wall and Union Ice	2	4, two horizontal locations, each with 2 vertical subsamples	450

The general locations of the bank samples are shown in Figure 6-3 of the Work Plan. Actual sampling locations will be selected in the field by the collection team. The team will use existing boring logs for the site to assist them in selecting representative locations.

The banks are about 15 feet above mean lower low water (MLLW). Sampling will target 0 to 8 feet MLLW to include the main component that could slide in the future. Three samples will be collected from the bank to a depth of 1 foot at each location. The three samples will be selected to represent material that appears most likely to slide into the slough. Three types of natural materials are expected to be found along the banks: imported, gravelly, sandy fill; clayey silt; and silty sand. If a material does not make up more than 20 percent of the bank by visual inspection, it will not be considered a significant source of potential contamination to the slough cap and will not be sampled. Blocks of concrete are not expected to be significant sources of contamination, and will not be sampled.

Samples will be collected using the Region 9 boat and a soil hand auger. Equal quantities of each of the three samples from each location will be composited by homogenization in a nondedicated, stainless steel bowl with a stainless steel spoon. After homogenization, the composited sample will be placed in the appropriate sample jars (Table 4-8). The original three samples from each location will be retained and archived for contingent analysis. Equipment will be decontaminated between sampling stations and rinsate blank samples for PCDD/PCDF and semivolatile organic compound (SVOC) analyses will be collected.

3.5 SCAPS EXPLORATION

The next phase of the field exploration will involve characterizing the vertical and horizontal extent of the petroleum hydrocarbon plume using the SCAPS, equipped with a LIF sensor. Approximately 40 SCAPS borings to a maximum depth of SCAPS capability (assumed to be less than 200 feet bgs) will be placed at the site. The total number of penetrations necessary to meet the project objectives will be determined in the field. The initial 10 locations of the planned 40 SCAPS penetrations are shown on Figure 6-2 of the Work Plan. The remaining 30 locations will be chosen based on the initial LIF and CPT results. Care will be taken when locating SCAPS penetrations in areas containing concentrated sludge or contaminants, which are now capped with asphalt (i.e., capped main processing area where sludge from former 300,000-gallon tank was placed). The locations of the SCAPS penetrations may be limited by where access agreements have been obtained. Access to a vacant lot south of A-5 on Washington Street has been requested but may not be obtained. If access agreements are not obtained, SCAPS penetrations will be limited to the areas within property boundaries. In addition, the central processing area contains many subsurface structures and the access for the SCAPS rig will be limited. To gain access to the area between the slough and asphalt cap, the fence along Old Mormon Slough may have to be temporarily removed.

The location of the SCAPS penetrations will be measured and documented. The penetration locations will be measured daily with a cloth tape to the nearest 1 foot from existing, already-surveyed site features. In addition, a minimum of two directional orientations from already-surveyed site features will be recorded to accurately locate the SCAPS penetration locations. Salient information regarding the SCAPS penetrations, including location, date, wavelength signature depth, and comments, will be recorded on a push-probe penetration log form (Appendix B).

The LIF sensor response is based on fluorescence and will be calibrated with a field TRPH method to define detect versus non-detect of POL constituents above a threshold concentration. Continuous fluorescence measurements will be collected for the entire length of each of the SCAPS borings to provide an indication of relative concentrations of suspected contaminants.

The initial 10 penetration locations were pre-selected based on locations of known or suspected high contamination or in locations where data gaps exist. The remaining locations of SCAPS borings will be selected in the field and will be based on the following:

- SCAPS LIF borings will be spaced to provide areawide information on NAPL occurrence and stratigraphy. The data on extent of NAPL contamination will be used to identify the area of interest for thermal treatment.

- Areas of highest contamination and different POL contaminant types will be further defined to evaluate if more than one contaminant type requires treatment.

- The depth of POL contamination above the LIF threshold concentration will be defined.

- The volume and location of free-phase product will be evaluated. In addition, an evaluation of the vertical and horizontal extent of dissolved and free-phase contamination will be conducted.

- Data will be collected to fill in gaps for the conceptual site model (CSM).

During the installation of the SCAPS probes, continuous geotechnical and stratigraphic data will also be collected to help interpret contaminant distribution and to delineate the continuity of subsurface materials that may influence contaminant movement, such as clay, silt, and cobble zones. The SCAPS data will also be used to optimize the placement of soil borings and monitoring wells. All SCAPS penetrations will be grouted to ground surface with a cement silica flour mixture. The SCAPS standard operating procedure (SOP) is included in Appendix A.

3.6 SCAPS SOIL AND GROUNDWATER SAMPLING

Based on the results of the LIF screening, soil and groundwater samples will be collected to obtain more detailed contamination information. Table 3-1 provides a summary of sample types and laboratories for SCAPS data collection. For cost estimating purposes, 20 penetration locations, with 3 sampling zones for each penetration, have been assumed. Actual numbers of penetrations and sample intervals will be determined in the field. Because the SCAPS fluorescence intensity is generally proportional to in situ concentration of contaminants, the LIF data can be used to identify zones of probable high concentrations of contaminants. The proportional feature of the SCAPS LIF data can be used to pinpoint the zones of highest contaminant concentration and screen the variation in concentration across the site.

The objectives of the soil and groundwater sampling include the following:

- Obtaining SCAPS LIF calibration and verification samples representative of different soil types, different emission spectra, and different emission intensity selected throughout the site within SCAPS depths limitations
- Obtaining soil samples to verify anomalous LIF sensor responses
- Confirming the true bottom of POL, PAH, and PCP contamination
- Assessing potential PCB contamination in the Cellon process area
- Collecting soil samples for analysis of total organic carbon (TOC) from areas that have not been impacted by site contamination
- Identifying the appropriate locations for soil borings
- Collecting soil samples for permeability analysis
- Assessing the percent saturation of NAPL contamination
- Collecting data on chemical makeup and magnitude of site contamination

At least one SCAPS penetration will be placed in the Cellon process area to collect three soil samples for PCB analysis. In addition, two penetrations will be located in areas determined to be free of contamination to collect samples for TOC analysis.

All SCAPS soil samples will be measured for total recoverable petroleum hydrocarbons (TRPH) using a modified version of EPA Method 418.1 by the SCAPS laboratory. Fingerprinting of soil and groundwater will also be performed with an on-site laboratory provided by the EPA Region 9 Field Analytical Support Program (FASP). The FASP laboratory will conduct total petroleum hydrocarbon (TPH) fingerprinting using gas chromatography/flame ionization detector (GC/FID) methods to identify C_{12} to C_{24} (diesel-range) and C_{24} to C_{35} (motor-oil-range) concentrations. The Region 9 laboratory will also perform analysis for PAHs and PCP on soil and groundwater samples using a modified Method 8270 analysis to allow for rapid turnaround time for results. PCB analysis, when required, will be performed by Region 9 laboratory in accordance with the EPA Contract Laboratory Program (CLP) statement of work. Soil TOC analysis will also be performed by an off-site laboratory (PTS Laboratories, Inc.). Permeability measurements will be performed by the EPA Kerr Laboratory in Ada, Oklahoma. Field TRPH, TPH, PAH, and PCP data will also be used for on-site validation and calibration of the fluorescence response obtained by SCAPS LIF sensor. These data will aid in evaluating the relationship between LIF response and TRPH, TPH, and PAH concentrations over the range of site soil and contaminant types. After completion of sampling, the SCAPS borings will be grouted to the ground surface with a silica flour and cement mixture. The SOP for SCAPS soil collection is included in Appendix A.

3.7 MICROWELL INSTALLATION

For the purposes of obtaining groundwater elevation data, two 1-inch-diameter microwells may be installed at the extreme northwest and northeast corners of the site (Figure 6-4 of the Work Plan). They will be installed in SCAPS probes at locations where additional groundwater level data are needed. The purpose of these microwells is to help establish boundary conditions for a groundwater flow model. Additional microwells may be installed with stainless steel hydrophobic screens to enable sampling of NAPL, if present. The SOP for microwell installation is included in Appendix A. The locations and elevations of all wells installed during this investigation will be surveyed.

3.8 CONTINGENCY SOIL BORINGS

In the event that the SCAPS encounters refusal before reaching the necessary depth or before the contamination has been fully characterized, a drill rig will be mobilized to the site to complete the investigation initiated by the SCAPS. If a drill rig is required, contingency borings will be drilled, without sampling, to the depth where the SCAPS experienced refusal. Below this depth, soil will be sampled continuously with a 3.5-inch diameter core barrel sampler. The core barrel will be advanced in 2.5-foot (California split spoon sampler), 5-foot, or maximum of 10-foot runs, to be determined by the field geologist. Split soil samples from at least every 5 feet will be submitted to the FASP laboratory for TPH analysis and sent to the off-site Region 9 laboratory for PAH and PCP analyses (Table 3-1). The remaining samples will be archived on site in core boxes for permeability analysis from stratigraphic units not encountered during the SCAPS investigation. After the contingency soil borings are completed, they will be grouted to the ground surface with cement grout containing 40 percent silica flour.

3.9 NAPL TESTING

Because the existing data on NAPL composition from recovered product may not be sufficient for design purposes, additional information on whether NAPL composition varies across the site and in different phases in needed (i.e., DNAPL vs. LNAPL). Two separate NAPL testing events will be conducted. Approximately 10 to 20 samples of LNAPL and DNAPL will be collected from the SCAPS portion of the investigation in addition to previously existing monitoring wells. NAPL samples representative of locations across the site will be selected in addition to NAPL samples thought to be representative of different chemical composition.

Three days prior to the start of data collection activities, the pumps and riser pipes from the wells selected for NAPL sampling will be removed using a drilling rig and placed on plastic, adjacent to the wells. NAPL thicknesses will be measured and recorded on the field form in Appendix B prior to sampling the wells. The pumps and riser pipes will be wrapped in protective material and placed in storage until a decision is made whether to reinstall them. When sampling is completed, the pumps and riser pipes will be reinstalled and the pumps will be tested to ensure that they are functioning properly.

The wells for NAPL analysis will be selected from Table 3-2. NAPL thicknesses will be measured and recorded on the field form in Appendix B prior to sampling the wells. NAPL samples will be collected from the wells with disposable, bottom-filling bailers. Sample volume, container requirements, and disposition are given in Table 4-9.

The NAPL samples will be submitted for the following analyses:

- SVOCs by EPA Method 8270
- Hydrocarbon fingerprinting (C_8 to C_{35}) by GC/FID
- Density, tests at 10^{o}C increments from 10^{o}C to 90^{o}C
- Viscosity, tests at 10^{o}C increments from 10^{o}C to 90^{o}C
- Solubility at a minimum of two temperatures

- [illegible]-water interface tension, tests at 10°C increments from 10°C to 90°C. These tests will be performed on site groundwater

- Wettability

- Boiling point distribution by ASTM D86

Analyses, with the exception of boiling point distribution, will be conducted by the EPA Kerr Laboratory in Ada, Oklahoma. In addition, SVOC and hydrocarbon analyses will be conducted by Columbia Analytical Services and the EPA Kerr Laboratory.

3.10 SOIL BORING AND MONITORING WELL INSTALLATION

After completion of the SCAPS investigation, including the possible contingency borings, two soil borings will be completed to a depth of 250 feet bgs. The placement of the borings will be based on the results of the SCAPS and other on-site analysis as well as previously installed borings. It is expected that the borings will be completed in areas of significant NAPL contamination, but with different contamination signatures, if possible, and where representative stratigraphic data can be collected. The continuous cores collected from these soil borings will be archived on site in a freezer. In addition, the cores will be visually examined for the presence of NAPL. The following descriptions of NAPL will be documented on the boring logs (Appendix B) for each soil boring and SCAPS penetration location:

- No visible evidence – No visible evidence of oil on soil sample

- Sheen – Sheen as described by the sheen testing methodology presented below

- Staining – Visible brown or black staining on soil. Can be visible as mottling or in bands. Typically associated with fine-grained soils.

- Coating – Visible brown or black oil coating soil grains. Typically associated with coarse-grained soils.

- Oil Wetted – Visible brown or black oil wetting the soil sample. Oil appears as a liquid and is not held by soil grains. Soils oozing petroleum typically contain approximately 2 to 3 percent petroleum.

Sheen screening is a sensitive method that can be effective in detecting petroleum-based products in concentrations lower than regulatory cleanup guidelines. Water sheen testing involves placing soil in water and observing the water surface for signs of a sheen. Sheens are classified as follows:

- No Sheen (NS) – No visible sheen on water surface
- Slight Sheen (SS) – Light colorless film; spotty to globular; spread is irregular, not rapid; areas of no sheen remain; film dissipates rapidly
- Moderate Sheen (MS) – Light to heavy film, may have some color or iridescence, globular to stringy, spread is irregular to flowing; few remaining areas of no sheen on water surface
- Heavy Sheen (HS) – Heavy colorful film with iridescence; stringy, spread is rapid; sheen flows off the sample; most of water surface may be covered with sheen

Samples will be tested from each of five aquifer zones and five aquitard zones so that data from different hydraulic zones and depths can be compared. Once the interval has been selected based on lithology, the most highly contaminated sample interval will be submitted for chemical analysis. After completion of the soil borings, 4-inch-diameter monitoring wells with prepacked stainless steel screens and mild steel risers may be installed to permit groundwater sampling. Dielectric material will be placed between the screen and riser to minimize galvanic corrosion. The decision to develop these borings into monitoring wells and well construction decisions will be made in the field by the technical team. The standard operating procedures (SOPs) used to drill soil borings, collect subsurface soil samples, install and develop monitoring wells, and abandon the borings, if necessary, are presented in Appendix A. If wells are installed at these locations, they will be surveyed.

Soil samples will be collected in a 3.5-inch-diameter core barrel. Physical testing of soil samples will consist of:

- Cation exchange capacity
- Grain size analysis
- Porosity
- Permeability
- Density
- NAPL saturation

Dioxin, furan, and CLP RAS metals (arsenic, copper, chromium, and zinc only) will be collected at only one of the two borings. The boring suspected to contain the highest concentration will be selected. Soil samples selected for treatability analysis will bracket the contaminant concentration range and will be representative of the various contaminant signatures. Laboratory analysis will be conducted by the EPA Kerr Laboratory and the EPA Region 9 Laboratory.

3.11 TREATABILITY STUDY

A summary of the treatability study to be conducted for the site is discussed below. A more thorough discussion is presented in Appendix C of the QAPP.

The primary objectives of the treatability study for the McCormick and Baxter site is to determine the rate of creosote (PAH) recovery as a function of pore volumes of condensed steam injected, and to determine the amount of residual creosote remaining after approximately eight pore volumes of steam have been injected. Eight pore volumes has been previously determined to be the approximate limits for economic viability of steam injection, and thus will be used as the approximate cutoff point for steam injection. The effects of steam temperature and pressure on creosote recovery rates will also be determined using pressure cycling. Leachate sampling will be done both before and after steam injection to determine the changes in dissolved creosote composition and concentration. It is also of interest to determine if oxidation of the remaining creosote compounds is likely to occur naturally, providing a “polishing” step after the completion of steam injection.

It is known that the metals arsenic, chromium, copper, and zinc were used during the wood treating operation at the site. Large quantities of arsenic also occur naturally in the soils at the site. It is currently unknown if the temperatures and pressures that will be present during steam injection will affect metals by mobilizing them or by changing their form. Thus additional soil columns will be steamed so that soil and effluent samples will be analyzed to determine the initial speciation of the metals, and to determine if the steam injection mobilizes these metals or changes their speciation.

The initial treatability experiments will be performed with creosote-contaminated soils. If it is determined that there are other organic compounds of concern at the site, additional treatability studies will be completed later. The treatability study, and all associated analytical chemistry will be performed by the EPA Kerr Laboratory.

3.12 MONITORING WELL GROUNDWATER SAMPLING AND ANALYSIS

To obtain data regarding potential off-site migration and natural attenuation potential and the capacity of the system, groundwater samples will be collected from 15 of the existing monitoring wells shown on Figure 6-5 of the Work Plan and listed in Table 3-3. All pumps in these wells will be removed, wrapped in plastic, and put into storage.

A secondary objective involves evaluating selected wells that have shown an historic upward trend in PCP or PCDD/PCDF contaminant concentration. Groundwater samples will be collected using the low-flow sampling procedure included in Appendix A. However, instead of the dedicated bladder pump system included in the SOP, non-dedicated bladder pumps will be used. Purge water generated during groundwater sampling will be contained in 55-gallon drums approved by the Department of Transportation, which will be labeled and stored on site prior to disposal. Details of the management and disposition of the purge water are contained in the Investigation-Derived Waste Plan. The samples will be analyzed for the following constituents to evaluate the natural attenuation potential of the aquifer:

- Total and dissolved manganese by EPA Method 200.7
- Sulfate, chloride, nitrite, and nitrate by EPA Method 300 Series
- Total organic carbon by EPA Method 9060
- Routine field parameters redox potential, pH, temperature, specific conductivity, dissolved oxygen, and turbidity
- Hach field analyses for measuring dissolved oxygen, dissolved carbon dioxide, total alkalinity, total hardness, and total iron

In addition to physical analysis, the chemical analyses listed in Table 3-3 will also be performed.

3.13 MONITORING WELL SUPPORT ACTIVITIES

3.13.1 Documentation

Records of drilling operations and related activities will be documented by the overseeing geologist and by the drilling contractor. These records will consist of the soil boring log (Appendix B) and information recorded in the project field notebook. Copies of these records will be maintained at the drill site while drilling is in progress, and will be provided with the final report.

The soil boring log will include descriptions of soil and NAPL encountered, total depth of the boring, diameter of the hole, formation contacts, occurrence of first water, sampling depths, water level measurements, amount of sealing material used for abandonment, and any other information deemed appropriate by field personnel. Descriptions of soil will be according to American Society for Testing and Materials (ASTM) D2488-90, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

A field drilling report will be prepared and maintained by the drilling contractor on a daily basis. The report will specify the number of hours worked, materials used, unusual problems, and other special comments and observations.

3.13.2 Groundwater Monitoring Well Installation, Development, and Sampling

The procedures for monitoring well installation, development, purging, and sampling are presented in Appendix A. The monitoring wells will be constructed in accordance with the San Joaquin County Public Health Service's *Standards for Well Construction and Destruction in San Joaquin County*, and EM 1110-1-4000, *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites* (U.S. ACE 1998). Well installation will be performed by a licensed drilling contractor whose employees are qualified to work at hazardous waste sites. All drilling, well installation, development and testing, and sampling operations will be supervised or performed by a geologist or qualified scientist. The drilling contractor will be responsible for obtaining and submitting all well drilling permits and logs, as required by the State of California. The drilling contractor will be contracted by the USACE.

Following installation, the monitoring wells will be developed using the procedure described in Appendix A. Development will cease if NAPL is encountered because a large volume of highly contaminated water would be produced.

3.14 DECONTAMINATION OF DRILLING AND SAMPLING EQUIPMENT

Equipment used during the field investigation and sampling activities will be decontaminated before use at the site and between sampling locations to prevent cross-contamination. The field activities in which decontamination procedures will be followed include SCAPS exploration, SCAPS soil and groundwater sampling, microwell installation activities, slough sidewall sampling, and all associated sampling activities. The specific procedures for decontamination are outlined in this section.

Downhole drilling and sampling equipment, including the SCAPS, microwell, and sonic drilling equipment, will be decontaminated before entering and leaving the site and between sampling locations. Downhole equipment (e.g., drilling casing, drilling rods, soil samplers) and other equipment in direct contact with the sampled materials, soil cuttings, and fluids will be cleaned between borings and other sampling locations.

Decontamination of large drilling equipment is required to prevent cross-contamination of sampling locations, especially those in which groundwater monitoring wells will be established, or from which soil samples will be retrieved for chemical analysis. This process also provides for the protection of personnel subsequent to demobilization from restricted areas. During decontamination of drilling equipment and accessories, it is especially critical to clean the inside of casing, drill rods, drill bits, and all couplings and threads. Prior to leaving the facility, the drill rig will be decontaminated. Drilling equipment will be decontaminated on a trailer equipped with a water collection basin. The decontamination water will be contained in the pole wash area. The management and disposition of decontamination water is discussed in the Investigation-Derived Waste Plan. The drilling tools will be cleaned by a high-pressure hot water wash until all visible soil and other debris have been removed.

Before installation, all sections of well screen and riser will be rinsed with a high-pressure hot water washer, using potable water. If the well casings are obtained pre-cleaned by the manufacturer in factory-sealed containers, high-pressure hot water washing is not required.

Sampling equipment includes all non-disposable sampling devices, which are used to collect or contain a sample prior to placement into a laboratory-provided sample container. Such equipment may include split spoons, stainless steel spoons and bowls, stainless steel cable and the submersible pump. Disposable equipment may include bailers. Monitoring well sampling will be conducted using dedicated pumps or tubing. Before initial use, all sampling equipment that may contribute to the contamination of a sample must be thoroughly decontaminated, unless specific documentation exists to show that the sampling equipment has already been decontaminated. Pre-cleaned equipment, in factory-sealed containers does not require decontamination.

The sampling equipment will be decontaminated between sample locations according to the following procedure:

- Scrub equipment thoroughly with phosphate-free detergent and warm potable water and use a brush to remove any particulate matter or surface film
- Triple rinse and/or flush with clean potable water
- Rinse and/or flush with clean deionized water
- Package and seal equipment in plastic bags or other appropriate containers to prevent recontamination

Small nondisposable sampling equipment that comes in contact with NAPL will be decontaminated as described previously, followed by a solvent rinse with isopropyl alcohol and hexane. The containment and disposal of decontamination wash water and other waste material is described in the Investigation-Derived Waste Plan.

3.15 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be employed to evaluate data quality. Quality control samples are controlled samples introduced into the analysis stream whose results are used to review data quality and to calculate the accuracy and precision of the chemical analysis program. The purpose of each type of field QC sample, collection and analysis frequency, evaluation criteria, and methods of collection are described in this section.

Field QC checks are accomplished through the analysis of controlled samples that are introduced to the laboratory from the field. Rinsate and field blanks, field duplicates, matrix spike/matrix spike duplicates (MS/MSDs), and performance evaluation (PE) samples will be collected and submitted to the mobile field laboratory and/or the fixed laboratories, where applicable, to provide a means of assessing the quality of data resulting from the field sampling program.

3.15.1 Rinsate and Field Blanks

Rinsate blanks are collected to determine the potential for cross-contamination of samples during collection. Rinsate blanks will be collected and analyzed at the rate of 5 percent if utilizing non-dedicated sampling equipment. If dedicated or disposable sampling equipment is utilized, field blanks will be collected instead. Rinsate and field blanks will be submitted to both the mobile field laboratory and the fixed laboratory. Rinsate blanks will consist of store-bought distilled water collected from the final rinse of sampling equipment after the decontamination procedures described in Section 3.10. Blank sample collection methods and frequency are described in Sections 3.7, 3.8, 4.1, and 4.2. Field blanks will consist of store-bought distilled water transferred directly into sample containers in the field.

The rinsate groundwater blank will be collected by filling the rinsed PVC tube (used in decontamination) with 2 gallons of store-bought distilled water. A 4-foot-long piece of unused Teflon-lined tubing will be attached to the freshly decontaminated pump. The pump will be placed into the PVC tube containing the distilled water. The pump will be started and flow established at approximately 300 ml/minute. Approximately 1/2 gallon of distilled water will be pumped through the pump and tubing before pre-labeled sample containers will be filled from the discharge end of the tubing.

The rinsate soil blank will be collected from the stainless steel bowls that will be used to collect soil samples prior to placing them in sample containers. The rinsate and blank will be collected by rinsing the bowl with approximately 2 gallons of store-bought distilled water. The bowl will be rinsed with approximately 2 gallons of distilled water, which will be collected and stored in 55-gallon drums as described in the Investigation-Derived Waste Plan. Following rinsing with 2 gallons of distilled water, pre-labeled sample containers will be filled using a dedicated stainless steel funnel.

All rinsate or field blanks will be submitted blind to the laboratory, with sample numbers that are indistinguishable from primary samples. Quality control criteria and corrective actions are the same as for method blanks (as described in Section 4.2.2 of the QAPP). Blank samples will be analyzed for the same parameters as the associated field samples.

3.15.2 Field Duplicates

Field duplicate samples will be used to check for sampling reproducibility. Field duplicates will be submitted to the mobile field laboratory and the fixed laboratory at a frequency of 10 percent of the field samples for every analytical method. Field duplicate samples are collected in conjunction with and by the same methods as the primary sample. Field duplicate samples will be submitted from locations having significant concentrations of target analytes as determined by results of field screening. Control limits for field duplicate precision are 30 percent relative percent difference (RPD) for aqueous samples and 50 percent RPD for soil and NAPL samples.

Field duplicates will be submitted blind to the laboratories, with sample numbers that are indistinguishable from primary samples. Quality control criteria for field duplicates and calculation and reporting of the RPD are described in Section 7.1 of the QAPP.

3.15.3 Matrix Spike/Matrix Spike Duplicates

MS/MSDs are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy and precision of the analysis. The MS/MSDs will be collected and analyzed at a rate of 5 percent of the field samples for each analytical method or at least one for each analytical batch, whichever frequency is greater. Known concentrations of analytes are added to environmental samples; the MS or MSD is then processed through the entire analytical procedure and the recovery of the analytes calculated. Results are expressed as percent recovery of the known spiked amount (and RPD for MS/MSD pairs).

Field duplicate and MS/MSD samples will be collected from different locations. Additionally, MS/MSD samples should not be collected from locations with potentially high concentrations of target analytes that may mask the added MS/MSD compounds. Because of the high concentrations of target analytes, MS/MSD samples will not be submitted with NAPL samples.

3.15.4 Performance Evaluation Samples

Performance evaluation (PE) samples will be submitted to the laboratories to evaluate the accuracy of the TPH and SVOC analyses; PE samples will be submitted blind for chemical analysis. Four soil samples will be submitted to the SCAPS laboratory for TRPH analysis. Four soil samples will be submitted to the FASP laboratory for TPH-Dx analysis. Eight soil samples will be submitted to the EPA Region 9 laboratory for PAH and PCP analysis. The PE samples will be spiked by the commercial supplier with the site COCs at concentrations consistent with those previously observed in soil and groundwater at the site. One PE sample for each matrix will be analyzed the first day of mobile laboratory analysis for that matrix. The PE sample results will immediately be compared to the vendor's documented acceptable control limits by the USACE Technical Leader. Sample analysis will not continue until the laboratory has met certified PE sample acceptance limits and approval has been obtained from the USACE Technical Leader. Assuming criteria have been met, a second sample of that matrix will be analyzed at random the same week, with the remaining PE samples submitted blind to the laboratory at regular intervals through the remaining analysis schedule. The PE supplier will fill pre-cleaned sample bottles with the PE material. Fictitious sample identification numbers will be assigned in the field as described in Section 5.2.

3.15.5 Temperature Blanks

One temperature blank will be prepared and submitted to the fixed laboratory with each cooler. The temperature blank will consist of a sample jar containing water, which will be packed in the cooler in the same manner as the rest of the samples. The temperature blank is to be used to measure the cooler temperature upon receipt of the cooler at the laboratory.

Table 3-1
Field Activities

Field Activity	Laboratory	Soil Column	Soil	Groundwater	NAPL
SCAPS LIF					
TPH by fluorescence	SCAPS team	X			
Stratigraphy	SCAPS team	X			
TRPH	SCAPS team		X		
TPH-Dx	Region 9 FASP		X	X	
PAH and PCP	Region 9 Lab		X	X	
PCBs	Region 9 Lab		X		
TOC	PTS		X		
Permeability	EPA Kerr Lab		X		
SCAPS Microwell Installation					
Water level measurements	On-site			X	
Contingency Soil Borings					
TPH-Dx	Region 9 FASP		X		
PAH and PCP	Region 9 Lab		X		
Permeability	EPA Kerr Lab		X		
Continuous Soil Borings/Monitoring Wells					
Archive continuous cores		X			
Metals speciation	EPA Kerr lab		X		
Treatability testing	EPA Kerr lab		X		
Metals (arsenic, copper, chromium, and zinc)	Region 9 Lab		X		
Dioxin/furans	Region 9 QAMS		X		
Grain size	PTS		X		
Density	PTS		X		
Porosity	PTS		X		
Permeability	EPA Kerr lab		X		
NAPL saturation	PTS		X		
Cation exchange capacity	PTS		X		
TPH-Dx	Region 9 Lab		X		
PAHs and PCP	Region 9 Lab		X		
TPH-Dx	EPA Kerr Lab		X		
SVOCs full TAL	EPA Kerr Lab		X		
Bank Stabilization Characterization					
Dioxin/Furans	Pacific Analytical Labs		X		
SVOCs	Region 9 Lab		X		
NAPL Sampling (SCAPS, Microwells and/or Monitoring Wells)					
TPH-Dx	EPA Kerr Lab and Columbia Analytical Services				X

Table 3-1 (Continued)
Field Activities

Field Activity	Laboratory	Soil Column	Soil	Groundwater	NAPL
SVOCs - Complete TAL with TICs	EPA Kerr Lab and Columbia Analytical Services				X
Density	EPA Kerr Lab				X
Viscosity	EPA Kerr Lab				X
Solubility	EPA Kerr Lab				X
Oil-water interfacial tension	EPA Kerr Lab				X
Wettability	EPA Kerr Lab				X
Boiling point distribution/distillation	PTS				X
Groundwater Sampling (Monitoring Wells)					
Dioxin/Furans	Region 9 QAMS			X	
SVOCs - Complete TAL	Region 9 Lab			X	
Density	EPA Kerr lab			X	
Total and dissolved manganese	Region 9 Lab			X	
Sulfate, chloride, nitrate, nitrite	Region 9 Lab			X	
TOC	Region 9 Lab			X	
Field meters (redox, pH, temp, spec. cond., DO, turb)	On-site			X	
Hach kits (DO, alkalinity, hardness, total iron)	On-site			X	

Table 3-2
Potential NAPL Monitoring Wells
McCormick and Baxter Stockton Site

Well ID	Well	Comments
	Total Depth	
A-4	37.05	
A-5	35.44	
A-6	(27.45)	Total depth questionable; pump probably still in well.
A-8	37.88	
A-10	34.58	
DSW-1D	(58.5)	Pump not removed from well; total depth is depth at pump.
DSW-4B	74.38	
DSW-4C	129.61	
DSW-4D	179.58	
DSW-4E	266.39	
DSW-5B	78.25	
DSW-6B	90.37	
DSW-6C	141.26	
OFS-4D	197.66	
OFS-4E	255.65	
ONS-1B	86.15	
ONS-1C	144.58	
ONS-2A	59.71	

Table 3-3
Monitoring Well Sampling Rationale

Monitoring Well ID	Analysis to Be Performed	Rationale
A-5	1613B/8270	Well A-5 is an on-site boundary well in which PCP has been detected at qualitative concentrations up to 180 µg/L. Sampling will monitor off-site migration from the oily waste pond source area. The dioxin level at this well has increased historically. A field duplicate for SVOCs will be collected from this well. Sampling this well for dioxin will provide information about dioxin plume migration.
A-8	8270	Well A-8 is centrally located within the main processing source area. Along with well A-10, it has historically contained the highest concentrations of wood treating chemicals found in the site groundwater. The PCP concentration in this well has been increasing so it has been included in the monitoring program.
DSW-4B	1613B/8270	Well DSW-4B is located at the southern site boundary, downgradient of the main processing source area. Previous sampling has shown that this well (along with DSW-6B) contains some of the highest concentrations of naphthalene found in the B zone (up to 20 mg/kg); however, to date PCP has only been qualitatively detected. (Interferences may mask the presence of PCP.) SVOCs analysis are requested to monitor the concentrations at the site boundary. Dioxins levels have continued to increase sharply in this well. The August 1997 sampling event result was 12,657 pg/L 2,3,7,8-TCDD TEQs. Dioxins were detected at 1,792 pg/L in August 1996 and 30 pg/L in November 1997. In 1998 this well contained the highest concentration at 1,684 pg/L. Dioxin analyses are requested to confirm the increase in the concentrations detected in 1998. The field duplicates for SVOCs and PCDD/PCDF will be collected from this well.
DSW-4C	1613B/8270	Well DSW-4C is located at the southern site boundary downgradient of the main processing source area. It is clustered with well DSW-4B which has previously shown some of the highest concentrations of naphthalene in the B zone. This well contains the second-highest dioxin TEQ concentrations (4,336.45 pg/L) found in the site groundwater; a significant increase from previous sampling results. Previous data indicate the presence of naphthalene up to 110,000 µg/L, and PCP has been detected at 8,000 µg/L. SVOCs are requested to monitor the site boundary for possible vertical and lateral migration of PAHs and PCP. Dioxin analyses are requested to confirm the increase in the concentrations detected in 1998.
DSW-4D	1613B/8270	Well DSW-4D is located at the southern site boundary downgradient of the main processing source area. It is clustered with wells DSW-4B and DSW-4C which have previously shown some of the highest concentrations of naphthalene and dioxin in the B and C zones. Naphthalene was qualitatively detected in the August 1997 sampling event. A result of 2.52 pg/L 1,2,7,8-TCDD TEQs was obtained for the November 1995 sampling event. This well has not since been sampled for dioxins. SVOCs and dioxins analyses are requested to monitor vertical migration and the upward trend in contaminant concentrations of chemical plumes.

Table 3-3 (Continued)
Monitoring Well Sampling Rationale

Monitoring Well ID	Analysis to Be Performed	Rationale
DSW-6B	1613B/8270	Well DSW-6B is located at the site southwestern boundary downgradient of the oily waste pond source area. Previous sampling has shown that this well (along with well DSW-4B) contains some of the highest concentrations of naphthalene found in the B zone (78 mg/L in 1996 and 100 mg/L in 1995). The date, PCP has only been qualitatively detected, but it is suspected that interference from PAHs may have masked the presence of PCP. In the August 1997 sampling event, PCP was qualitatively detected at 110 µg/L. PCP has not been detected in the wells downgradient to DSW-6B. This well contains the highest concentration of dioxins (22,234 pg/L in 1996 and 27,082 pg/L TEQ in 1995).
DSW-6C	1613B/8270	Well DSW-6C is located at the southwestern site boundary, downgradient of the oily waste pond source area. It is clustered with well DSW-6B which has previously shown some of the highest concentrations of naphthalene and the highest dioxin concentrations in the B zone. Naphthalene has been detected up to 85 µg/L. PCP has not been detected in this well. Dioxins have been confirmed in this well at levels below the MCL. Dioxin analysis is requested to monitor the vertical plume migration.
DSW-7A	8270	DSW-7A is a boundary well located on the southeast side of the site. It is clustered with wells in the B and C zones and is slightly east of the true downgradient from the main processing area. Naphthalene and dioxins have been detected in this well at very low levels and PCP has not been detected in this well. This well has been sampled four times since 1993.
DSW-7B	8270	DSW-7B is a boundary well located on the southeastern side of the site. It is clustered with wells in the A and C zones and is slightly east of true downgradient from the main processing area. This well has been sampled five times since 1993. PCP has not been detected in this well. Naphthalene was qualitatively detected at 4 µg/L in 1995.
DSW-7C	8270	DSW-7C is a boundary well located on the southeast side of the site. It is clustered with wells in the A and B zones and is slightly east of true downgradient from the main processing area. Dioxins were detected at low levels in the August 1993 and November 1995 sampling events. PCP was qualitatively detected at this well in June 1994. Naphthalene was detected qualitatively in three sampling events in low concentrations. This well could not be sampled in the August 1997 event. This well is being sampled to monitor the site boundary for PAHs and PCP.

Table 3-3 (Continued)
Monitoring Well Sampling Rationale

Monitoring Well ID	Analysis to Be Performed	Rationale
OFS-3B	1613B/8270	Well OFS-3B is intended to monitor water quality outside the southern site boundary. The well is located downgradient from the oily waste pond source area and cross-gradient of the main processing source area. It is clustered with wells in the A, C, D, and E zones. PCP was not detected in the well and naphthalene was only qualitatively detected at very low levels in November 1996. Since this well is the only B zone well downgradient of well DSW-6B, SVOCs and dioxin are requested to monitor off-site migration. This well was sampled for PCP-LDL in August 1997; however, the analytical results could not be obtained due to dilution problems at the analytical laboratory. Dioxin analysis is requested to monitor off-site migration of the dioxin plume associated with wells DSW-6B and DSW-4B. MS/MSD samples for SVOCs and PCDD/PCDF analyses will be collected from these wells.
OS-3E	8270	This well is needed to monitor the leading edge of the napthalene plume.
OS-4A	8270	Well OS-4A is intended to monitor water quality outside the south side boundary. This well is needed to monitor the leading edge of the naphthalene plume.
OS-4B	8270	Well OS-4B is located downgradient of the OFS-4 well cluster and is clustered with wells OS-4A and OS-4C. PCP was detected in the June 1994 sampling event, but not in the August 1996 sampling event. This well is needed to monitor the leading edge of the naphthalene plume.
OS-4C	8270	This well is needed to monitor the leading edge of the naphthalene plume.

4.0 SAMPLE HANDLING AND DOCUMENTATION

This section describes sample handling and documentation procedures. The procedures described are designed to provide a thorough record of events surrounding the collection of each sample, and to ensure, as far as can be accomplished in the field, that data collected are useable.

4.1 FIELD LOGBOOKS

Permanently bound field books with waterproof paper will be used as field logbooks because of their compact size, durability, and secure page binding. The pages of the logbook should be numbered consecutively and should not be removed for any reason. Entries will be made in black waterproof indelible ink.

Logbooks will document the procedures performed by field personnel. Each entry should be dated, legible, and contain accurate and complete documentation of the individual's activities. Documentation in the field logbook will be at a level of detail sufficient to explain and reconstruct field activities without relying on recollection by the field team members. Because the logbook is a complete documentation of field procedures, it should contain only facts and observations. Language should be objective, clear, concise, and free of personal interpretation or terminology that might be misconstrued.

No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change.

Field logbooks will be identified by the project name and a project-specific number (e.g., "Logbook #1 for McCormick and Baxter Superfund Field Exploration"), and stored in the field project files when not in use. Field logbooks will be photocopied after the field investigation, and photocopies will be stored in the project files. After field activities are completed, logbooks will be stored in the permanent project file.

4.2 SAMPLE IDENTIFICATION AND LABELING

To provide a sample tracking mechanism, each sample collected will be given a sample identification number using the numbering system described below. The sample identification number will include the sample type, station number, and an identification of the type of sample (primary, field split, etc.). The site name and sampling date will not be included in the sample identification number because this information will be recorded on the sample label and chain of custody form. Sample type, station number, and depth, sampling round designations are shown below. A sample identification number will be based on digits from each column, and will not include spaces, dashes or slashes.

Task	Sample Type	Station Number[a]	Depth or Sampling Round
SCAPS – Exploration	SE	001-040	feet bgs
SCAPS – Soil	SS	001-020	feet bgs
SCAPS – Groundwater	SG	001-020	feet bgs
SCAPS – NAPL	SN	001-010	feet bgs
Sidewall – Soil	SWS	001-015	feet bgs
Soil Boring – Soil	SB	001-005	feet bgs
Monitoring Well – Groundwater	GW[b]	001-013	01, 02, etc.
Monitoring Well – NAPL	NW[b]	001-010	01, 02, etc.

[a] Duplicate - add integer of 500 to station number
Field/Rinsate Blank - add integer of 700 to station number
Performance Evaluation - add integer of 900 to station number
[b] If NAPL (NW) sample collected, then no groundwater (GW) sample collected at that station

Note: Specify MS or MSD in comment section of the chain of custody form

Matrix spike/matrix spike duplicate (MS/MSD) samples will not be designated in the primary sample number. The sample to be used for MS/MSD will be specified in the comment section of the chain of custody. Sample volumes to be archived will be labeled “ARCHIVE” and designated with the same sample identification number as the primary sample. The QC field duplicate, field/rinsate blank, and performance evaluation (PE) samples will be identified with a fictitious station number of the primary sample.

The fictitious station numbers used to identify QC field duplicates, field/rinsate blanks, and PE samples will consist of a constant integer added to the number of the primary sample location that has been chosen as the QA station. A field duplicate sample will be designated by adding the integer 500 to the station number from which it was collected. A field/rinsate blank sample will be designated by adding the integer 700 to the station number from which the blank is collected. A PE sample will be designated by adding the integer 900 to the primary station number that has been designated as the QA station. No indication that a sample is a duplicate will be provided on the sample label or chain of custody form. Cross-references for duplicate and blank sample numbers will be clearly recorded in the field book and field logs.

Example 1: A SCAPS exploration sample collected from a depth of 5 feet bgs at sampling station SE001 would be labeled SE001005.

Example 2: A SCAPS soil sample collected from a depth of 2.5 feet within SCAPS exploration station SE001 would be labeled SS001002.5.

Example 3: A SCAPS groundwater sample collected from a depth of 2.5 feet within SCAPS exploration station SE001 would be labeled SG001002.5.

Example 4: A SCAPS NAPL sample is collected from a depth of 10 feet bgs from SCAPS exploration station 007. The sample would be labeled SN007010.

Example 5: A sidewall slough soil sample is collected from a depth of 1 feet bgs from sidewall station 007. The sample would be labeled SWS007001.

Example 6: A primary soil sample collected from soil boring number SB001 at 15 feet bgs would be labeled SB001015.

Example 7: A blind field duplicate of primary sample SB001015 would be labeled SB501015.

Example 8: A field/rinsate blank collected after sampling primary sample SB001015 would be labeled SB701015.

Example 9: A NAPL sample collected from monitoring well number MW008 from a first round of groundwater sampling would be labeled NW00801.

Sample labels, whether blank or pre-printed, will contain an abbreviated summary of the logbook entry for the sample. The following information should be included on sample container labels:

- Project number
- Sample identification number
- Date and time of sampling
- Name of sampling personnel
- Type of sample preservatives added
- Matrix
- Analyses to be performed

An example of a sample container label is shown in Appendix B.

4.3 SAMPLE DELIVERY GROUP

Soil and groundwater samples will be sent to the analytical laboratories in sample delivery groups (SDGs). Each SDG will consist of primary samples, blind field duplicates, associated MS/MSD samples, and/or rinsate blanks.

4.4 SAMPLE PRESERVATION AND HANDLING

This section describes the techniques used to handle and preserve samples once they are collected, including descriptions of sample containers, preservation techniques, and storage requirements.

4.4.1 Sample Containers

Soil and groundwater samples (primary as well as QA/QC) will be collected in glass or plastic containers purchased by the USACE. The containers will have screw-type lids to assure the bottles are adequately sealed. Teflon inserts located inside the lids of the containers will prevent sample reaction with the lid and improve the quality of the seal. Tables 4-1 through 4-10 list the specific container types, volumes, number of containers, and holding times for each analysis, including soil, groundwater, and NAPL for the field laboratories and fixed laboratory.

The containers will be precleaned and certified under chain of custody. Commercially available precleaned jars are acceptable. The field team will record batch numbers for the bottles in the logbook. With this documentation, bottles can be traced and bottle wash analyses can be reviewed.

4.4.2 Sample Preservation

The field team will add the required preservatives to the sample bottles that will be used for groundwater and rinsate blanks. They will affix waterproof labels to the bottles, on which the type of analysis and the type and amount of preservative will be written.

Sample preservation procedures are used to maintain the original character of analytes during storage and shipment. Regardless of the nature of the sample, absolute stability for all constituents cannot be achieved. Preservation techniques, such as pH control and refrigeration, may retard physicochemical and biochemical changes. As a general rule, analyzing the sample as soon as possible is the best way to minimize physicochemical and biochemical changes.

All samples will be placed in the appropriate sample container and refrigerated (on ice or ice-substitute in a cooler) immediately upon sample collection. The samples will be immediately transferred to the mobile field laboratory. Samples will be shipped to the fixed laboratory on a daily basis. The analytical laboratories will meet all specified holding times and should make every effort to prepare and analyze the samples immediately after they are received. Chemical preservation, sample container types, and temperature requirements for the analyses performed in this investigation are shown in Tables 4-6 through 4-10.

4.4.3 Storage Requirements

Samples will be placed in secure, on-site storage, or remain in the possession of the sampling personnel until they are shipped or delivered to the laboratory. Immediately after collection, and during shipment to the analytical laboratory, samples will be stored in the on-site freezer, coolers on ice or an ice-substitute at approximately 4°C. Either ice packaged in plastic storage bags or prepackaged ice-substitute will be used to maintain the temperature in the shipping containers at approximately 4°C. Ice will be replenished as needed to ensure adequate cooling of samples during storage and shipping. Samples to be archived on site for potential chemical analyses (i.e., continuous boring) will be stored at 4°C.

4.5 SAMPLE DOCUMENTATION

Entries into the logbook or other relevant sampling forms for sampling events will include, but not necessarily be limited to, the following:

- Project name, location, and number
- Rationale for collecting the sample
- Date and time of sampling
- Sample numbers
- Cross-reference of numbers for split and blank samples
- Media sampled
- Geographical location of the sampling point in reference to site facilities
- Physical location of the sampling point, such as depth below surface
- Method of sampling, including procedures, equipment, and any departure from the procedures specified in the Work Plan or the Sampling and Analysis Plan
- Rationale for any deviations from Management Plan procedures and documentation
- Results of field measurements, such as photoionization detector (PID)

- Sample preservation
- Type and quantity of container used for each sample
- Weather conditions at the time of sampling and previous events which may influence the representative nature of a sample—at a minimum, include temperature, approximate wind speed and direction, and sky cover
- Photographic information—briefly describe what was photographed and why, the date and time, the compass direction of the picture, number of the frame on the roll, and roll number
- Sketches, when appropriate, with reference points tied to existing structures in the area (i.e., trees, existing monitoring wells)
- Analyses requested
- Disposition of the sample (i.e., where it is being shipped)
- Airbill number of sample shipment, when applicable
- Other pertinent observations, such as the presence of other persons on the site (those associated with the job or members of the press, special interest groups, or passersby), and actions by others that may affect performance of site tasks
- Type of health and safety clothing/equipment used
- Name(s) of sampling personnel

4.6 CHAIN OF CUSTODY PROCEDURES

Verifiable sample custody is an integral part of all field and laboratory operations associated with this field exploration. The primary purpose of the chain of custody procedures is to document the possession of the samples from collection through storage and analysis to reporting. Chain of custody forms will become the permanent records of sample handling and shipment. The Field Investigation Manager or his/her designee will be responsible for monitoring compliance with chain of custody procedures.

Field sampling personnel are responsible for the care and security of samples from the time the samples are collected until they have been turned over to the shipping agent or laboratory. A sample is considered to be in one's custody if it is in plain view at all times, in the physical possession of the sampler, or stored in a locked place where tampering is prevented.

Empty coolers containing ice or ice substitute will be available at the study area for use each day in the field. Samples collected during the day will be stored in shipping coolers beginning at the time of collection. The coolers will be locked inside the field vehicle or other secure location when sampling personnel are not present.

A chain of custody form will be filled out for samples in each cooler, starting when the first sample of each batch is collected. An example of the chain of custody record that will be used is shown in Appendix B. Each chain of custody form will contain the following information:

- Sample identification numbers
- Date and time of sampling
- Type of sample and number of sample containers associated with each sampling point
- Total number of sample containers in cooler
- Unique cooler identification number
- List of analyses requested
- Name and signature of sampling personnel
- Shipping air bill number, when applicable
- Comments regarding MS/MSD samples, or any other information that is necessary for the laboratory
- Spaces for transfer of custody acknowledgment

When the chain of custody forms are complete, field team members will crosscheck the form for possible errors. If samples are repackaged for shipping or delivery, one team member will crosscheck the chain of custody with the samples that are packed while another team member packages the samples. Corrections will be made to each record with a single strike mark that is dated and initialed. The person who initials corrections will be the same person that relinquishes custody of the samples. The chain of custody forms will be signed and dated, placed in ziploc bags, and taped to the inside lid of the respective cooler.

4.6.1 Transfer to Project Laboratories

After a cooler of samples is packaged and the chain of custody form has been completed, the cooler will be closed, sealed with packing tape, and sampling personnel will affix two signed and dated custody seals so that if it is opened the seals will be broken. An example of a custody seal is provided in Appendix B. Custody seals will contain the following information:

- Sample team member's signature (signature must match signature on chain of custody forms)
- Date

Coolers, completed with chain of custody documentation, will be hand-delivered to the field laboratory, and sent by courier or shipped by overnight courier to the fixed laboratory by the sampling team. The shipping agent will not enter into the formal chain of custody procedures, and therefore will not sign the chain of custody form. Copies of bills of lading provided by the shipping agent will be kept with chain of custody forms in order to document shipping procedures.

4.6.2 Laboratory Custody Procedures

A cooler receipt form will be filled out by the laboratory (Appendix B). Upon receipt by the laboratory, custody seals will be inspected and the chain of custody forms signed and dated by laboratory personnel. Laboratory personnel will verify sample numbers and the conditions of each cooler. Shipping manifests and chain of custody forms signed and dated by laboratory personnel will be considered sufficient documentation of sample custody transfer from the sampler, through the shipping agent, to the analyst in the contracted analytical laboratory.

A copy (pink) of each chain of custody form will be retained by the sampling team for the project file and the original (yellow and white) will be sent with the samples. Bills of lading will also be retained as part of the documentation for the chain of custody records. In conjunction with data reporting, the analytical laboratory will return the original chain of custody forms to the project manager for inclusion into the central project file.

4.7 DAILY CHEMICAL QUALITY CONTROL REPORTS

Field activities will be documented via the daily chemical quality control report (DCQCR) form. An example DCQCR form is included in Appendix B. The reports will be prepared and submitted daily, and will summarize field and laboratory activities and results. Data generated on site by the mobile field laboratory, all field measurement data, and field-sampling decisions will be made available to the USACE Technical Team Leader within 24 hours of sample collection. The DCQCR will contain the following information:

- Project information
- Work performed, samples collected including associated QA/QC samples, and personnel involved
- Weather
- Available analytical results, physical parameter measurements, calculation results, and required QC data
- Field audits performed and results
- Sampling, sample handling, chemical parameter measurement problems, deviations from the approved plan, and corrective actions taken
- Signatures of field personnel completing the DCQCR and initials of personnel making changes
- Summary of verbal or written instructions for retesting or changes of work

The DCQCR will be completed at the end of each day. Copies of field forms, mobile field laboratory data summary forms, and pages of field logbook completed for that day’s work will be referenced on the form and attached to minimize transcription errors. Forms and attachments will be completed within 24 hours and posted on the website without attachments. The Technical Team Leader or Field Investigation Manager will be responsible for completing and posting the DCQCR.

Table 4-1
Mobile Field Laboratory Sampling and Analysis Summary—Soil

Method	Method Reference	Primary Samples	Field Duplicate (10%)	Field/Rinse Blank (5%)	MS/MSD (5%)
SCAPS Soil Sampling					
TPH by Fluorescence	ASTM D 6187 (SCAPS SOP)	Continuous	NA	NA	NA
TRPH	SCAPS SOP	60	6	NA	NA
TPH-Dx	Region 9 SOP - Modified	60	6	3	3
Contingency Soil Borings					
TPH-Dx	Region 9 SOP - Modified	Up to 150	Up to 15	Up to 8	Up to 8

Table 4-2
Mobile Field Laboratory or In-Field Sampling and Analysis Summary—Groundwater

Method	Method Reference	Primary Samples	Field Duplicate (10%)	Field/Rinse Blank (5%)	MS/MSD (5%)
SCAPS Groundwater Sampling					
TPH-Dx	Region 9 SOP - Modified	10	1	1	1
Monitoring Well Sampling					
Field Meters for Redox Potential, pH, Temperature, Specific Conductance, Dissolved Oxygen, and Turbidity	Field Meters	15	NA	NA	NA
Field Test Kits for Dissolved Oxygen, Alkalinity, Hardness and Total Iron	HACH test kits Chemets (DO)	15	2	NA	NA

Table 4-3
Fixed Laboratory Sampling and Analysis Summary—Soil

Method	Method Reference	Primary Samples	Field Duplicate (10%)	Field/Rinse Blank (5%)	MS/MSD (5%)
SCAPs Soil Sampling					
PAHs and PCP - rapid TAT	Region 9 SOP with modifications	60	6	3	3
PCBs	CLP SOW with modifications	3 to 6	1	1	1
Permeability	Kerr lab SOP	9 to 12	1 to 2	NA	NA
TOC	Walkley-Black	9 to 12	1 to 2	NA	1
Sidewall Slough Sampling					
Dioxins/Furans	EPA 1613B	8	1	1	NA
PAHs and PCP - standard TAT	Region 9 SOP	8	1	1	1
Contingency Soil Borings					
PAHs and PCP- rapid TAT	Region 9 SOP with modifications	Up to 150	Up to 15	Up to 8	Up to 8
Permeability	Kerr Lab SOP	10	1	NA	NA
Continuous Soil Borings					
TPH-Dx	Region 9 FASP Lab SOP	20	2	1	1
PAHs and PCP - standard TAT	Region 9 SOP	20	2	1	1
Dioxin/Furans	EPA 1613B	10	1	1	NA
Metals (As, Cu, Cr, Zn only)	CLP SOW RAS	10	1	1	1
Metals Speciation	Kerr Lab SOP	up to 20	2	1	1
Treatability Testing	Kerr Lab SOP	up to 20	2	NA	NA
Grain Size	ASTM D 422	20	2	NA	NA
Porosity	API RP40	20	2	NA	NA
Permeability	Kerr Lab SOP	20	2	NA	NA
NAPL Saturation	PTS SOP	10	1	NA	NA
Cation Exchange Capacity	SW-846 9071A	20	2	NA	NA
Density	ASTM D2937	20	2	NA	NA
SVOC Full TAL	Kerr Lab SOP	20	2	1	1
TPH-Dx	Kerr Lab SOP	20	2	1	1

Table 4-4
Fixed Laboratory Sampling and Analysis Summary—NAPL

Method	Method Reference	Primary Samples	Field Duplicate (10%)	Field/Rinse Blank (5%)	BS/BSD (5%)
SCAPS, Microwell and Monitoring Well Sampling					
TPH-Dx[a]	Modified 8015	10 to 20	1 to 2	NA	1
SVOC TAL w/ TICs[a]	SW-846 8270C	10 to 20	1 to 2	NA	1
Viscosity	Kerr Lab SOP (ASTM D445)	10 to 20	1 To 2	NA	NA
Density (ASTM D1481)	Kerr Lab SOP	10 to 20	1 to 2	NA	NA
Solubility	Kerr Lab SOP	10 to 20	1 to 2	NA	NA
Wettability	Kerr Lab SOP	10 to 20	1 to 2	NA	NA
Boiling point distribution - ASTM D86	PTS SOP	10 to 20	1 to 2	NA	NA
Oil-Water Interfacial Tension	Kerr Lab SOP (ASTM D971)	10 to 20	1 to 2	NA	NA

[a] Analyzed by both Kerr Lab and Columbia Analytical Services
BS/BSD - blank spike/blank spike duplicate

Table 4-5
Fixed Laboratory Sampling and Analysis Summary—Groundwater

Method	Method Reference	Primary Samples	Field Duplicate (10%)	Field/Rinse Blank (5%)	MS/MSD (5%)
SCAPS Groundwater Sampling					
PAHs and PCP - rapid TAT	Region 9 SOP with modification	10	1	1	1
Monitoring Well Sampling					
SVOC TAL - standard TAT	SW-846 8270C	15	2	1	1
Dioxin/Furans	EPA 1613B	7	1	1	NA
TOC	EPA 9060	15	2	NA	1 (MS/Lab duplicate)
Density (ASTM D1481)	Kerr Lab SOP	15	2	NA	NA
Total manganese	EPA 200.7	15	2	1	2 (MS/Lab duplicate) (10% frequency)
Dissolved manganese	EPA 200.7	15	2	1	2 (MS/Lab duplicate) (10% frequency)
Sulfate, Chloride, Nitrate, Nitrite	EPA 300 series	15	2	1	1 (MS only)

Table 4-6
SCAPS and FASP Laboratory Sample Containers, Preservation, and Holding Times—Soil

Method	Method Reference	Container	Preservative	Holding Time
SCAPS				
TPH by Fluorescence	ASTM D 6187 (SCAPS SOP)	NA	NA	NA
TRPH	SCAPS SOP	4-oz wide mouth	4 ± 2 °C	28 days
Region 9 FASP				
TPH-Dx	Region 9 SOP - Modified	4-oz wide mouth	4 ± 2 °C	7 days to extraction/ 30 days to analysis

Table 4-7
FASP Laboratory Sample Containers, Preservation, and Holding Times—Groundwater

Method	Method Reference	Container	Preservative	Holding Time
TPH-Dx	Region 9 SOP - Modified	1-L amber glass	4 ± 2 °C	7 days to extraction/ 30 days to analysis

Table 4-8
Fixed Laboratory Sample Containers, Preservation, and Holding Times—Soil

Method	Method Reference	Container	Preservative	Holding Time
Region 9 Laboratory				
PAHs and PCP TPH-Dx PCBs	Region 9 SOP - modified Region 9 SOP CLP SOW - modified	4-oz glass wide mouth	4 ± 2 °C	14 days to extraction/ 30 days to analysis
Metals	CLP RAS	4-oz glass wide mouth	None	6 months (28 days for mercury)
Kerr Laboratory				
SVOC full TAL TPH-Dx	Kerr SOP Modified 8015	4-oz glass wide mouth	4 ± 2 °C	14 days to extraction/ 30 days to analysis
Metals Speciation	Kerr Lab SOP	4-oz glass wide mouth	None	6 months (28 days for mercury)
Permeability	API RP 40	2 x 1-L glass wide mouth	None	None
Treatability Testing	Kerr Lab SOP	1-L glass wide mouth	None	None
PTS Laboratories				
Density	SW-846 9081	16-oz glass wide mouth (or tube)	None	None
TOC	Walkley-Black	Combine into two 16-oz glass wide mouth (or one 4-oz if TOC only)	4 ± 2 °C	28 days
Grain Size	ASTM D 422		None	None
Porosity	ASTM D2937		None	None
NAPL Saturation	PTS Lab SOP		4 ± 2 °C	None
Cation Exchange Capacity	SW-846 9071A		None	None
Pacific Analytical Laboratories				
Dioxin/Furans	SW-846 1613B	4-oz glass wide mouth	4 ± 2 °C	7 days to extraction/ 40 days to analysis

Table 4-9
Fixed Laboratory Sample Containers, Preservation, and Holding Times—NAPL

Method	Method Reference	Container	Required Volume	Preservative	Holding Time
Columbia Analytical Services					
TPH-Dx and SVOC TAL w/ TICs	Modified 8015 SW-846 8270C	40-mL amber glass vial	5 mL 5 mL	4 ± 2 °C	None
Kerr Lab					
Viscosity Density Solubility Wettability Oil-Water Interfacial Tension TPH-Dx SVOC TAL w/TICs	Kerr Lab SOP Kerr Lab SOP Kerr Lab SOP Kerr Lab SOP Kerr Lab SOP Modified 8015 SW-846 8270C	1-L amber glass	< 20 mL 100 mL 100 mL 50 mL 750 mL 5 mL 5 mL	4 ± 2 °C	None
PTS Laboratories					
Boiling point distribution	PTS Lab SOP	4-oz glass wide mouth	100 mL	4 ± 2 °C	None

Table 4-10
Fixed Laboratory Sample Containers, Preservation, and Holding Times—Groundwater

Method	Method Reference	Container	Preservative	Holding Time
Region 9 Laboratory				
PAHs and PCP - rapid TAT	Region 9 SOP with modifications	1-L amber glass	4 ± 2 °C	7 days to extraction/ 40 days to analysis
SVOC TAL	SW-846 8270C	1-L amber glass	4 ± 2 °C	7 days to extraction/ 40 days to analysis
Total manganese	EPA 200.7	500-ml HDPE	4 ± 2 °C, pH<2 with HNO_3	6 months
Dissolved manganese	EPA 200.7	500-ml HDPE, field filtered	4 ± 2 °C, pH<2 with HNO_3	6 months
Sulfate, Chloride, Nitrate, Nitrite	EPA 300 series	500-ml HDPE	4 ± 2 °C	28 days; 48 hours for Nitrate/Nitrite
TOC	EPA 415.1	250-ml amber glass	4 ± 2 °C, pH<2 with H2SO4	28 days
Kerr Laboratory				
Density	Kerr Lab SOP	500-ml HDPE	4 ± 2 °C	None
Extra	—	1-L amber glass	4 ± 2 °C	—
Pacific Analytical Laboratories				
Dioxin/furans	SW-846 1613B	1-L amber glass	4 ± 2 °C	7 days to extraction/ 40 days to analysis

5.0 SAMPLE PACKAGING AND SHIPPING

5.1 PACKAGING

The procedures and material used for sample packaging must adequately protect the sample container from accidental breakage during shipping. Sample packaging and labeling will conform to the requirements of Appendix F of USACE Engineering Regulation ER-1110-1-263 (U.S. ACE 1996). Glass sample containers will be placed into plastic bags, and will be wrapped and cushioned in inert packing material such as Styrofoam, closed-cell foam packing material, or plastic bubble wrap. Plastic sample containers do not require individual cushioning material, but should be packed well to prevent movement during transport. Caps will be screwed on tightly. The plastic sample containers will be placed into individual, resealable plastic bags, which will then be sealed. Ice or ice-substitute will be placed in the container in a manner to ensure adequate and equal cooling for all samples.

5.2 SAMPLE SHIPPING

All sample containers will be placed inside a strong shipping container, such as a metal or plastic picnic cooler with a hard plastic liner. The shipping container should be sufficient to prevent leaks or spills of ice water or potentially broken sample containers. The drainage hole at the bottom of the cooler will be taped shut so that the contents from potential broken containers of prepackaged ice, ice substitute, or sample will not escape. The shipping container lid will be adequately secured with tape to prevent opening during shipping. The shipping container will be adequately cleaned between shipments to prevent cross-contamination of samples.

Transfer of samples from the project site to the project analytical laboratory is expected to be performed by the field personnel. Deliveries that will arrive at a laboratory or at the courier’s office to be picked up by laboratory personnel must be arranged with the laboratory before shipping occurs. There will be daily communication with the FASP laboratory to avoid overloading the laboratory with samples. The maximum number of samples the laboratory can accommodate per day is 20. Communication with the laboratory will enable more regular delivery of samples and smoother receipt of analytical results.

Addresses, telephone numbers, and contacts of the laboratories analyzing samples for the project are presented in Table 5-1. Federal Express will be used for shipping samples to MultiChem Analytical Services and PTS Laboratories, Inc.

Table 5-1
Project Laboratories Contact Information

Laboratory	Address and Contact
SCAPS Team, USACE Tulsa District (Mobile field laboratory with SCAPS)	USACE, Tulsa District 1645 South 101 East Ave. Tulsa, OK 74128 Contact: Steve Brewer (field) Phone: (918) 832-4122 Contact: Angela Burckhalter (office) Phone: (918) 669-4957
EPA Region 9 FASP (Mobile field laboratory)	1337 S. 46th Street, Building 201 Richmond, CA 94804-4698 Contact: Liza Finley Phone: (510) 412-2334 Contact: Jeff Mays (field) Phone: (510) 412-2367
EPA Region 9 Laboratory	1337 S. 46th Street, Building 201 Richmond, CA 94804-4698 Contact: Nancy Wilson Phone: (510) 412-2377 Backup Contact: Rich Bauer Phone: (510) 412-2312 Fax: (510) 412-2300
EPA Region 9 QAMS BPA Laboratory	75 Hawthorne Street San Francisco, CA 94105 Contact: Gail Jones Phone: (415) 744-1498
Columbia Analytical Services, Inc.	1317 S. 13th Ave, P.O. Box 479 Kelso, WA 98626 Contact: Diane Wiegle Phone: (360) 577-7222 Fax: (360) 636-1068
EPA Robert S. Kerr Environmental Research Laboratory (Kerr Lab)	919 Kerr Research Drive Ada, OK 74820 Contact: Eva Davis Phone: (580) 436-8548 Fax: (580) 436-8703
Environmental Resources Associates	5540 Marshall Street Arvada, CO 80002 Contact: Joel Holtz Phone: (303) 431-8454 Fax: (303) 431-0159
PTS Laboratories, Inc.	8100 Secura Way Santa Fe Springs, CA 90670 Contact: Richard Young Phone: (562) 907-3607 Fax: (562) 907-3610

Table 5-1 (Continued)
Project Laboratories Contact Information

Laboratory	Address and Contact
Pacific Analytical Laboratories	6349 Paseo del Lago Carlsbad, CA 92009 Contact: Steven Parsons Phone: (760) 931-1766 Fax: (760) 931-9479

6.0 FIELD CORRECTIVE ACTIONS

The ultimate responsibility for maintaining quality throughout the field explanation rests with the USACE Project Manager. The day-to-day responsibility for assuring the quality of field and laboratory data rests with the Technical Team Leader, Field Investigation Manager, the project QA/QC Officer, and the Laboratory Program Administrator.

Any nonconformance with the established QC procedures will be expeditiously identified and controlled. Where procedures are not in compliance with the established protocol, corrective actions will be taken immediately. Subsequent work that depends on the nonconforming activity will not be performed until the identified nonconformance is corrected.

The Technical Team Leader and/or Field Investigation Manager will review the procedures being implemented in the field for consistency with the established protocols. Sample collection, preservation, labeling, etc., will be checked for completeness. Where procedures are not strictly in compliance with the established protocol, the deviations will be field documented and reported to the project QA/QC Officer. Corrective actions will be defined by the Field Investigation Manager and USACE Technical Team Leader and documented as appropriate. Upon implementation of the corrective action, the Field Investigation Manager will provide the project QA/QC Officer with a written memo documenting field implementation. The memo will become part of the field exploration project file.

7.0 FIELD SCHEDULE

The following tentative schedule shows the possible order of and amount of time (in calendar days) to complete the field tasks described in this plan:

- Preliminary site surveying—20 days
- Geophysical investigation—4 days
- Slough sidewall sampling at Old Mormon Slough—3 days
- SCAPS mobilization and field prep—4 days
- Conduct pre-selected LIF pushes—6 days
- Conduct groundwater sampling—5 days
- Conduct field-selected LIF pushes—30 days
- Conduct NAPL sampling of monitoring wells—3 days
- SCAPS soil and groundwater sampling—16 days
- Contingency sampling days (SCAPS)—4 days
- SCAPS demobilization—1 day
- Conduct soil borings/monitoring wells—45 days
- Sonic drilling

  Contingency borings—30 days
  Continuous borings/install monitoring wells—45 days

- FASP field analysis

  FASP lab mobilization—5 days
  Conduct field analysis—28 days
  FASP lab demobilization—1 day

- orting

  SCAPS report—35 days
  Preliminary summary of data—18 days
  Draft investigation report—28 days
  Final investigation report—12 days

An overall project schedule is provided in Section 9 of the Work Plan.

8.0 REFERENCES

American Society for Testing and Materials (ASTM). 1990. *Practice for Description and Identification of Soil (Visual-Manual Procedure).* Practice D 2488-90.

United States Army Corps of Engineers (U.S. ACE). 1998. *Monitoring Well Design, Installation and Documentation at Hazardous, Toxic, and Radioactive Waste Sites.* ENG5056-R, ENG5056A-R. EM1110-1-4000.

APPENDIX A

Field Standard Operating Procedures

CONTENTS

SCOPE OF WORK
GEOPHYSICAL SURVEY OF SUBSURFACE STRUCTURES AND DEBRIS
McCormick and Baxter Superfund Site
Stockton, California

1.0 GENERAL

The purpose of the work specified herein is to use geophysical methods to locate, mark and map the location, shape and size of subsurface structures and metal debris at the McCormick and Baxter Superfund Site, in Stockton California. Surface structures at the site include an asphalt cap, a fence along the north end of the property along the slough, a couple of buildings, three pump stations, approximately 35 monitoring wells, and brush and debris. Subsurface features may include subsurface utilities and pipes, building basements, railroad tracks and ties, drums, railroad cars, and metal debris. The Contractor is to perform the geophysical survey by the end of May and generate a draft report by June 4, 1999.

2.0 PROJECT LOCATION

The McCormick and Baxter (M&B) wood preserving company operated on a 29 acre site at 1295 W. Washington Street in Stockton, California, from 1942 until 1990. The site is located in an industrial area near the junction of the I-5 interchange (see Figure 1). The northern boundary of the site borders Old Mormon Slough, which empties into the Port of Stockton turning basin on the San Joaquin River. The nearest residences are more than 200 feet from the site. The Contractor shall arrange for site entry through Randy Olsen, U. S. Army Corps of Engineers (USACE) at (916) 557-5285.

3.0 HISTORY OF THE SITE

M&B chemically treated wood products in pressure cylinders with various preservation solutions containing creosote, pentachlorophenol (PCP), arsenic, copper, chromium and zinc. Solvents or carriers for these preservatives reportedly included petroleum-based fuels such as fuel oil kerosene and diesel; butane; and ether. Sources of contaminant releases at the site included the oily waste ponds, the concrete oily waste tank, a paved pole washing area, underground and aboveground storage tanks, oil/water separators, condensate storage tanks, storm water collection sumps, and boiler room sumps (see Figure 2).

The chemicals of concern (COCs) identified for the M&B Site is PCP, carcinogenic polynuclear aromatic hydrocarbons (cPAH), arsenic, dioxins/furans and naphthalene. Dioxins/furans are believed to have originated as manufacturing impurities contained in the PCP solutions. Although relatively non-toxic, naphthalene is included as a COC because it is widely distributed throughout soil and groundwater at the Site in relatively high concentrations and it serves as an indicator for the presence of non-carcinogenic PAHs (ncPAH).

Sediment contamination related to the M&B Site appears to be limited to Old Mormon Slough, which is located directly adjacent to the M&B facility. The primary COC□s identified in sediments are PAHs and dioxin; PCP was not widely distributed. Concentrations of cPAHs and ncPAHs and dioxin were elevated in Old Mormon Slough sediments relative to the Stockton Channel reference location. Total PAH concentrations in Old Mormon Slough decreased with increasing depth in the western half of Old Mormon Slough.

EPA conducted several phases of removal actions to stabilize Site conditions, improve Site security, and demolish and dispose of aboveground structures and equipment. EPA addressed contaminant released into Old Mormon Slough by installing a sheet piling wall along the southwestern shoreline of Old Mormon Slough to control oily seepages from the former oil waste ponds area. EPA also excavated approximately 12,000 cubic yards (cy) of contaminated soil from the pond area and contained the excavated soil in a lined repository in the central portion of the Site. EPA then covered the central processing area with an asphalt cap.

4.0 CONTRACT REQUIREMENTS

The Contractor shall be required to furnish all equipment, material, and labor necessary to perform the contract services described in this scope of work.

4.1 Equipment

The Contractor will be responsible for performing a geophysical survey to delineate the location, size, and shape of subsurface structures and metal debris within a 16 acre area west of Union Pacific Railroad property boundary, with the exception of the two stormwater ponds (see Figure 3). The Contractor will use a minimum of two geophysical methods to obtain subsurface data. The methods will take into consideration the project requirements (outlined below), site soils (i.e. clay, silt and sand), the type of objects being identified in the subsurface, and other factors that may effect instrument readings.

The Contractor will be responsible for obtaining geophysical equipment that can detect both ferrous and nonferrous material down to 15 feet; the depth at which the water table is suspected to have limited burial of debris. It is the responsibility of the Contractor to recommend the type of geophysical method(s) (i.e. magnetometer, EM-31, GPR), that would provide the geophysical data required in this SOW. All equipment used for this survey shall be calibrated daily and shall be operated according to the manufactures instructions.

4.2 Survey Requirements

A grid shall be established by the Contractor using a designated spacing interval which will allow detected anomalies to be clearly defined. The Contractor shall clearly mark the grid onsite and leave it in place once the survey has been completed allowing the grid to be used for future investigative activities. All anomalies identified in the field shall be well defined, marked onsite, and indicated on maps produced for the report. The Contractor will be responsible for correlating corners of the geophysical grid to surveyed monuments onsite and displaying geophysical anomalies on a map in their proper relation to surface features.

At a minimum, the Contractor shall be responsible for locating and marking the corners of buried basements and foundations; the location and dimension of a railroad car; former AST pipelines; railroad ties; drums; utilities lines; and burial pits. It is recommended that the

Contractor use known subsurface features (i.e. existing building foundations) to perform quality assurance on the equipment.

4.3 Personnel

Field personnel shall consist of at least one experienced professional with at least two years of experience using geophysical equipment. Field personnel shall be highly skilled in interpretation of all data processed. **All field personnel are required to be certified in 40 hour OSHA hazardous waste training.**

5.0 SUBMITTALS

5.1 Work Plan

Before starting the geophysical survey, the Contractor shall review site boring logs to evaluate site soils and identifying depth to groundwater (Attachment 1); review the requirements of the geophysical survey; review site maps (Figures 1-3); and identifying subsurface structures suspected to be onsite (Attachment 2). The Contractor shall use the provided information in Attachments 1 & 2 and Figures 1-3 to select the geophysical equipment and method(s) that will meet project requirements. The Contractor will provide a one page memorandum outlining the type and brand of equipment he recommends for the survey, his rationale for selecting this equipment, one sentence on why he didn't chose other geophysical methods, and a brief paragraph on the work to be performed at the site and the approach. The Contractor will supply this memorandum to Carrie Romine for review two weeks before the scheduled survey. The USACE representative will review and respond to the memorandum within 48 hours of being submitted. The Contractor will not start the survey until this memorandum has been approved.

5.2 Draft Report

After the survey is completed the Contractor shall submit five colored copies of the Draft Report by June 4, 1999 to Randy Olsen for review. The report shall include copies of the survey results, a summary of the field investigation results with a brief description of the equipment used, procedures, a site description, colored maps to scale showing the geophysical data collected for all methods employed and a map showing the contractor's interpretation of the location and type of subsurface features detected, and any other descriptive information related to the geophysical survey.

5.3 Final Report

Within one week of receipt of the Draft Report by Randy Olsen, it will be returned to the Contractor with comments to be incorporated into the Final Report. The Contractor shall then have one week in which to submit five colored copies and an electronic format of the Final Report to the Randy Olsen. The Final Report shall have all required revisions included.

6.0 GOVERNMENT RESPONSIBILITIES

The Government will provide the following to the Contractor:

1) Available maps of the project area.
2) Entry to the site.

7.0 PROTECTION OF TE

The Contractor shall take all necessary precautions to preserve the site conditions encountered prior to the start of any work. All litter and debris generated by the Contractor will be gathered and disposed of in proper containers daily. After completion of work, the Contractor shall remove all debris, waste, trash, and unused materials and supplies and shall restore the site as nearly as possible to its original condition, with the exception of the grid used for the geophysical survey.

8.0 SAFETY REQUIREMENTS

Safety requirements regarding equipment and personnel shall be strictly observed in accordance with the Corps of Engineers Safety and Health Requirements Manual EM 385-1-1. Manuals are available through the Corps of Engineers Contracting Division. The Contractor is responsible for providing their own Site Safety and Health Plan taking into consideration the contaminants of concern listed above.

9.0 BID SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
001	All work required for the completion of this Scope of Work except those items listed below as a unit price. This lump sum bid item includes mobilization and demobilization of equipment and personnel, restoration of the site to its original conditions, labor, materials, all incidental costs associated with this scope of work, etc.	1	LS		
002	Geophysical Survey, including all equipment, supplies, labor, and any other costs associated with locating subsurface structures and debris.	32	Hour		
003	Submittals, including all labor, supplies, and any other costs associated with the production of the reports (i.e. memorandum, draft report, final report).	1	LS		

Possible Sources of Geophysical Surveyors:

1) Muir/Pierce Geophysics
395 Java Drive
Sunnyvale, CA 94089
Phone (408) 383-0502
Fax (408) 383-0502
Attn: Don Pierce

2) Spectrum Environmental Services, Inc.
622 Glen Oaks Blvd.
San Fernando, CA 934071
Phone (818) 365-9371
Fax (818) 361-1680
Attn: Tom Han

3) Krazan & Associates
215 West Dakota Avenue
Clovis, CA 93612
Phone (209) 348-2200
Fax (209) 348-2201
Attn: Bruce Meyers

4) Cooksley Geophysics Inc
P.O. Box 1602
Redding, CA 96099
Phone (530) 241-3167
Fax (530) 241-3147
Attn: Jim Cooksley

5) Northwest Geophysical Associates, Inc
P.O. Box 1063
Corvallis, Or 97339
Phone (541) 757-7231
Fax (541) 757-7331

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SCOPE OF WORK
SUBSURFACE EXPLORATIONS
McCormick and Baxter Superfund Site
Stockton, California

1.0 General Requirements

This scope of work (SOW) describes the subsurface explorations using the sonic drilling technology to be performed at the McCormick and Baxter Superfund Site, in Stockton, California. This SOW consists of drilling 2 boreholes to a maximum depth of 300 feet, collecting soil samples for chemical analysis and lithological characterization, and potentially installing two monitoring wells. These boreholes will be continuous cores. The proposed two boreholes are scheduled to begin around September 8, 1999. This SOW also provides an *option* to perform 15 “contingency” boreholes to a maximum depth of 300 feet, collecting soil samples for chemical analysis and lithologic characterization. The contingency borings will be drilled to a specified depth (SCAPS refusal) as designated by the field geologist and then continuous cores will be collected to a maximum depth of 300 feet bgs. The contingency work is scheduled to begin on or about August 2, 1999. The Contractor will be notified 12 calendar days prior to 8 September 1999 whether the *optional* contingency borehole project will be completed. If the required contingency borings are not completed prior to the start of drilling for the two continuous cores, completion of contingency borings will be performed following the completion of the two continuous cores.

2.0 Project History and Location

The McCormick and Baxter (M&B) wood preserving company operated on a 29 acre site at 1295 W. Washington Street in Stockton, California from 1942 until 1990. M&B chemically treated wood products in pressure cylinders with various preservation solutions containing creosote, pentachlorophenol (PCP), arsenic, copper, chromium, and zinc. Solvents or carriers for these preservatives reportedly included petroleum based fuels such as fuel oil kerosene and diesel, butane, and ether. The chemicals of concern (COC) identified for the M&B site are PCP, carcinogenic polynuclear aromatic hydrocarbon (cPAH), arsenic, dioxins/furans and naphthalene. Dioxins/furans are believed to have originated as manufacturing impurities contained in the PCP solution.

The M&B site is located in an industrial area near the junction of the I-5 interchange (see Figure 1). The northern boundary of the site borders Old Mormon Slough which empties into the Port of Stockton turning basin on the San Joaquin River. The site terrain is relatively flat and the only remaining aboveground structures at the site are an office building, two storage sheds, and a stormwater collection system lift station. The former processing areas and tank farm are paved, and the rest of the site is unpaved with limited vegetative cover. A layer of gravel between 1 and 3 feet thick is found across most of the site. The subsurface strata most likely to be encountered are alluvial fan and fluvial deposits including silt, silty clay, clayey silt, silty sand, sand, and coarse-grained sands and gravels.

The Contractor shall arrange for site entry though Randy Olsen, U.S. Army Corps of Engineers (USACE) at (916) 557-5285.

3.0 Protection of Site

The Contractor shall maintain existing survey monuments and existing structures, and protect them from damage from equipment and vehicular traffic. Any items damaged by the Contractor shall be repaired to USACE specifications by the Contractor at the Contractor's expense. Local and state water and air pollution requirements will be met and closely monitored.

All litter and debris will be cleaned up daily and placed in containers for proper disposal. After completion of work, the Contractor shall remove all debris, waste, trash, and unused materials or supplies and shall restore the site as nearly as possible to its original condition.

4.0 Description of Work and Services

The Contractor shall furnish all services, materials, equipment, supplies, and personnel necessary to perform the services as required and described in this SOW. The Pricing Schedule summarizes work to be completed for this SOW and is located on page 10.

4.1. General Requirements

The work to be performed includes drilling two continuous borings to an approximate depth of 250 to 300 feet. The borings will be drilled to characterize the extent of NAPL contamination and define the subsurface geology. Soil will be logged continuously in all the boreholes by the

USACE field geologist and samples will be collected for analysis at designated intervals. Soil samples will be analyzed by onsite and offsite laboratories. The two continuous borings may be completed as 4-inch diameter monitoring wells.

4.1.1 Personnel

The Contractor shall provide personnel consisting of at least one experienced operator and one helper. The operator shall have a minimum of three years experience operating the equipment provided. All individuals shall have the required EPA and OSHA training for hazardous waste operations in accordance with 29 CFR 1910.120 (40-Hour OSHA Certified). The Contractor shall have a current C-57 California State Water Well Drillers License to perform the services specified in this scope of work.

4.1.2 Equipment

The Contractor shall provide one sonic drill rig capable of drilling boreholes to depths of at least 300 feet using at least 6 inch outer diameter (OD) casing for the 15 contingency borings, and 8-inch outer diameter (OD) casing for the two continuous core borings. The equipment must allow for the collection of soil samples by a California Modified split spoon sampler and a 3.5-inch diameter core barrel in 5 foot and a 10 foot sections. The drill rig shall be fully maintained, in good condition, and complete with all necessary accessories and supplemental equipment conforming to the manufacturer’s specifications for the type and size required. Soil and groundwater sample containers will be provided and collected by USACE personnel. The Contractor will supply all drums necessary to containerize drill cuttings and development water, as specified in section 4.1.9.

The Contractor is responsible for maintaining his equipment. Any down time associated with the maintenance or repair of any piece of the equipment will be at the cost of the Contractor and not the Federal Government.

4.1.3 Soil Sampling

Two Continuous Boreholes

The continuous borings will be drilled using a 8-inch OD casing and a 3.5-inch diameter core barrel to collect soil samples. The core barrel will be advanced ahead of the casing for sample collection to prevent cross contamination between sample intervals. Soil samples will be collected continuously from the surface to the total depth of the hole (determined in the field by the geologist) for the two continuous borings. Soil samples will be vibrated out of the core barrel and into a plastic sleeve, knotted at both ends. The two continuous borings may be completed as monitoring wells to a depth to be determined by the government inspector (USACE representative), in accordance to the specifications outlined in sections 4.1.4 - 4.1.6.

Fifteen Contingency Boreholes (optional)

The contingency borings will be drilled using a 6-inch OD casing to advance to a specified depth (approximately 100 feet below ground surface). Once the casing has been advanced to the specified depth, and excess soil has been removed, a 3.5-inch OD core barrel will be advanced in front of the casing to collect a continuous core sample. The core barrel will be advanced in either 5-foot or 10-foot runs (determined by the field geologist). Samples will be collected from the specified depth [approximately 100 feet below ground surface (bgs)] to the total depth of the borehole (approximately 300 feet bgs). Some soil samples may potentially be requested from between the ground surface and the specified depth (approximately 100 feet bgs). Soil samples will be vibrated out of the core barrel and into a plastic sleeve, knotted at both ends.

The Contractor shall wear clean nitrile gloves during all drilling, decontamination and sampling activities. Gloves shall be changed prior to each soil sample collected and between each borehole.

Precautions shall be taken to fully contain water and soil cuttings produced during borehole drilling, sampling, backfilling, and decontamination of equipment. To minimize the potential for surface contamination, drill cuttings will be contained using four (4) millimeter thick plastic sheets encircling the area adjacent to the drill flight. During drilling, borehole cuttings generated will be transferred from the plastic sheets to 55-gallon drums.

Boreholes left open after drilling will be covered with a minimum ¼-inch plywood and safety cones will be placed around the location until the borehole is backfilled. All completed holes shall be backfilled by the end of each day, in accordance with section 4.1.8 - Borehole Abandonment.

4.1.4 Monitoring Well Installation

Two monitoring wells may be installed in the 2 continuous boreholes with a total maximum depth of approximately 300 feet. The monitoring wells will be drilled using a 8-inch casing. The wells will be constructed with 4-inch diameter schedule 40 mild steel casing with a riser, locking well cap, and pre-packed, stainless steel, wire wrapped, well screen. The wells will have 10 foot screened intervals with a 0.02-inch screen slot size and will be prepacked with a sand filter pack consisting of clean number 20 Monterey sand. The 20 Monterey sand (filter pack) will extend at least 1 foot below the screened interval and extend three feet above the screen interval. The sand will be placed below and above the prepacked screen using a tremie pipe. The top of the filter pack will be continuously sounded during retraction of the temporary casing by the Contractor to ensure that the filter pack remains within the casing during removal. A bentonite clay seal will be placed above the filter pack with a maximum thickness of 5 feet and shall not be placed within NAPL (if present). The seal will be installed using ¼-inch diameter bentonite pellets and the minimum hydration time for the bentonite seal will be one hour. Halliburton Class G - 40% silica flour cement grout will be mixed with a mechanical grout mixer (progressive cavity pump) and placed from the top of the clay seal to the ground surface using a tremie pipe. Centralizers will be placed at the top and bottom of the well and every 40 feet in between. The Contractor shall furnish and use stainless steel centralizers for centralizers that contact the ends of the screen and PVC centralizers for centralizers that contact the mild steel riser.

The wells may be screened at a depth other than the final depth of the boring. The difference between the final depth of the boring and the bottom of the well screen may be significant and may require the placement of a cement grout seal below the well screen using a tremie pipe. Sufficient time (i.e. 72 hours) will be required to allow the grout to set before constructing the well.

4.1.5 Monitoring Well Development

The monitoring wells will be developed by surging, bailing, and pumping. The surge block will have a diameter slightly less (approximately 1/8 inch) than the inside diameter of the well casing. The well casing will be pumped prior to surging to insure that an adequate flow of water is entering the well. Surging will begin slowly across the entire length of the well screen. The pace of the surging motion will be gradually increased until the surge block has a vertical velocity of 3 to 5 feet per second. Well surging will be alternated with pumping approximately every 15 minutes during development to clean accumulations of sediment in the well and to allow the USACE representative to determine the progress of the well development. Development shall continue for a minimum of four hours or until the government inspector determines that the well is adequately developed for sampling purposes. At the end of development, the drillers will clean all sediment from the bottom of the well. The development water will be pumped into 55-gallon drums supplied by the Contractor. Wells with NAPL present will not be developed, and shall be at the discretion of the USACE representative.

4.1.6 Well Completion

Flushmount or steel riser completions shall be determined in the field by the USACE representative and shall depend on the site conditions. Wells will be completed using a 5-foot length of steel casing. Steel riser completions shall extend 2.5 feet above ground surface. The casing will be installed on the same day the grout is placed. A four foot square protective concrete pad approximately 6 inches thick and 3 inches below ground surface will be poured around the steel casing. The pad shall slope away from the casing to prevent water from pooling adjacent to the casing. A locking cover will be installed on top of the protective casing. Padlocks will be provided by the Government and will be placed on each monitoring well.

4.1.7 Decontamination

The Contractor shall decontaminate all equipment that will be placed into the borehole and all equipment that may come in contact with soil samples. Equipment shall be decontaminated prior to and after each boring. All decontamination water shall be stored in 55-gallon drums. The Contractor shall provide five, 5-gallon buckets and 3 clean brushes for decontamination of the split spoon sampler. The Contractor shall wear clean nitrile gloves during decontamination activities.

Decontamination procedures for drilling equipment shall be as follows:

- Rinse with a pressure steam cleaner,
- If visible dirt or oil is present on the equipment, wash with detergent and potable water, and rinse with pressure steam cleaner,
- Air dry

The Contractor shall decontaminate sampling equipment, including samplers and sample sleeves prior to sample collection. Decontamination procedures are as follows:

- Wash with alconox and water solution
- Rinse with potable water
- Rinse with reagent grade water
- Rinse with acetone and hexane
- Air dry

USACE shall construct a temporary decontamination pad at the former concrete pole washing area for use by the Contractor. The decontamination pad shall be used by the Contractor for steam cleaning drilling equipment. Decon water will be allowed to evaporate.

4.1.8 Borehole Abandonment

Once sampling of the borehole has been completed, the Contractor shall abandon the borehole. Halliburton Class G - 40% silica flour cement grout shall be used to abandoned the boreholes, with 7.5 to 9 gallons of water per 90 pound sack of cement. Grouting material shall be mixed with a mechanical grout mixer and pumped through a tremie pipe in one continuous operation from the bottom of the interval to be sealed to the top. Boreholes will be abandoned in compliance with the state and county well abandonment requirements.

4.1.9 Investigation Derived Waste

All soil cuttings and waste fluids generated will be separated and placed into 55-gallon drums by the Contractor. The Contractor shall furnish approximately sixteen (16) DOT approved 55-gallon drums and shall move the drums to a centralized storage area onsite. [*The actual number of drums to be provided by the Contractor will be based on whether contingency borings will be drilled, and whether onsite facilities are capable of handling the waste water volume.*] The storage site will be designated by the USACE Project Leader.

4.1.10 Project Submittals

Prior to any onsite work, the Contractor will submit the following items to the USACE Project Leader. No mobilization will occur onsite until the USACE Project Leader has reviewed the following documents:

-C-57 California State Water Well Drillers License
-Current 40-hour OSHA Certifications
-Certificate of Medical Surveillance
-Certificate of Respirator Fit Test
-Proof of Worker's Compensation Insurance
-Drilling and Monitoring Well Installation Permits
-Contractor's Site Health and Safety Plan (section 5.0)
-Summary of Drill Rig Operator's Work Experience

5.0 Health and Safety

The Contractor is responsible for the tasks defined by this SOW and is required by regulation to develop and implement a written safety and health program in compliance with the requirements of OSHA Standard 29 CFR 1926 and 1910. The Contractor shall have his Safety and Health Plan onsite during field work along with his 40-Hour OSHA certificate. The Contractor shall comply with all Federal, state and local health and safety requirements, e.g. the Occupational Safety and Health Administration (OSHA) requirements (Title 29, Code of Federal Regulations Part 1926), the California Occupational Safety and Health Administration (CAL-OSHA) requirements (8CCR5192), the Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1), and Hazardous Waste Operations and Emergency Response (Title 29 CFR 1910.120) are applicable to this contract.

All personnel on site shall be equipped with level D modified clothing at all times. Modified Level D equipment includes the following:

- Hard hat
- Steeled-toed boots
- Safety glasses with side shields
- Hearing protection
- Nitrile gloves

All recordable accidents/injuries/illnesses shall be reported immediately. A completed ECG 3394, Accident Investigation Report shall be submitted within two working days in accordance with AR 385-40 and USACE Supplement 1 to the regulation. The Contractor shall submit the Safety and Health Plan to the USACE representative for approval prior to any on-site work.

6.0 Permits and USA Utility Clearance

USA Utility clearance will be obtained by the COE representative. Any additional clearance associated with the activities outlined in the SOW will be obtained by the Contractor. Drilling and monitoring well installation permits will be obtained by the Contractor.

7.0 Period of Service

All work shall be scheduled and coordinated with the USACE Project Leader, Randy Olsen at (916) 557-5285. Field work is scheduled to begin on or about 2 August 1999 for the 15 contingency borings (optional) and on 8 September 1999 for the continuous borings and potential monitoring well installation. Twelve (calendar) day notice will be provided to the Contractor for any changes made to the schedule or scope of work.

8.0 Pricing Schedule

This pricing schedule shall be completed by the Contractor and submitted with any attachments as needed as the Contractor's official bid. The Contractor shall furnish labor, materials, equipment and incidental costs necessary for subsurface explorations at McCormick and Baxter Superfund Site, Stockton, California in accordance with the attached scope of work. The bid shall be into the USACE Contracting office by July 1, 1999.

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
001	Mobilization and Demobilization includes, delivery and removal of all equipment and supplies to be furnished by the Contractor, restoration of the site to its original conditions, and submittals.	1	Job	Lump Sum (LS)	
002	Drill Rig Rental for 2 Continuous borings to an approximate depth of 250 to 300 feet, including equipment, labor, materials, supplies, and incidental costs. Labor includes, but is not limited to, drilling of boreholes, sample collection, standby time caused by COE personnel, borehole abandonment or monitoring well installation, and decontamination of equipment. Equipment includes, but is not limited to, decontamination equipment, drill rig, equipment for collecting and transferring waste fluids to 55-gallon drums, for collection of soil samples, monitoring well installation equipment, and equipment for borehole abandonment.	90	Hr		

OPTIONAL ITEMS SET A (CONTINUOUS BORINGS)					
Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
003A	Installation of wells, includes all materials and supplies associated with well installation [i.e. stainless steel casing, prepacked stainless steel wire wrapped well screen, bentonite plug, sand pack, Halliburton Class G - 40% silica flour cement, centralizers, well completion (flushmount or steel riser completion)etc.]	500	Ft		
004A	Well Development, using a development rig., and includes all equipment, material, and supplies.	20	Hr		
005A	Borehole Abandonment (continuous borings), including all materials and supplies (Halliburton Class G - 40% silica flour cement).	500	Linear Ft		
006A	DOT approved, clean, 55-Gallon Drums for containment and storage of soil cuttings and waste water.	16	Each drum		

OPTIONAL ITEMS SET B (CONTINGENCY BORINGS)					
Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
007B	Mobilization and Demobilization includes, delivery and removal of all equipment and supplies to be furnished by the Contractor, restoration of the site to its original conditions, submittals, and incidental costs.	1	Job	LS	
008B	Drill Rig Rental for 15 Contingency borings to an approximate depth of 250 to 300 feet, including equipment, labor, materials, supplies, and incidental costs. Labor includes, but is not limited to, drilling of boreholes, sample collection, standby time caused by COE personnel, borehole abandonment, and decontamination of equipment. Equipment includes, but is not limited to, decontamination equipment, drill rig, equipment for borehole abandonment, equipment for collecting and transferring waste fluids to 55-gallon drums, for collection of soil and groundwater samples, and for keeping the soil wet to maintain dust control.	450	Hr		
009B	Borehole Abandonment (contingency borings), including all materials and supplies (Halliburton Class G - 40% silica flour cement).	3,750	Linear Ft		
010B	DOT approved, clean, 55-Gallon Drums for containment and storage of soil cuttings and waste water.	64	Each drum		

Subtotal (without option item sets) $___________

Subtotal Option Item Set A only $___________

Subtotal Option Item Set B only $___________

Placeholder for Low-Flow SOP

SCOPE OF WORK
SURVEY A 32 ACRE PARCEL AND 35 MONITORING WELLS
McCormick and Baxter Superfund Site
Stockton, California

1.0 General Information

The McCormick and Baxter (M&B) wood preserving company operated on a 29 acre site at 1295 W. Washington Street in Stockton, California, from 1942 until 1990. The site is located in an industrial area near the junction of the I-5 interchanges (see Figure 1). The northern boundary of the site borders Old Mormon Slough, which empties into the Port of Stockton on the San Joaquin River. During the years of operation M&B chemically treated wood products in pressure cylinders with various preservation solutions containing creosote, pentachlorophenol (PCP), arsenic, copper, chromium and zinc. The site is currently being remediated by U.S. Environmental Protection Agency.

2.0 Survey Requirements

The Sacramento District in-house survey crew shall be responsible for surveying 32 acres, known as the McCormick and Baxter Superfund Site, located in Stockton, California. The survey shall take place in the month of May and a topographic map shall be produced using Intergraph by June 15, 1999.

- Horizontal and vertical controls shall be established for the survey. The horizontal control shall be in NAD83 state plane coordinates and the vertical control shall be in NGVD 88.
- A minimum of four monuments shall be placed and surveyed onsite. The monuments should be placed along the fence line or by a building since future use of the site for field activities is not clear at this time.
- The survey shall be performed on a scale of 1″ = 50′. Reading shall be taken on a 50 foot grid using a total station.
- The survey crew shall be responsible for surveying in all pertinent site features. At a minimum the pertinent site features shall include all existing above ground structures, the repository pit, the sheet pile wall along the slough, the perimeter security fence, the two holding ponds, the corners of the asphalt cap, buildings, paved areas, and the well pump house.
- All onsite monitoring wells shall be surveyed to a vertical control of 0.01’ on the north side of the casing/monument. GPS will be used for the control points when surveying in the well casings.

3.0 Deliverables

All data and maps shall be supplied electronically to Randy Olsen. Two hard copies of the topographic map shall be supplied displaying all pertinent site features and onsite monitoring wells. The map shall display contours to an accuracy of a half of a foot and shall be produced using Intergraph.

4.0 Schedule

The required completion date for this surveying effort and providing the deliverables to Randy Olsen is 15 June 1999.

5.0 Points of Contact

The points of contact for questions regarding this survey action are:

- Richard Smith (206) 764-3309
- Randy Olsen (916) 557-5285
- Kira Lynch (206) 764-6918

SCOPE OF WORK
SURVEYING OF THE SOUTH BANK OF OLD MORMON SLOUGH
McCormick and Baxter Superfund Site
Surface Water and Sediment Operable Unit
Stockton, California

1.0 Introduction

As part of the remediation efforts to be implemented at the McCormick and Baxter Superfund Site (MBSS), the banks along Old Mormon Slough (OMS) will be stabilized to curtail the failure of contaminated soils into the waterway and onto the planned contaminated sediment containment cap. A survey of the OMS banks is required to develop a comprehensive stabilization design and to compute required quantities of materials needed to implement the final design.

2.0 Survey Requirements

The survey of the OMS banks will require the following:

2.1 Cross sections at 50 foot intervals beginning at the east end of the sheet pile wall existing immediately north of the MBSS Oily Waste Pond (OWP) area and extending along the south bank to the end of OMS and around the eastern end of the slough to the point where private land is reached (the entire southern and eastern bank of OMS). Cross sections shall measure vertical elevations to a scale of 1-inch = 1-foot. Cross sections shall extend a minimum of 100-feet onto the MBSS upland (measured from the top edge of OMS banks). The lower (northern and western ends of the sections) shall be completed within 2-hours plus or minus of low tide and shall extend a minimum of 10 feet into the slough.

2.2 Cross sections shall indicate the presence of slope features (concrete blocks, piping, trees, and visible soil tension cracks).

2.3 Cross sections shall indicate the location of the MBSS perimeter security fence.

2.4 The survey crew shall make note of the general kind of vegetation (grasses, low shrubs less than 4 feet, shrubs greater than 4 feet, and trees) within 200 feet of the embankment along the transects. This information will be used by a Contractor to determine the amount and nature of the clearing for the bank protection.

2.5 Sufficient survey points shall be obtained along each survey line to accurately plot the location of each change in slope, the tops and bottoms of all vertical surfaces, and the slope features listed in item 2.2 above.

2.6 All surveyed cross sections shall be identified on a base map of the site showing the location of each cross section, the orientation of each cross section, the starting point of each cross section, and the ending point of each cross section. The base map will be to a scale of 1-inch = 20-feet. The base map may be plotted on multiple sheets if required.

2.7 Deliverables.

All cross sections and the base map shall be supplied in electronic format using MICROSTATION. One hard copy shall be supplied of the cross sections and base map.

3.0 Schedule

The required completion date for this surveying effort and providing the deliverables to Seattle District is 15 June 1999. Deliverables shall be sent via FedEx Next Day Delivery to:

Seattle District
U.S. Army Corps of Engineers
4735 East Marginal Way South
Seattle, WA 98134-2385
Attn: Jim McBane
CENWS-EC-DB-CS

4.0 Points of Contact

The Seattle District Points of Contact for questions regarding this surveying action are:

- Jim McBane, (206) 764-3712
- Alternate #1, Mr. Dennis Fischer, (206) 764-3555
- Alternate #2, Mr. John Wakeman, (206) 764-3430

APPENDIX B

Standard Field Forms

CONTENTS

NAPL Thickness/Sampling Form

Well ID	Date and Time	LNAPL Top[a]	LNAPL Bottom	LNAPL Thickness	Water Top[a]	Water Bottom	DNAPL Top[a]	DNAPL Bottom	DNAPL Thickness	Well Total Depth	Comments
A-4											
A-5											
A-6											
A-8											
A-10											
DSW-1D											
DSW-4B											
DSW-4C											
DSW-4D											
DSW-4E											
DSW-5B											
DSW-6B											
DSW-6C											
OFS-4D											
OFS-4E											
ONS-1B											
ONS-1C											
ONS-2A											

[a] All measurements are in feet below ground surface for flush mounted wells or feet below top casing for wells with casing stickup above ground surface.

SCAPS
Tulsa District Corps of Engineers
CPT/LIF Report Form

Push ID: ____________________ Tool ID:________ Date: ______________

Total Push Depth: ________________ Time Push Completed: __________________

Grout: ______________________________________

Comments: ____

++

Push ID: ____________________ Tool ID:________ Date: ______________

Total Push Depth: ________________ Time Push Completed: __________________

Grout: ______________________________________

Comments: ____

++

Push ID: ____________________ Tool ID:________ Date: ______________

Total Push Depth: ________________ Time Push Completed: __________________

Grout: ______________________________________

Comments: ____

++

Push ID: ____________________ Tool ID:________ Date: ______________

Total Push Depth: ________________ Time Push Completed: __________________

Grout: ______________________________________

Comments: ____

CONTENTS

CONTENTS (Continued)

Section Page

CONTENTS (Continued)

APPENDIXES

TABLES

ABBREVIATIONS AND ACRONYMS

AES	atomic emission spectrometry
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
CDFG	California Department of Fish and Game
CIH	certified industrial hygienist
CLP	Contract Laboratory Program
COC	chemical of concern
CPT	cone penetrometer testing
CSM	conceptual site model
DCQCR	daily chemical quality control report
DHS	Department Health Services (now DTSC)
DNAPL	dense nonaqueous-phase liquid
DO	dissolved oxygen
DQO	data quality objective
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EQL	estimated quantitation limit
EPA	U.S. Environmental Protection Agency
FASP	Field Analytical Support Program
FSP	field sampling plan
GC/FID	gas chromatography/flame ionization detector
GC/MS	gas chromatography/mass spectroscopy
GMS	groundwater monitoring system
GPC	gel permeation chromatography
GPR	ground-penetrating radar
ICP	inductively coupled plasma
IR	infrared
LCS	laboratory control sample
LIF	laser-induced fluorescence
LIMS	Laboratory Information Management System
LNAPL	light nonaqueous-phase liquid
MCL	maximum contaminant level
MDL	method detection limit
MQL	method quantitation limit
MRL	method reporting limit
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level

ABBREVIATIONS AND ACRONYMS (Continued)

NAPL	nonaqueous-phase liquid
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzodioxins
PCDF	polychlorinated dibenzofurans
PCP	pentachlorophenol
PE	performance evaluation
PEM	performance evaluation mixture
PFE	pressurized fluid extraction
PM	project manager
POL	petroleum, oil, and lubricant
QA/QC	quality assurance/quality control
QAMS	Quality Assurance Management System
QAPP	quality assurance project plan
QL	quantitation limit
QLS	quantitation limit standard
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPD	relative percent difference
RPM	regional project manager
RSD	relative standard difference
RWQCB	Regional Water Quality Control Board
SAP	sampling and analysis plan
SCAPS	Site Characterization and Analysis Penetrometer System
SDG	sample delivery group
SOP	standard operating procedure
SVOC	semivolatile organic compound
TAL	target analyte list
TIC	tentatively identified compound
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TPH-Dx	total petroleum hydrocarbon – diesel extended
TRPH	total recoverable petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOA	volatile organic analysis
VOC	volatile organic compounds

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP), in conjunction with the Field Sampling Plan (FSP), composes the Sampling and Analysis Plan (SAP), which is an integral part of the Management Plan for the McCormick and Baxter Superfund site field exploration. The purpose of the SAP is to assure production of high quality data that meet project objectives and requirements and accurately characterize measurement parameters. The SAP provides protocols for collecting samples, measuring and controlling data, and documenting field and laboratory methods so that the data are technically and legally defensible. The SAP was prepared in accordance with guidelines set forth by the U.S. Army Corps of Engineers requirements (U.S. ACE 1994).

The SAP has two major components: Part I - the Field Sampling Plan (FSP) and Part II - the Quality Assurance Project Plan (QAPP). The FSP presents the detailed scope of work associated with field activities (e.g., sample types, sample locations) and specifies the procedures to be used for sampling and other field operations. The QAPP describes the analytical data quality objectives, field and laboratory analytical procedures, quality assurance/quality control (QA/QC) procedures, and data quality evaluation criteria.

Sampling and analysis procedures for the field exploration are designed to be sufficient to satisfy the data quality objectives (DQOs) identified in Section 6.0 of the Work Plan. This plan presents the analytical methods and associated QA/QC procedures selected to meet the DQOs.

2.0 ANALYTICAL DATA QUALITY OBJECTIVES

The primary objective of this field exploration is to collect data required to better define the type and extent of nonaqueous-phase liquid (NAPL) contamination, and evaluate the geologic restraints to assess appropriate in situ thermal treatment technologies that will enhance the removal of contaminants from the subsurface. Secondary objectives include groundwater monitoring to document potential off-site transport of contaminants, Old Mormon Slough sidewall soil sampling to predict potential recontamination of the sediment cap, and Cellon process area soil sampling and analysis for polychlorinated biphenyls (PCBs). Data should be scientifically and legally defensible.

Sample collection and analysis methods have been selected to provide data of sufficient quality for the above project objectives. Data will not be used to prepare a risk assessment or for evaluating compliance with regulatory screening levels.

2.1 CHEMICALS OF CONCERN

Previous activities at the site indicate that chemicals of concern (COCs) have been found in soil and/or groundwater at the site. Available analytical data indicate the COCs are polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), dioxin/furans, and arsenic.

2.2 DATA COLLECTION APPROACH

A dynamic sampling and analysis process was developed to generate data to meet project objectives. A logical chain of reasoning will be followed so that the data gathered supports the conclusions made by the technical staff. This investigation allows for changes in the number of locations/samples as the investigation progresses, and results from the early stages will be evaluated and incorporated in refining the site conceptual model prior to additional data collection. A more detailed description of the sampling rationale and project DQOs can be found in Section 6.2 of the Work Plan.

Data will be collected using field portable instruments, on-site mobile laboratories, and off-site fixed laboratories. All measurements will be made according to standard operating procedures (SOPs) documented in the Sampling and Analysis Plan (SAP). Field sampling SOPs are included in Appendix A to the FSP. Laboratory analysis SOPs are included in Appendix C to this QAPP. The following section describes the approach towards data generation in the field and off site, and describes sources of uncertainty and how uncertainty will be managed. The quality control program associated with this approach and documented in this QAPP has been developed to address these uncertainties.

2.2.1 Field Portable Instruments

Chemical field measurement results will be used to assess site conditions for worker health and safety (e.g., dust monitoring), measure natural attenuation parameters in groundwater (e.g., field instruments for dissolved oxygen), determine the extent of NAPL in soil (e.g., Site Characterization and Analysis Penetrometer System laser-induced fluorescence [SCAPS LIF]), and determine geologic/hydrogeologic properties of soil (e.g., SCAPS cone penetrometer testing [CPT]).

Methods and equipment have been selected to give rapid assessments of site conditions and therefore have a higher degree of uncertainty than more rigorous methods. The inherent uncertainly of these methods is acceptable for this project because the rapid assessment allows for immediate assessment of site conditions (e.g., natural attenuation parameters and dust levels) and a greater number of measurements (e.g., SCAPS CPT and LIF). A greater number of measurements allows for more representative sampling throughout the site and can compensate for the inherent variability in the measurement methods and contaminant distribution heterogeneity. Field measurements will be evaluated immediately in the field by the technical team who will make decisions on subsequent sampling locations and site conditions.

2.2.2 SCAPS Laboratory

The SCAPS laboratory will analyze soil samples for total recoverable petroleum hydrocarbon (TRPH). The TRPH analysis gives estimated concentrations of petroleum hydrocarbons in a sample and will be used to correlate SCAPS LIF response. The rapid assessment for TRPH will allow a greater number of measurements and more representative sampling throughout the site. TRPH results will not identify specific fuel types or composition, and may be subject to interferences from natural organic materials. These uncertainties are acceptable for this project because bulk petroleum hydrocarbon estimates are suitable for defining the presence or absence of NAPL. Followup analyses will be performed on these samples by the on-site mobile laboratory to better define fuel type and composition. Field measurements will be evaluated immediately in the field by the technical team who will make decisions on subsequent sampling locations.

2.2.3 On-Site Mobile Laboratory

The on-site mobile laboratory (EPA Region 9 Field Analytical Support Program [FASP] laboratory) will analyze soil and groundwater samples collected during SCAPS sampling for total petroleum hydrocarbon-diesel extended (TPH-Dx). TPH-Dx analysis gives estimated concentrations of total petroleum hydrocarbons (TPH) and gives profiles of different fuel types present in samples. Profiles (analysis chromatograms) will be evaluated qualitatively by an experienced analyst who will identify fuel types present based on a library of fuel type standards previously analyzed. These uncertainties in concentration and identity are acceptable for this project because it still allows the identification of presence or absence of TPH at the site. Additionally, the rapid assessment for TPH-Dx will allow a greater number of measurements and more representative sampling throughout the site. TPH-Dx results will be evaluated immediately in the field by the technical team who will make decisions on subsequent sampling locations to assure that the extent of different fuel types present at the site are identified.

2.2.4 Off-Site Fixed Laboratories

Several off-site fixed laboratories will analyze soil, groundwater, and NAPL samples for physical and/or chemical characteristics. Rapid turnaround analysis for PAHs and PCP will be required only for soil and groundwater collected during SCAPs sampling. Soil results will be reported on a wet weight basis. This uncertainty is acceptable because results will be evaluated qualitatively to define different fuel types present at the site. Results will be evaluated as soon as they become available by the technical team who will make decisions on subsequent sampling locations to assure that the extent of different fuel types present at the site are identified. Dry weight results will be reported with final data packages. All other fixed laboratory analyses will be performed with routine turn around times because results are not needed immediately to define the extent of the NAPL contamination. Methods and laboratories were selected that could provide data to support design needs of the thermal treatment systems. Associated quality controls are sufficient to support decisions based on these results.

2.3 ANALYTICAL METHODS

Analytical methods were selected to provide data to support project objectives. Analytical methods to be performed for the field exploration are described in Section 5.0. Laboratories performing these methods are listed in Table 2-1. Laboratory SOPs are included as Appendix C.

Additionally, soil samples will be collected and submitted to the EPA Kerr Lab for steam treatability testing. A summary of the treatability study objectives and methods is included in Appendix E.

2.4 ANALYTICAL METHOD DETECTION LIMITS, QUANTITATION LIMITS, AND REPORTING LIMITS

Sensitivity requirements for all methods and matrices are driven by the DQOs. Specific requirements by method and matrix are presented on page 2-4 below, followed by the definitions for method detection limits (MDL), quantitation limits (MQL), and reporting limits (MRL).

Test Method	**Matrix**	**Driver**
TPH by LIF	Soil	Technology limitations and site-specific factors. Threshold values (reporting limits) will be determined in the field.
TRPH by IR	Soil	Less than LIF threshold value
TPH-Dx by GC/FID (FASP and fixed laboratories)	Soil	Less than LIF threshold value
TPH-Dx by GC/FID (FASP laboratory)	Groundwater	Less than LIF threshold value
TPH-Dx by GC/FID (fixed laboratories)	NAPL	Concentration determined by dilution
SVOC (FASP and fixed laboratories)	Soil	Soil target cleanup levels for the protection of groundwater. (All MRLs are below except benzo[a]pyrene.)
SVOCs (fixed laboratory)	Groundwater	MCLs
SVOCs (fixed laboratory)	NAPL	Concentration determined by dilution
Other analyses	Soil, groundwater, NAPL	Engineering design requirements

2.4.1 Method Detection Limit

The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte (Appendix B of 40 CFR 136). Method detection limit studies have been performed by the mobile field laboratory (EPA Region 9 FASP) and the EPA Region 9 laboratory and are acceptable for this project.

2.4.2 Method Quantitation Limit

The MQL represents the value for which the laboratory has demonstrated the ability to reliably quantitate target analytes within a prescribed performance criteria for the method performed. Operationally, it is equivalent to the concentration of the lowest calibration standard in the initial calibration curve.

2.4.3 Method Reporting Limit

The MRL is a threshold value below which the laboratory reports a result of non-detected. It may be based on project-specific concentrations of concern, regulatory action levels, or sensitivity capability of method and instrument. The MRLs are adjusted based on the sample matrix and any necessary sample dilutions. Operationally, it is equivalent to the MQL adjusted based on the sample matrix and any necessary dilutions. Routine laboratory MRLs for all target analytes are listed in Appendix A.

Table 2-1
Project Laboratories

Laboratory	Methods	Matrix	Address And Contact
SCAPS Team	TRPH by Fluorescence TRPH by 418.1 Geotech/Stratigraphy	Soil Soil Soil	1645 S. 101st E. Ave. Tulsa, OK 74128 Contact: Eddie Mattioda Phone: (918) 669-7445
EPA Region 9 FASP	TPH-Dx	Soil, GW	Contact: Jeff Mays (Lockheed Martin); Liza Finley (EPA)
EPA Region 9 Laboratory	TPH-Dx SVOCs PCBs Metals Total and Dissolved Manganese Sulfate Chloride Nitrate Nitrite TOC	Soil Soil, GW Soil Soil GW GW GW GW GW GW	1337 S. 46th Street, Building 201 Richmond, CA 94804-4698 Contact: Nancy Wilson Phone: (510) 412-2377 Backup Contact: Rich Bauer Phone: (510) 412-2312 Reception: (510) 412-2300
Pacific Analytical Laboratories	Dioxin/Furans	Soil, GW	6349 Paseo del Lago Carlsbad, CA 92009 Contact: Steven Parsons Phone: (760) 931-1766 Fax: (760) 931-9479
EPA Robert S. Kerr Environmental Research Laboratory (Kerr Lab)	Density Viscosity Solubility Oil-water Interfacial Tension Wettability TPH-Dx SVOCs Permeability Metals Speciation Treatability Testing	NAPL, GW NAPL NAPL NAPL NAPL NAPL NAPL Soil Soil Soil	919 Kerr Research Drive Ada, OK 74820 Contact: Eva Davis Phone: (580)436-8548
Columbia Analytical Services	TPH-Dx SVOCs	NAPL NAPL	1317 S. 13th Ave., P.O. Box 479 Kelso, WA 98626 Contact: Diane Wiegle Phone: (360) 577-7222 Fax: (360) 636-1068
PTS Laboratories, Inc.	Boiling Point Distribution Grain Size Porosity Cation Exchange Capacity Density NAPL Saturation TOC	NAPL Soil Soil Soil Soil Soil Soil	8100 Secura Way Santa Fe Springs, CA 90670 Contact: Richard Young Phone: (562)907-3607 Fax: (562) 907-3610

3.0 METHODS AND QUALITY CONTROL FOR FIELD ACTIVITIES

This section describes field measurement procedures, sample handling, and coordination procedures between the sampling team and analytical laboratories. Detailed sampling procedures are discussed in the Field Sampling Plan (FSP).

3.1 FIELD MEASUREMENT METHODS

Measurements to be made during field activities include dust monitoring, NAPL screening, and groundwater quality parameter screening.

3.1.1 Air Monitoring for Health and Safety

Field screening will be used to evaluate health and safety conditions during drilling. All meters used will be calibrated daily according to manufacturer’s instructions. Specific monitoring requirements are discussed in the Site Safety and Health Plan.

3.1.2 Groundwater Field Measurements

Groundwater will be monitored during sampling for specific conductance, pH, temperature, and redox potential using a YSI Model 3560 with flow-through chamber. Turbidity will be measured using a Hach Portalab Turbidimeter. Dissolved oxygen will be measured using a YSI 55 with flow-through chamber. Each instrument will be used and calibrated daily according to the manufacturers’ instructions.

Additionally, groundwater samples will be screened in the field for dissolved oxygen, total alkalinity, total hardness, and total iron using commercially available field test kits. All test kits will be used according to the manufacturer’s instructions. No instrument calibration is required for these methods. Method summaries are provided below.

Analyte	Test Kit	Reagent
Dissolved Oxygen	CHEMets™	Rhodazine D
Total Alkalinity	Hach™	H_2SO_4
Total Hardness	Hach™	EDTA
Total Iron	Hach Accuvac™	1,10 Phenanthroline

Field test kits for the above measurements will be run in duplicate at a frequency of one every 10 samples to assess the precision of field test kit results. Additionally, dissolved oxygen results from the YSI meter and the field test kit will be compared in the field to assess the quality of the data being obtained.

Dissolved carbon dioxide in groundwater will be calculated from test kit results using the following formula:

$$P_{CO_2}(atm) = \frac{(\gamma co_3^{2-})(10^{-pH})^2}{10^{-18.2}} \times \frac{Alkalinity(mg / LCaCO_3)}{\left(2 + \frac{10^{-pH}}{10^{-10.3}}\right)\left(5 \times 10^4\right)}$$

Where:

P_{CO_2} = partial pressure of carbon dioxide in atmospheres

γco_3^{2-} = activity coefficient of carbonate (0.6 to 1.0 for groundwater with total dissolved solids <10,000 mg/L)

$Alkalinity$ = total inorganic carbon alkalinity

3.1.3 SCAPS Cone Penetrometer Testing (CPT) and LIF

A SCAPS equipped with laser-induced fluorescence (LIF) sensor will be used to define the horizontal and vertical extent of the petroleum hydrocarbon plume. At the same time, the SCAPS will be equipped with geotechnical sensors (cone pressure and sleeve friction) that will be used to provide simultaneous and continuous geotechnical and stratigraphic information. At the end of each penetration by the SCAPS, sensor data will be plotted as a function of depth and archived. Brief descriptions of each of these sensors is included below. The SOPs for the SCAPS LIF are included in Appendix C.

Visual evaluation of soil cores for NAPL contamination will be compared against LIF data. Sample intervals representative of different soil types, different emission spectra, and different emission intensity will be selected based on SCAPS LIF and geotechnical sensor measurements. The SCAPS will be used to obtain soil samples from these locations for on-site TRPH, TPH-Dx, PAH, and PCP analyses, and groundwater samples for TPH-Dx, PAH, and PCP analyses. The EPA FASP team has committed to deploying a mobile lab facility to the site during the investigation. Analysis of TPH and PCP will be conducted with a single extraction followed by analysis of PAHs. On site lab facilities will allow less than 24-hour turnaround time for all analytes. TRPH, TPH-Dx, and PAH and PCP soil data will be used for on-site validation and calibration of the fluorescence response obtained by the SCAPS LIF sensor. This data will assist with determining the relationship between LIF response and TRPH, TPH, and PAH concentration over the range of site soil and contaminant types. The relationship between LIF signal, TRPH, TPH-Dx, and PAH and PCP soil data will be evaluated by the technical team. The TRPH, TPH-Dx, and PAH and PCP data will be used to determine the contaminant concentration above which dissolved contamination is suspected. The SCAPS LIF data will be used to define the boundary of the NAPL and petroleum, oil, and lubricant (POL) contamination above the site specific threshold concentration.

Hydrocarbon Presence Using LIF

The LIF sensor can detect the presence of hydrocarbons in the bulk soil matrix throughout the vadose zone, capillary fringe, and saturated zones. The SCAPS will be used to collect a continuous record of possible contaminant locations and more complete delineation of the area of contamination. The SCAPS LIF system is capable of providing information on contaminant distribution of POL compounds. Since the SCAPS fluorescence intensity is generally proportional to in situ concentration, SCAPS LIF data can be used to effectively delineate not only the presence, but also the relative concentration of contaminants. This proportional feature of the SCAPS LIF data can be used to pinpoint the zones of highest contaminant concentration and screen the variation in concentration across the site.

The SCAPS LIF uses a nitrogen laser as the ultraviolet excitation source. The N2 laser has a wavelength of 337 nanometers and pulses at a rate of 10 times per second. This wavelength will excite aromatic compounds with three or more rings as well as some two-ring compounds. Fluorescence intensity is generally proportional to in situ hydrocarbon concentration. The SCAPS LIF sensor provides spatial resolution of 4 cm when driven at 1 meter/minute.

The SCAPS LIF sensor response is checked using an aqueous solution of Rhodamine 6G (10 uMol/L) before and after each penetration event to monitor LIF system response and document any system drift.

The linear range for the LIF is approximately 100 mg/kg to 50,000 mg/kg. The LIF system will be calibrated on site with a field TRPH method for the purpose of defining detects versus nondetects of POL above a cutoff threshold. The site-specific fluorescence threshold will be determined by comparing SCAPS POL sensor LIF response to soil analyses for TRPH, TPH-Dx, and PAH and PCP. The fluorescence threshold is the quantitative limit that the fluorescence intensity must exceed in order to qualify as a detection. The fluorescence detection threshold will be defined as the practical detection level in mg/kg as determined by comparing LIF response to the field TRPH method results.

Non-linearity of LIF response tends to occur at concentrations greater than 10,000 mg/kg. Sample intervals with LIF fluorescence response above this level will be targeted for TRPH, TPH-Dx, and PAH and PCP analyses of soil and/or water samples. In sandy soils, the non-linearity occurs at lower concentrations than in clay-rich soils, possibly due to self-adsorption or saturation.

Verification soil samples will be collected at depths of interest, including areas of strong, medium, low, and no fluorescence response, and analyzed for TRPH. LIF and TRPH results should be in agreement on detect and nondetect for 80 percent of the samples, with a false negative rate of less than 5 percent. In addition, verification soil samples will be collected from areas of different soil types and fluorescence emission spectra. Soil verification samples will be collected following completion of the LIF field effort, and will be used to assist with interpretation of the three-dimensional map of fluorescence response.

The LIF is subject to interference that can make data reduction complicated, and limit the real-time nature of data analyses and decision making. Moisture in soil and fluorescing compounds or minerals (e.g., carbonates) may affect the LIF readings and influence performance statistics. The LIF sensitivity to petroleum, oil, and lubricants generally increases with greater soil moisture content. LIF sensitivity generally increases with increased grain size.

The potential presence of fluorescence emission from non-target (non-hydrocarbon) analytes within the soil matrix must also be considered when assessing LIF data. Because the LIF sensor collects full spectral information it is almost always possible to discriminate between hydrocarbon and non-hydrocarbon fluorescence by analyzing the spectral features associated with the data. The SCAPS LIF sensor system uses a multichannel detection scheme to capture a complete fluorescence emission spectrum at each point along the push. Suspected nontarget fluorescence emission based on spectral response will be investigated by obtaining a soil sample at the appropriate depth and analyzing this sample for TRPH in the field. The LIF response will be considered non-target fluorescence if the TRPH indicates a nondetect. Once the non-target fluorescence has been confirmed using TRPH, the emission spectra will be used to differentiate non-target fluorescence in subsequent penetrations.

Soil Classification Using Geotechnical Sensors

The SCAPS geotechnical sensors will be used to provide simultaneous and continuous geotechnical and stratigraphic information. The SCAPS probe will be operated to collect subsurface stratigraphy data in accordance with procedures described in American Society for Testing and Materials (ASTM) Method D3441.

3.2 FIELD MEASUREMENT INSTRUMENT CALIBRATION PROCEDURES

The calibration and general maintenance of field instruments will be the responsibility of the Field Investigation Manager, the USACE Project Technical Team Leader, or the SCAPS leader. Field instruments requiring calibration include:

- Dust meter
- YSI 3560 for pH (calibrate with pH 4, 7, and 10 standard buffer solutions), Eh, and specific conductance

- Hach Model 16800 for turbidity
- YSI 55 for dissolved oxygen
- SCAPS CPT and LIF

All calibration procedures and measurements will be made in accordance with manufacturers' specifications and standard operating procedures. Field instruments will be checked and calibrated prior to their use on site, and batteries will be charged and checked daily where applicable. Instrument calibrations will be performed at the beginning of each work day and checked and recalibrated if necessary through the course of the day according to manufacturer's specifications or if deemed necessary by sampling personnel. Special attention will be given to instruments that may drift with change in ambient temperature.

Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and segregated to prevent inadvertent use. Such equipment will be properly tagged to indicate that it should not be used until repaired. Equipment that cannot be repaired or recalibrated will be replaced.

All documentation pertinent to the calibration and/or maintenance of field equipment will be maintained in an active field logbook. Logbook entries regarding the status of field equipment will contain, but will not necessarily be limited to, the following information:

- Date and time of calibration
- Name of person conducting calibration
- Type of equipment being serviced and identification (make, model and serial number)
- Reference standard used for calibration (such as pH of buffer solutions)
- Calibration and/or maintenance procedure used
- Other pertinent information

3.3 SAMPLE HANDLING, CONTAINERS, PRESERVATION, AND HOLDING TIMES

Sample containers, preservation, and holding times are summarized by matrix in Tables 4-6 to 4-10 in the FSP. Soil and water samples will be collected in glass or plastic containers purchased for the project. NAPL samples will be collected in glass containers. The containers will have screw-type lids to assure adequate sealing of the bottles. Lids of the containers will have Teflon inserts to prevent sample reaction with the lid and to improve the quality of the seal.

Commercially available pre-cleaned jars will be used and the USACE will maintain a record of certification from the supplier. The bottle shipment documentation will record batch numbers for the bottles. With this documentation, bottles can be traced to the supplier and bottle wash analysis results can be reviewed. The bottle wash documentation will be archived by the supplier for a period of 5 years.

Sample preservation will be performed in the field. Sample preservation procedures are used to maintain the character of analytes as sampled (i.e., representative concentrations and/or speciation in situ) during storage and shipment. Regardless of the nature of the sample, absolute stability for all constituents cannot be achieved. Preservation techniques, such as pH control and refrigeration, may retard physiochemical and biochemical changes. As a general rule, analyzing the sample as soon as possible is the best way to minimize physicochemical and biochemical changes.

All samples will be placed in the appropriate sample container and refrigerated (on ice in a cooler) immediately upon sample collection. The samples will be transferred to the mobile field laboratory and contract laboratories as soon as possible and using chain of custody procedures as described in the FSP. Upon receipt at the contract laboratories, a cooler receipt form will be filled out to document sample condition. The laboratories will meet all specified holding times and should make every effort to prepare and analyze the samples immediately after they are received.

3.4 COORDINATION WITH ANALYTICAL LABORATORIES

Team members will work closely with the laboratories (mobile and fixed) to ensure that samples are handled and analyzed following procedures described in this QAPP. A schedule of field work and sampling will be established approximately two weeks prior to commencement of field work. Each day that samples are hand delivered or shipped to the laboratories, a designated team member will notify the laboratories to confirm that samples have been sent.

The laboratories will contact the Project Chemist, Kira Lynch, as soon as possible and no later than 24 hours after it is suspected that re-analysis of a sample by the laboratory is unable to determine a result due to matrix interference.

When the FASP laboratory is on site, communication will occur every morning regarding samples to be collected and laboratory capacity for the day. The FASP laboratory can run a maximum of only 20 samples, plus QC, per day under ideal conditions.

4.0 QUALITY CONTROL SAMPLES

Field QC and laboratory QC samples will be employed to evaluate data quality. Quality control samples are controlled samples introduced into the analysis stream whose results are used to review data quality and to calculate the accuracy and precision of the chemical analysis program. The purpose of each type of QC sample, collection and analysis frequency, and evaluation criteria are described in this section. Collection and analysis frequency are summarized in Tables 4-1 through 4-6. Laboratory control limits are listed in Appendix B.

Quality control procedures for both the mobile field laboratory and the fixed laboratories' analyses will be consistent with the requirements described in the laboratories' protocols and methods. These requirements are defined in SOPs as part of the laboratory's QA program plan. Methods for establishing the quality of laboratory measurements and sample results will generally conform with EPA Contract Laboratory Program scope of work or SW-846 QC requirements and quality criteria (when applicable). All QC measurements and data assessment for this project will be conducted on samples from and within batches of samples from this project alone; in other words, no "other project" samples will be used with samples from this project for assessment of data quality.

4.1 FIELD QUALITY CONTROL SAMPLES

Field QC checks are accomplished through the analysis of controlled samples that are introduced to the laboratory from the field. Rinsate and field blanks, field duplicates, matrix spike/matrix spike duplicate (MS/MSD), and performance evaluation (PE) samples will be collected and submitted to the mobile field laboratory and/or the fixed laboratories, where applicable, to provide a means of assessing the quality of data resulting from the field sampling program. Field QC samples will be selected by the sampling team and designated on the chain of custody form as appropriate.

4.1.1 Rinsate and Field Blanks

Rinsate blanks are collected to determine the potential for cross-contamination of samples during collection. Rinsate blanks will be collected and analyzed at the rate of 5 percent if utilizing non-dedicated sampling equipment. If dedicated or disposable sampling equipment is utilized, field blanks will be collected instead. Rinsate and field blanks will be submitted to both the mobile field laboratory and the fixed laboratory. Rinsate blanks will consist of store-bought distilled water collected from the final rinse of sampling equipment after the decontamination procedures described in Section 3.9 of the FSP. Blank sample collection methods and frequency are described in the FSP. Field blanks will consist of store-bought distilled water transferred directly into sample containers in the field.

All rinsate or field blanks will be submitted blind to the laboratory, with sample numbers that are indistinguishable from primary samples. Quality control criteria and corrective actions are the same as for method blanks (Section 4.2.2). Blank samples will be analyzed for the same parameters as the associated field samples.

4.1.2 Field Duplicates

Field duplicate samples will be used to check for sampling reproducibility. Field duplicates will be collected from locations with suspected high contamination levels. Field duplicates will be submitted to the mobile field laboratory and the fixed laboratory at a frequency of 10 percent of the field samples for every analytical method. Field duplicate samples will be submitted from locations having significant concentrations of target analytes as determined by results of field screening. Control limits for field duplicate precision are 30 percent relative percent difference (RPD) for aqueous samples and 50 percent RPD for soil and NAPL samples.

Field duplicates will be submitted blind to the laboratories, with sample numbers that are indistinguishable from primary samples. Quality control criteria for field duplicates and calculation and reporting of the RPD are described in Section 7.1.

4.1.3 Matrix Spike/Matrix Spike Duplicates

MS/MSDs are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy and precision of the analysis. The MS/MSDs will be collected and analyzed at a rate of 5 percent of the field samples for each analytical method or at least one for each analytical batch, whichever frequency is greater. Known concentrations of analytes are added to environmental samples; the MS or MSD is then processed through the entire analytical procedure and the recovery of the analytes calculated. Results are expressed as percent recovery of the known spiked amount (and RPD for MS/MSD pairs).

Because MS/MSD samples measure the matrix interference of a specific matrix, only MS/MSD samples from this investigation will be analyzed, and not samples from other projects. The MS/MSD samples will be analyzed for the same parameters as the associated field samples in the same QC analytical batch.

In those instances, MS/MSD samples will be collected from a different location. Additionally, MS/MSD samples should not be collected from locations with potentially high concentrations of target analytes that may mask the added MS/MSD compounds. Because of the high concentrations of target analytes, MS/MSD samples will not be submitted with NAPL samples.

4.1.4 Performance Evaluation Samples

PE samples will be submitted to the laboratories to evaluate the accuracy of the TPH and semivolatile organic compound (SVOC) analyses. PE samples will be submitted blind for chemical analysis. Four soil samples will be submitted to the SCAPS laboratory for TRPH analysis. Four soil samples will be submitted to the FASP laboratory for TPH-Dx analysis. Eight soil samples will be submitted to the EPA Region 9 laboratory for PAH and PCP analysis. The PE samples will be spiked by the commercial supplier with the site COCs at concentrations consistent with those previously observed in soil and groundwater at the site. One PE sample will be analyzed the first day of laboratory analysis. The PE sample results will be immediately compared to the vendor's documented acceptable control limits by the USACE Project Technical Team Leader. Sample analysis will not continue until the laboratory has met certified PE sample acceptance limits and approval has been obtained from the USACE Project Technical Team Leader. Assuming criteria have been met, a second sample of that matrix will be analyzed at random the same week, with the remaining PE samples submitted blind to the laboratory at regular intervals through the remaining analysis schedule.

The PE material will be from commercial sources. The PE supplier will fill pre-cleaned sample bottles with the PE material. Fictitious sample identification numbers will be assigned in the field as described in Section 5.2 of the FSP.

4.2 LABORATORY QUALITY CONTROL SAMPLES

Laboratory QC checks are accomplished through analyzing initial and continuing calibration samples, method blanks, surrogate spikes, laboratory control samples (LCS), and laboratory duplicate samples. Not all of these QC samples will be required for all methods. Typically, these samples are not required for non-SW-846 methods such as ASTM methods. Method-specific QC samples are described in the laboratory SOPs.

4.2.1 Initial and Continuing Calibration Samples

Laboratory instrument calibration requirements are summarized in Tables 4-2 through 4-6, and are discussed in Section 6.

4.2.2 Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. Laboratory method blanks will be analyzed at a minimum frequency of 5 percent or one per analytical batch for all chemical parameter groups.

Quality control criteria require that no contaminants be detected in the blank(s) above the MQL. If a chemical is detected, the action taken will follow the laboratory SOPs as modified. Blank samples will be analyzed for the same parameters as the associated field samples.

4.2.3 Surrogate Spikes

Accuracy of an analytical measurement is evaluated by using surrogate spikes. Surrogate compounds are compounds not expected to be found in environmental samples; however, they are chemically similar to several compounds analyzed in the methods and behave similarly in extracting solvents. Samples for organics analysis will be spiked with surrogate compounds consistent with the requirements described in the laboratory SOPs.

Percent recovery of surrogates is calculated concurrently with the analytes of interest, using the equation in Section 7.2. Since sample characteristics will affect the percent recovery, the percent recovery is a measure of accuracy of the overall analytical method on each individual sample.

4.2.4 Laboratory Control Samples

Laboratory control samples (LCS) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects. The LCS are prepared by spiking reagent water or silica sand with standard solutions prepared independently of those used in establishing instrument calibration. The LCS are extracted and analyzed with each batch of samples. Results are compared on a per-batch basis to established control limits and are used to evaluate laboratory performance for precision and accuracy. Laboratory control samples may also be used to identify any background interference or contamination of the analytical system that may lead to the reporting of elevated concentration levels or false positive measurements.

4.2.5 Laboratory Duplicate Samples

Precision of the analytical system is evaluated by using laboratory duplicates. Laboratory duplicates are two portions of a single homogeneous sample analyzed for the same parameter. Laboratory duplicates will be prepared and analyzed with project samples as listed in Tables 4-2 through 4-6.

Table 4-1
Field Quality Control Sample Collection Summary—Soil, NAPL, and Groundwater

Sample Type	Laboratory	Frequency
Rinsate/Field Blanks	Mobile, Fixed	5 percent
Field Duplicates	Mobile, Fixed	10 percent of all samples
MS/MSD (or Laboratory Duplicates)	Mobile, Fixed	5 percent of all samples or as specified in SOP
Performance Evaluation Samples	Mobile, Fixed	See discussion above

Table 4-2
Mobile Field Laboratory Quality Control Sample Summary—Soil

Method	Method Blanks[a]	Laboratory Duplicates (Percent)	MS/MSD (Percent)	LCS[a]	Surrogate	Initial Calibration	Continuing Calibration
TPH by Fluorescence	NA	NA	NA	NA	NA	Multi-point (Rhodamine 6G)	Before and after each push
TRPH	Every 10 samples	10	NA	NA	NA	7-pt	After every 10 samples
TPH-Dx	1/batch	NA	5	1/batch	All samples	3-pt	After every 12 hours

[a] Batch is equivalent to 20 or fewer samples prepared and analyzed together with common QC samples

Table 4-3
Mobile Field Laboratory Quality Control Sample Summary—Groundwater

Method	Method Blanks[a]	Laboratory Duplicates (Percent)	MS/MSD (Percent)	LCS[a]	Surrogate	Initial Calibration	Continuing Calibration
TPH-Dx	1/batch	NA	5	1/batch	All samples	3-pt	After every 12 hours

[a] Batch is equivalent to 20 or fewer samples prepared and analyzed together with common QC samples

Table 4-4
Fixed Laboratory Quality Control Sample Summary—Soil

Method	**Method Blanks[a]**	**MS/MSD (Percent)[b]**	**LCS (Blank Spike)[a]**	**Surrogate**	**Initial Calibration**	**Initial Calibration Verification**	**Continuing Calibration Standard[c]**
PAHs and PCP - rapid TAT	1/batch	5	1/batch	All samples	3-pt	1/batch	After every 12 hours
PAHs and PCP - standard TAT	1/batch	5	1/batch	All samples	5-pt	1/batch	After every 12 hours
TPH-Dx	1/batch	5	5 percent	All samples	5-pt	1/batch	After every 12 hours
Dioxin/Furans	See analytical request form (Appendix D)						
PCBs	1/batch	5	1/batch	All samples	3-pt	1/batch	After every 10 samples
Metals (As, Cu, Cr, Zn)	1/batch	5	1/batch	NA	See SOP	1/batch	After every 10 samples
Metals Speciation	1/batch	5	1/batch	NA	See SOP	1/batch	After every 10 samples
TOC	1/batch	5	1/batch	NA	2-pt	NA	After every 10 samples
Grain Size	NA	5[d]	NA	NA	NA	NA	NA
Porosity	NA	NA	NA	NA	NA	NA	NA
Permeability	NA	NA	NA	NA	NA	NA	NA
NAPL Saturation	1/batch	5	1/batch	NA	NA	NA	NA
Cation Exchange Capacity	1/batch	5	1/batch	NA	1-pt	Standard and blank with every batch	Standard and blank after every 10 samples
Density	NA	5[d]	NA	NA	NA	NA	NA

[a] Batch is equivalent to 20 or fewer samples prepared and analyzed together with common QC samples.
[b] MS/MSD for organics; MS/lab duplicate for inorganics
[c] Continuing calibration blank samples are analyzed immediately after continuing calibration standards.
[d] Laboratory duplicate only

Notes:
NA - not applicable
TAT - turn-around time

Table 4-5
Fixed Laboratory Quality Control Sample Summary—NAPL

Method	Method Blanks[a]	MS/MSD (Percent)	LCS (Blank Spike) [a]	Surrogate	Initial Calibration	Initial Calibration Verification	Continuing Calibration Standard[b]
TPH-Dx	1/batch	NA	1/batch	All samples	5-pt	1/batch	After every 10 samples
SVOC TAL w/ TICs	1/batch	NA	5 percent	All samples	5-pt	1/batch	After every 10 samples
Viscosity	NA	NA	NA	NA	NA	NA	NA
Density	NA	NA	NA	NA	NA	NA	NA
Solubility	NA	NA	NA	NA	NA	NA	NA
Wettability	NA	NA	NA	NA	NA	NA	NA
Boiling point distribution	NA	NA	NA	NA	NA	NA	NA
Oil-Water Interfacial Tension	NA	NA	NA	NA	NA	NA	NA

[a] Batch is equivalent to 20 or fewer samples prepared and analyzed together with common QC samples.
[b] Continuing calibration blank samples are analyzed immediately after continuing calibration standards.

Note:
NA - not applicable

Table 4-6
Fixed Laboratory Quality Control Sample Summary—Groundwater

Method	Method Blanks[a]	MS/MSD (Percent)	LCS (Blank Spike) [a]	Surrogate	Initial Calibration	Initial Calibration Verification[a]	Continuing Calibration Standard and Blank[b]
PAHs and PCP - rapid TAT	1/batch	5	1/batch	All samples	3-pt	1/batch	After every 12 hours
SVOC TAL - standard TAT	1/batch	5	1/batch	All samples	5-pt	1/batch	After every 12 hours
Dioxin/Furans	See analytical request form (Appendix D)						
TOC	1/batch	5 (MS/lab duplicate)	1/batch	NA	5-pt	1/batch	After every 10 samples
Density	NA	NA	NA	NA	NA	NA	NA
Total and Dissolved Manganese	Daily or 1/batch	10 (MS/lab duplicate)	Daily or 1/batch	NA	2-pt	After initial calibration and at the end of the analytical run	After every 10 samples
Sulfate, Chloride, Nitrate, Nitrite	Daily or 1/batch	10 (MS/lab duplicate)	Daily or 1/batch	NA	6-pt	After initial calibration and at the end of the analytical run	After every 10 samples

[a] Batch is equivalent to 20 or fewer samples prepared and analyzed together with common QC samples.
[b] Continuing calibration blank samples are analyzed immediately after continuing calibration standards.

Notes:
NA - not applicable
TAT - turn-around time

5.0 LABORATORY ANALYTICAL METHODS

This section describes the analytical procedures to be used for mobile field laboratory and fixed laboratory measurements. The analytical methods and associated QA/QC procedures were selected based on consideration of the DQOs. The analytical methods, calibration procedures, and QC measurements and criteria are based on current analytical protocols in the following:

- EPA Contract Laboratory Program (CLP) scope of work
- EPA SW-846 *Test Methods for Evaluation of Solid Waste* (U.S. EPA 1994a)
- American Society for Testing and Materials (ASTM annual updates)
- *Methods for the Chemical Analysis of Water and Wastes* (U.S. EPA 1979)
- Laboratory-specific SOPs

Laboratory method summaries, including reference and preservation, extraction, cleanup and instrumentation, are included in Tables 5-1 through 5-5. Laboratory-specific SOPs are included in Appendix C. Project-specific modifications to these methods are discussed below.

Laboratory QA will be implemented and maintained as described in this plan and according to the laboratories' QA plans and SOPs. Quality control samples are described in Section 4 of this QAPP. Analytical method target analytes, routine reporting limits, and control limits are listed in Appendices A and B.

The methods selected are sufficient to meet the project DQOs. While a best effort will be made to achieve the project DQOs, there may be cases in which it is not possible to meet the specified goals. Any limitation in data quality due to analytical problems (e.g., elevated detection limits due to highly contaminated samples) will be identified within 48 hours and brought to the attention of the USACE Project Technical Team Leader. In addition, this information will be discussed in the data evaluation report.

5.1 TARGET ANALYTE LIST FOR SEMIVOLATILES ANALYSIS

The target analyte list (TAL) for semivolatiles analysis for soil, groundwater, and NAPL samples will vary depending on the laboratory performing the analyses and requirements of the field sampling schedule. A limited list of analytes will be reported for all soil samples and groundwater samples collected during SCAPS sampling and Old Mormon Slough sidewall soil sampling. Results for SCAPS samples will be reported on a fast turnaround basis to facilitate field decision making. The complete TAL as specified in SW-846 Method 8270C will be reported for groundwater collected from monitoring wells. The complete TAL plus tentatively identified compounds (TICs) will be reported for all NAPL samples. The limited TAL is as follows:

- Naphthalene
- 2-Methylnaphthalene
- 1-Methylnaphthalene
- Acenaphthene
- Fluorene
- Anthracene
- Phenanthrene
- Fluoranthene
- Pyrene
- Chrysene
- Benzo(g,h,i)perylene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Dibenzo(a,h)anthracene
- Indeno(1,2,3-cd)pyrene
- Pentachlorophenol
- Carbazole
- Dibenzofuran

5.2 NONAQUEOUS-PHASE LIQUID ANALYTICAL APPROACH

Nonaqueous phase liquid samples are high concentration samples that will be analyzed differently than soil or water samples. Because percent levels of organic constituents such as TPH are expected, routine reporting limits are not applicable to this matrix; however, sample preparation, instrument calibration, quantitation limits and corrective actions are the same as for soil samples. The analytical approach to be used by EPA Kerr Lab and Columbia Analytical Services is described in this section.

The analyst will examine the sample for color and/or composition. The analyst will use their best judgement to establish an initial dilution factor based upon a visual inspection of the sample, previous experience with similar sample matrices, and mobile field laboratory results (if available) according to EPA SW-846 Method 3580 – Waste Dilution.

The sample will be analyzed according to the laboratory's SOPs for soil samples for TPH-Dx and SVOCs. The initial analytical data will be reviewed to determine if the dilution was appropriate (e.g., the majority of the detected compounds were within the linear range of the instrument). If the initial analysis has no hits then the analyst will reanalyze the sample at a lower dilution until a majority of the detectable compounds are within the calibration range. If after the initial analysis there are compounds demonstrated above the calibration range, the sample will be reanalyzed at a greater dilution to bring them within the calibration range.

The reporting limits will be the quantitation limit adjusted based upon the dilution factor or factors applied to each individual sample. The initial quantitation limits for NAPL are listed below. Matrix spikes, matrix spike duplicates, and laboratory duplicates will not be analyzed with NAPL samples. Soil surrogate control limits as listed in Appendix B will be used to evaluate surrogate recovery and determine corrective actions.

Analytical Method	**Columbia Analytical Services NAPL Quantitation Limit in mg/kg**
TPH-Dx	50
SVOC TAL	2-5

5.3 EPA REGION 9 LABORATORY PROPOSED APPROACH FOR SVOC ANALYSIS OF HYDROCARBON CONTAMINATED SOIL AND WATER SAMPLES

In order to achieve relatively rapid turn-around (7 calendar days) for SVOC analysis in soils and water samples that are expected to be heavily contaminated with hydrocarbon fuels and oils it will be imperative to avoid excessive instrument down-time. Instrument bake out and re-calibration will be minimized by limiting the amount of hydrocarbon contamination introduced into the gas chromatography/mass spectroscopy (GC/MS) analytical system. This will be accomplished primarily through dilution of sample extracts, but sample extract cleanup using simple solid phase partition will be investigated prior to the onset of the project.

The laboratory will follow EPA Region 9 laboratory SOP 315 for SVOC analysis by EPA Method 8270 with project-specific modifications. The following is a summary of the procedures.

Soil samples will be extracted following EPA Method 3545 using the Dionex ASE system. A sample mass of 10 grams (wet weight) will be extracted. Final volume of the soil extract will be 20 ml. Prior to SVOC analysis, TPH-Dx results will be obtained from the EPA Region 9 FASP laboratory. The SVOC extract for samples with TPH-Dx results of less than 10,000 mg/kg will be analyzed with no further dilution. Wet weight quantitation limits for these samples will be 20 mg/kg for individual PAH compounds and dibenzofuran, 50 mg/kg for pentachlorophenol. Samples with TPH-Dx results above 10,000 mg/kg will be further diluted after extraction and prior to analysis to bring extract TPH concentration down to a level similar to a 10,000 mg/kg sample (e.g., the SVOC extract for a sample with TPH-Dx results of 45,000 mg/kg would receive a 5X dilution prior to analysis). Compound quantitation limits would be raised proportional to the dilution.

Water samples will be extracted following EPA Method 3520C, continuous liquid-liquid extraction. An sample volume of 100 ml will be extracted. Final volume of the water extract will be 10 ml. Prior to SVOC analysis, TPH-Dx results will be obtained from the EPA Region 9 FASP laboratory. The SVOC extract for samples with TPH-Dx results of less than 1,000 mg/L will be analyzed with no further dilution. Quantitation limits for these samples will be 1 mg/L for individual PAH compounds and dibenzofuran, 2.5 mg/L for PCP. Samples with TPH-Dx results above 1,000 mg/L will be further diluted after extraction and prior to analysis to bring extract TPH concentration down to a level similar to a 1,000 mg/L sample (e.g., the SVOC extract for a sample with TPH-Dx results of 4,500 mg/L would receive a 5X dilution prior to analysis). Compound quantitation limits would be raised proportional to the dilution.

QA/QC criteria would be modified slightly to reduce the need for down-time, recalibration, and reanalysis of samples. A three-point initial calibration will be utilized, with a linearity criteria of 25 percent relative standard difference (RSD). Continuing calibration check criteria for PAHs, PCP, and dibenzofuran will be 35 percent RSD. Continuing calibration check for carbozole will not be controlled. Carbazole will be reported as a semi-quantitative result. Only acenaphthene, pyrene, and pentachlorophenol will be monitored in matrix spike and matrix spike duplicate samples. Only 2,4,6-tribromophenol, 2-fluorobiphenyl, and terphenyl-d14 will be monitored as surrogates. Recovery criteria and corrective action will be as in the SOP.

5.4 ADDENDUM TO EPA REGION 9 LAB SOP 385 FOR TPH-DX

The following changes will be made by the EPA Region 9 FASP laboratory to the Region 9 SOP for TPH-Dx analyses. The SOP is included in Appendix C.

1. The calibration standard will be an n-alkane mixture comprised of the even carbon numbers from C_8 to C_{40} (Florida total recoverable petroleum hydrocarbon standard).

2. A single response factor will be calculated by dividing the sum of the area responses for all components in the standard by the sum of the concentrations of all n-alkanes injected. The reported concentrations for the individual carbon number ranges will be calculated by multiplying each individual carbon number ranges percent contribution to the total area by the total concentration.

3. The calibration will be a three point calibration covering the linear range of the instrument with an allowable RSD of $\leq$25 percent.

4. The continuing calibration percent difference limit will be 35.

5. The surrogate recovery limits will be 50 to 150 percent. In addition to using n-hexacosane as a surrogate, a surrogate representative of the C_{40} range will be used.

6. A quantitation limit standard (QLS) will not be analyzed.

7. The MS/MSD/LCS spike will be diesel with recovery limits of 50 to 150 percent and RPD of 50 percent.

8. An LCS and a method blank will be analyzed daily. The MS/MSD samples will be field generated.

9. Ten grams of a soil sample, mixed with sodium sulfate, will be extracted with 10 mL of hexane in a 40-mL volatile organic analysis (VOA) vial by agitating with a Vortex mixer for 2 minutes. This will give a quantitation limit (QL) of 100 mg/kg.

10. Twenty mL of a water sample will be extracted with 4 mL of hexane in a 40-mL VOA vial by agitating with a Vortex mixer for 2 minutes. This will give a QL of 40 mg/L.

11. A 15-m, 0.53-mm internal diameter, 0.15 µm column of 100 percent polydimethylsiloxane (β = 880) will be used.

12. Reporting format:

	Conc. (mg/kg)	% of Total
Total		
C12		
C14		
C16, etc. through…		
C40		
Fuel type		

Each carbon number range will encompass approximately ± one carbon number.
Note that C_{26} will not be reported as n-hexacosane is used as a surrogate.

5.5 DEVIATIONS FROM CLP SOW OLM03.1 FOR PCB ANALYSIS

The following changes will be made by the EPA Region 9 laboratory to the CLP Scope of Work for polychlorinated biphenyl (PCB) analyses.

1. Ten grams of a solid sample mixed with sodium sulfate will be extracted by pressurized fluid extraction (PFE) (EPA Region 9 SOP 290) with hexane. Extracts will be cleaned up by procedures based on EPA SW-846 Method 3665A (sulfuric acid/permanganate cleanup) and SW-846 Method 3620B (Florisil cleanup). The estimated quantitation limit (EQL) will be 250 µg/kg.

2. Twenty mL aqueous sample will be extracted with 10 mL of hexane in a 40-mL VOA vial by agitation with a Vortex mixer. Extracts will be cleaned up by procedures based on EPA SW-846 Method 3665A (sulfuric acid/permanganate cleanup) and SW-846 Method 3620B (Florisil cleanup). EQL will be 65 µg/L.

3. Initially, a three-point calibration for Aroclor 1242, 1254, and 1260 will be done. A single-point calibration will be done for the other Aroclors. The RSD will be 25 percent. After the Aroclor(s) in the samples are identified, a three-point calibration will be done for those Aroclors and a single-point calibration will be done for the other Aroclors.

4. A performance evaluation mixture (PEM) will not be analyzed.

5. No calibration will be done for the single-response analytes or for toxaphene.

6. A calibration verification standard will be analyzed after every 10 samples. The standards analyzed will rotate through the Aroclor(s) found in the samples. The QC limit will be 35 percent difference.

7. MS/MSD samples will not be analyzed with each extraction batch; they will be field generated.

8. An LCS and a method blank will be extracted and analyzed with each extraction batch.

5.6 ADDENDUM TO EPA REGION 9 LABORATORY SOP 315 FOR SEMIVOLATILE ANALYSES

The following changes will be made by the EPA Region 9 laboratory to its SOP for semivolatile analyses for soil and groundwater samples collected using SCAPS and submitted for rapid turn-around analysis. The SOP is included in Appendix C.

1. The calibration will be a three-point calibration for the project specific analytes using the average response factor with an allowable %RSD of ≤25.

2. The continuing calibration %D QC limit will be 35.

3. No DDT breakdown evaluation will be done.

4. A quantitation limit standard (QLS) will not be analyzed.

5. QC results for carbazole will not be controlled; results for carbazole will be semi-quantitative.

6. Only acenaphthene, pyrene, and pentachlorophenol will be monitored in the matrix spike/matrix spike duplicate and blank spike samples.

7. A blank spike and a method blank will be analyzed with each batch of samples extracted.

8. The MS/MSD samples will be field generated.

9. Only 2,4,6-tribromophenol, 2-fluorobiphenyl, and terphenyl-d14 will be monitored as surrogates.

10. Ten grams (wet weight) of a soil sample, mixed with sodium sulfate, will be extracted following EPA Method 3545 using the Dionex ASE extractor. Final volume of extract will be 20 mL. This will give a QL of 20 mg/kg for individual PAH compounds and dibenzofuran and 50 mg/kg for pentachlorophenol.

11. Water samples will be extracted following EPA Method 3520C, continuous liquid-liquid extraction. A sample volume of 100 mL will be extracted with a final volume of 10 mL. This will give a QL of 1 mg/L for individual PAH compounds and dibenzofuran and 3 mg/L for pentachlorophenol.

12. Prior to SVOC analysis, TPH-Dx results will be obtained from the EPA Region 9 FASP mobile laboratory. SVOC extracts for samples with TPH-Dx results of less than 10,000 mg/kg or 1,000 mg/L will be analyzed with no further dilution. Samples with TPH-Dx results greater than this will be diluted after extraction and before analysis to bring the extract TPH concentration down about 10,000 mg/kg or 1,000 mg/L. Compound quantitation limits would be raised in proportion to the dilution.

Table 5-1
Mobile Field Laboratory Method Summary—Soil

Analyte	Method Reference	Preservation Method	Extraction Method	Cleanup Method	Instrument Detector
TPH by Fluorescence	ASTM D 6187 (SCAPS SOP)	NA	NA	NA	Fluorescence detector (photodiode array with optical multichannel analyzer)
TRPH	SCAPS SOP	Refrigeration	Sonication in freon	Silica gel	Buck 404 Infrared Spectrophotometer
TPH-Dx	Region 9 SOP - Modified	Refrigeration	Vortex in hexane	NA	GC/FID

Table 5-2
Mobile Field Laboratory Method Summary—Groundwater

Analyte	Method Reference	Preservation Method	Extraction Method	Cleanup Method	Instrument Detector
TPH-Dx	Region 9 SOP - Modified	Refrigeration	Vortex in hexane	NA	GC/FID

Table 5-3
Fixed Laboratory Method Summary—Soil

Analyte	Method Reference	Preservation Method	Extraction Method	Cleanup Method	Instrument/ Detector
TPH-Dx	Region 9 SOP	4 ± 2 °C	PFE	NA	GC/FID
PAHs and PCP (rapid and standard TAT)	Region 9 SOP - Modified	4 ± 2 °C	PFE	GPC	GC/MS
Dioxin/Furans	SW-846 1613B	4 ± 2 °C	Soxhlet	See analytical request form (Appendix D)	High-resolution GC/MS
PCBs	CLP SOW - Modified	4 ± 2 °C	PFE	Sulfuric acid/ permanganate, florisil	GC/ECD
Metals (As, Cu, Cr, Zn)	CLP RAS	None	Acid digestion	None	ICP/GFAA
Metals Speciation	Kerr Lab SOP	None	NA	NA	NA
TOC	Walkley-Black	4 ± 2 °C	Dean-Stark	None	Titration with Fe SO_4
Grain Size	ASTM D 422	None	NA	NA	NA
Density	ASTM D2937	None	NA	NA	NA
Porosity	API RP40	None	Toluene	None	NA
Permeability (Hydraulic Conductivity)	Kerr Lab SOP	None	NA	NA	Constant-temperature incubator with diaphragm metering pump, fraction collector, and Omega PX800 pressure transducers
NAPL Saturation (Oil and Grease)	PTS SOP	4 ± 2 °C	PTS SOP	NA	Analytical balance
Cation Exchange Capacity	SW-846 9081	None	Sodium acetate	NA	Atomic absorption

Notes:
GFAA - graphite furnace atomic absorption
ICP - inductively coupled plasma - atomic emission spectroscopy
NA - not applicable
PFE - pressurized fluid extraction
TAT - turn-around time

Table 5-4
Fixed Laboratory Method Summary—NAPL

Analyte	Method Reference	Preservation Method	Extraction Method	Cleanup Method	Instrument/ Detector
TPH-Dx	SW-846 8015 Modified	Refrigeration	NA	NA	GC/FID
SVOC TAL with TICs	SW-846 8270C	Refrigeration	NA	NA	GC/MS
Viscosity	Kerr Lab SOP (ASTM D1296)	Refrigeration	NA	NA	Brookfield Rotational Voscometer Model DV-1
Density	Kerr Lab SOP	Refrigeration	NA	NA	Balance
Solubility	Kerr Lab SOP	Refrigeration	Methylene chloride	NA	GC/MS
Wettability	Kerr Lab SOP	Refrigeration	NA	NA	Visual inspection
Boiling point distribution/distillation (ASTM D86)	Kerr Lab SOP	Refrigeration	NA	NA	Thermometer
Oil-Water Interfacial Tension	Kerr Lab SOP (ASTM D971)	Refrigeration	NA	NA	Fisher Surface Tensiometer Model 20

Notes:
GC/FID - gas chromatograph/flame ionization detector
GC/MS - gas chromatograph/mass spectrophotometer
GPC - gel permeation chromatography
NA - not applicable

Table 5-5
Fixed Laboratory Method Summary—Groundwater

Analyte	Method Reference	Preservation Method	Extraction Method	Cleanup Method	Instrument/ Detector
PAHs and PCP (rapid TAT)	SW-846 8270C	4 ± 2 °C	Continuous liquid/liquid	GPC	GC/MS
SVOC TAL (standard TAT)	SW-846 8270C	4 ± 2 °C	Continuous liquid/liquid	GPC	GC/MS
Dioxin/Furans	SW-846 1613B	4 ± 2 °C	Sep funnel	See analytical request form (Appendix D)	High Resolution GC/MS
TOC	EPA 415.1	4 ± 2 °C	NA	NA	Dohrman Total Organic Carbon Analyzer DC-190
Density	Kerr Lab SOP	4 ± 2 °C	NA	NA	Balance
Total and Dissolved Manganese	EPA 200.7	Nitric acid to < pH2, 4 ± 2 °C	Acid digestion	None	ICP-AES
Sulfate, Chloride, Nitrate, Nitrite	EPA 300 series	4 ± 2 °C	None	None	Dionex Ion Chromatograph/ DX120

Notes:

GC/FID - gas chromatograph/flame ionization detector
GC/MS - gas chromatograph/mass spectrophotometer
GPC - gel permeation chromatography
ICP-AES - inductively coupled plasma – atomic emission spectrometry
NA - not applicable
TAT - turn-around time

6.0 INSTRUMENT CALIBRATION AND MAINTENANCE

Analytical instrument calibration and maintenance will be conducted in accordance with the QC requirements identified in each laboratory SOP and QA plan, and the manufacturers' instructions. General requirements are discussed below.

6.1 STANDARD SOLUTIONS

A critical element in the generation of quality data is the purity/quality and traceability of the standard solutions and reagents used in the analytical operations. To ensure the highest purity possible, all primary reference standards and standard solutions will be obtained from a reliable commercial source. The laboratories will maintain a written record of the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and all other pertinent information for all standards, standard solutions, and individual standard preparation logs.

Standard solutions will be validated prior to use. Validation procedures can range from a check for chromatographic purity to verification of the concentration of the standard solution using another standard solution prepared at a different time or obtained from a different source. Stock and working standard solutions will be checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change of concentration. Care will be exercised in the proper storage and handling of standard solutions, and all containers will be labeled as to compound, concentration, solvent, expiration date, and preparation data (initials of preparer/date of preparation). Reagents will be examined for purity by subjecting an aliquot or subsample to the corresponding analytical method as well.

6.2 BALANCES

Analytical balances will be calibrated annually according to manufacturers' instructions and have a calibration check before each use by laboratory personnel. Balance calibration shall be documented in appropriate hard-bound log books with pre-numbered pages.

6.3 REFRIGERATORS

All refrigerators will be monitored for proper temperature by measuring and recording internal temperatures on a daily basis. At a minimum, thermometers used for these measurements will be calibrated annually, according to manufacturers' instructions.

6.4 ATER SUPPLY SYSTEM

The project laboratories will maintain an appropriate water supply system that is capable of furnishing ASTM Type II polished water to the various analytical areas.

6.5 LABORATORY INSTRUMENTS

As stated in SW-846 and applicable laboratory SOPs, calibration of all analytical instrumentation is required to ensure that the analytical system is operating correctly and functioning at the sensitivity required to meet project-specific DQOs. Each instrument will be calibrated with standard solutions appropriate to the instrument and analytical method, in accordance with the methodology specified and at the QC frequency specified in the project laboratory SOPs.

The calibration and maintenance history of the mobile and fixed project laboratory instrumentation is an important aspect of the project's overall QA/QC program. As such, all initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer's instructions and in accordance with applicable EPA protocols to ensure the equipment is functioning within the tolerances established by the manufacturer and the method-specific analytical requirements.

7.0 ANALYTICAL DATA QUALITY INDICATORS

The DQOs for the McCormick and Baxter Superfund site field exploration are designed to ensure that the accuracy and precision of the data will be sufficient that the data will be useful for identifying the source of, evaluating the potential for natural attenuation of, and designing in situ treatment methods for NAPL at the site.

The data quality parameters presented in this section are precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity. Project-specific control limits for these parameters are presented in Appendix B. Required QA/QC sample frequency and calibration requirements are summarized for all laboratory analyses in Tables 4-1 through 4-6.

7.1 PRECISION

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. Precision is expressed in terms of analytical variability. For this project, analytical variability will be measured as the RPD or coefficient of variation between analytical lab duplicates and between the MS and MSD analyses. Monitoring variability will be measured by analysis of blind field duplicate samples.

Precision will be calculated as the RPD as follows:

$$\%RPD_i = \frac{2\left|O_i - D_i\right|}{\left(O_i + D_i\right)} \times 100\%$$

where:

$\%RPD_i$ = Relative percent difference for compound i
O_i = Value of compound i in original sample
D_i = Value of compound i in duplicate sample

The resultant RPD will be compared to acceptance criteria and deviations from specified limits reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions. The RPD will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer.

7.2 ACCURACY

Accuracy is the amount of agreement between a measured value and the true value. It will be measured as the percent recovery of MS/MSD, organic surrogate compounds, and PE samples. Additional potential bias will be quantitated by the analysis of blank samples (e.g., method and rinsate blanks).

Accuracy shall be calculated as percent recovery of analytes as follows:

$$\%R_i = (Y_i \div X_i) \times 100\%$$

where:

$\%R_i$ = percent recovery for compound i

Y_i = measured analyte concentration in sample i (measured - original sample concentration)

X_i = known analyte concentration in sample i

The resultant percent recoveries will be compared to acceptance criteria and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be reviewed during data quality review, and deviations from the specified limits will be noted and the effect on reported data commented upon by the data reviewer.

7.3 REPRESENTATIVENESS

Representativeness is the degree to which sample results represent the system under study. This component is generally considered during the design phase of a program. This program will use the results of all analyses to evaluate the data in terms of its intended use. Site locations for sampling are placed using a biased approach to maximize the likelihood of locating and identifying site contamination, if present. Areas of apparent contamination have been selected for determination of potential impacts from past activities.

7.4 COMPARABILITY

Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), reference materials, and screening values. This goal will be achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. It should be noted that to meet the DQOs for this project, rapid, turn-around analyses are being performed, which result in method modification (see Section 5). These modifications may result in non-comparability between data sets (e.g., TPH-D in soil). Comparability will be evaluated during data quality assurance review (see Section 10).

7.5 COMPLETENESS

Completeness for usable data is defined as the percentage of usable data out of the total amount of data generated. Because the number of samples that will be collected to measure each parameter exceeds that required for the analysis, approximately 100 percent completeness is anticipated. When feasible, the amount of sample collected will be sufficient to reanalyze the sample, should the initial results not meet QC requirements. Less than 100 percent completeness could result if sufficient chemical contamination exists to require sample dilutions, resulting in an increase in the project-required detection/quantitation limits for some parameters. Highly contaminated environments can also be sufficiently heterogeneous to prevent the achievement of specified precision and accuracy criteria. The target goal for completeness shall be 98 percent for all data. Completeness for quality data shall be 95 percent for each individual analytical method. Quality data are data obtained in a sample batch for which all QC criteria were met. Completeness will be calculated as follows:

$$\%C = \frac{A}{I} x100\%$$

where:

$\%C$ = Percent completeness (analytical)
A = Actual number of samples collected/valid analyses obtained
I = Intended number of samples/analyses requested

Non-valid data (i.e., data qualified as “R” rejected) will be identified during the QA review (Section 10.3).

7.6 SENSITIVITY

The sensitivity of the analytical methods (i.e., method detection limits) identified for this project is sufficient to allow comparison of project results to decision criteria. Analytical method reporting limits for all requested analytes are listed in Appendix A.

8.0 PREVENTATIVE MAINTENANCE

Field and laboratory instrumentation will be examined and tested prior to being put into service and will be maintained according to the manufacturer's instructions. Sampling personnel will maintain a supply of typical maintenance replacement items available in the field to help prevent downtime because of equipment malfunctions. Examples of typical equipment maintenance items may include but not be limited to filters, tubing, fittings, sample containers, and calibration standards.

8.1 FIELD INSTRUMENTS

The following equipment or instruments, if utilized, will be serviced before the project is initiated and at regular intervals during the project as required by the manufacturer's instructions:

- pH, conductivity, temperature, Eh meter
- Dissolved oxygen (DO) meter
- Turbidity meter

Manufacturer's instructions will be followed for any additional equipment that is required for the project.

8.2 LABORATORY INSTRUMENTS

All laboratory instruments will be maintained as specified in the project laboratories' QA plans and according to manufacturers' instructions.

9.0 CORRECTIVE ACTIONS

The ultimate responsibility for maintaining quality throughout the field exploration of the McCormick and Baxter Superfund site rests with the USACE Project Manager. The day-to-day responsibility for assuring the quality of field and laboratory data rests with the USACE Project Technical Team Leader, Field Investigation Manager, the Project QA/QC Officer, and the laboratory program administrator.

Any nonconformances with the established QC procedures will be expeditiously identified and controlled. Where procedures are not in compliance with the established protocol, corrective actions will be taken immediately. Subsequent work which depends on the nonconforming activity will not be performed until the identified nonconformance is corrected.

9.1 FIELD CORRECTIVE ACTION

The Field Investigation Manager will review the procedures being implemented in the field for consistency with the established protocols. Sample collection, preservation, labeling, etc., will be checked for completeness. Where procedures are not strictly in compliance with the established protocol, the deviations will be field documented and reported to the project QA/QC Officer. Corrective actions will be defined by the Field Investigation Manager and USACE Project Technical Team Leader and documented as appropriate. Upon implementation of the corrective action, the Field Investigation Manager will provide the Project QA/QC Officer with a written memo documenting field implementation, who will review it and provide a copy to the USACE Project Technical Team Leader. The memo will become part of the field exploration project file.

9.2 LABORATORY CORRECTIVE ACTION

The laboratory QA data reviewer will review the data generated to ensure that all QC samples have been run as specified in the protocol. Recoveries of LCS, surrogates, and MS samples for consistency with method accuracy, and RPD for laboratory duplicate and MSD samples for consistency with method precision, will be evaluated against the control limits listed in Appendix B.

Laboratory personnel will be alerted that corrective actions are necessary if any of the following occur:

- The QC data are outside the warning or acceptance windows established for precision and accuracy. The laboratory project manager will contact the laboratory QA manager to discuss out-of-control limit data sets. If the analyses cannot produce data sets that are within control limits, the USACE Project Technical Team Leader will be notified within 48 hours of any analysis that fails to meet the data quality objectives specified in this QAPP.

- Blanks contain contaminants at concentrations above the levels specified in the laboratory QA plan for any target compound.
- Undesirable trends are detected in matrix spike or LCS recoveries, RPD between MSDs, or surrogates recoveries.
- Unusual changes in detection limits are observed.
- Deficiencies are detected by the laboratory QA manager during internal or external audits, or from the results of performance evaluation samples.

If any nonconformances in analytical methodologies or quality control sample results are identified by the analyst, corrective actions will be implemented immediately. Specific corrective actions are outlined in each method laboratory SOP. Corrective action procedures will be handled initially at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors, check the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. The analyst will immediately notify his/her supervisor of the identified problem and the investigation which is being conducted. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor and laboratory QA manager for further investigation. Once resolved, full documentation of the corrective action procedure will be filed by the laboratory QA manager, and if data are affected, USACE Project Technical Team Leader will be provided a corrective action memo for inclusion into the project file.

Corrective action may include, but will not be limited to the following:

- Reanalyzing suspect samples if holding time criteria permit
- Resampling and analyzing new samples
- Retrieving the archived sample for analysis
- Evaluating and amending sampling and/or analytical procedures (with USACE consultation)
- Accepting data with an acknowledged level of uncertainty (with USACE consultation)

- Recalibrating analytical instruments
- Evaluating and attempting to identify limitations of the data

Data deemed unacceptable following the implementation of the required corrective action measures will not be accepted by the USACE Project Technical Team Leader and follow-up corrective actions will be explored.

9.3 CORRECTIVE ACTIONS FOLLOWING DATA EVALUATION

The Project QA/QC Officer will review the field and laboratory data generated for this project to ensure that all project quality assurance objectives are met. If any nonconformances are found in the field procedures, sample collection procedures, field documentation procedures, laboratory analytical and documentation procedures, and data evaluation and quality review procedures, the impact of those nonconformances on the overall project QA objectives will be assessed. Appropriate actions, including resampling and reanalysis, may be recommended to the USACE Project Manager and the EPA RPM so that the project objectives can be accomplished.

10.0 LABORATORY DATA REDUCTION, DELIVERABLES, QA REVIEW, AND REPORTING

The chemical data reduction and review process for this project will include data generation, reduction, and two levels of QA review. The first level of review will be conducted by the analytical laboratory data reviewer. After receipt of data packages by the USACE, the Project QA/QC Officer, or a designee, will conduct an independent data quality review. The USACE will also prepare a quality control summary report to evaluate and compare data quality objectives of the overall project. Data quality review responsibilities are summarized below.

Task	Project Laboratories	USACE
Laboratory data quality review and data reduction	X	
Independent data quality review		X
Quality Control Summary Report		X

10.1 DATA REDUCTION, REVIEW, AND DELIVERABLES BY PROJECT LABORATORIES

10.1.1 Data Reduction Procedures

Mobile Field Laboratories Data Reduction Procedures

The mobile field laboratories will perform in-house analytical data reduction. Data reduction by the laboratory will be conducted as follows:

- Raw data produced by the analyst will be processed and reviewed for attainment of QC criteria as established in the SOPs for overall reasonableness, and for transcription or calculations errors.

- The analyst will decide whether any sample reanalysis is required and discuss reanalysis with the laboratory project manager as soon as possible.

- Preliminary data will be available within 24 hours of sample receipt.

- Upon acceptance of the preliminary reports by the laboratory project manager, final reports will be generated. Final data reports will be available within 30 working days of the completion of field work.

Fixed Laboratories Data Reduction Procedures

The fixed laboratories will perform in-house analytical data reduction under the direction of the laboratory QA manager. Data reduction will be conducted as follows:

- Raw data produced by the analyst will be processed and reviewed for attainment of QC criteria as outlined in this SAP and/or established EPA methods, for overall reasonableness, and for transcription or calculations errors.

- After entry into the Laboratory Information Management System (LIMS), a computerized report will be generated and sent to the laboratory QA data reviewer.

- Preliminary slough soil data will be available within 2 weeks after samples are submitted for dioxin analyses, and 2 to 3 weeks after samples are submitted for SVOC analyses.

- The laboratory QA data reviewer will decide whether any sample reanalysis is required and the laboratory project manager will discuss reanalysis with the Project QA/QC Officer as soon as possible. If corrective actions have been taken and data still does not meet project quality assurance requirements, the USACE Project Technical Team Leader will be notified by the Project QA/QC Officer within 48 hours of the corrective action.

- Upon acceptance of the preliminary reports by the laboratory QA data reviewer, final reports will be generated. Final data reports will be available within 30 calendar days of sample submittal.

Laboratory data reduction procedures will be those specified in EPA SW-846 (3rd edition) and those described in the laboratory SOPs. The data reduction steps will be documented, signed, and dated by the analyst.

Laboratory Qualifiers

Laboratory qualifiers as described and defined in the laboratory QA plans will include:

- Concentration below required reporting limit
- Estimated concentration due to poor spike recovery
- Concentrations of the chemical also found in laboratory blank
- Other sample-specific qualifiers necessary to describe QC conditions

Laboratory Recordkeeping

The laboratories will maintain detailed procedures for laboratory recordkeeping in order to support the validity of all analytical work. Each data report package submitted to USACE will contain the laboratories' written certification that the requested analytical method was run and that all QA/QC checks were performed. The laboratory program administrator will provide USACE with QC reports of their external audits if appropriate, which will become part of the central project files.

10.1.2 In-House Laboratory Data Review by Mobile and Fixed Laboratories

The laboratory review will be conducted by a laboratory QA reviewer who has the initial responsibility for the correctness and completeness of the data. The laboratory QA reviewer will evaluate the quality of the work based on an established set of laboratory guidelines and this QAPP to ensure that:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- Appropriate procedures have been followed
- Analytical results are correct and complete
- QC sample results are within appropriate QC limits
- Laboratory blanks are within appropriate QC limits
- Special sample preparation and analytical requirements have been met
- Documentation is complete (all anomalies in the preparation and analysis have been documented; holding times are documented)

10.1.3 Data Deliverables

To ensure that project data are sufficient to meet both qualitative and quantitative DQOs, laboratory data deliverables permitting a data quality assessment are required. Laboratory deliverables will be sufficient to permit a limited quality review of precision, accuracy, and adherence to the method SOP.

Information provided will be sufficient to review the data with respect to:

- Holding times and conditions
- Detection/quantitation limits
- Initial and continuing calibration
- Surrogate recoveries
- Laboratory duplicates and MS/MSDs
- Precision and accuracy
- Representativeness
- Comparability
- Completeness

SCAPS Deliverables

For SCAPS LIF results for soil TPH and geotechnical data, daily deliverables will include the following:

- Summary table with push ID, total push depth, push type, push start time, brief comments

- Field data form (either text or scanned) with push information such as push ID, total push depth, and comments regarding stratigraphy or LIF response (anomalous intervals, peak wavelength, possible contaminant identification)

- Graphical file of scanned field result for each push; this form contains graphical representation of cone resistance, sleeve friction, soil classification, fluorescence intensity, and wavelength at peak

- Graphical file of map view site showing push locations and cultural features (roads, buildings, etc.)

- Graphical file of orthographic view with stratigraphy

- Graphical file of orthographic view with LIF counts

- Graphical file of 3-D view with iso-surface of LIF counts

- GMS support files that are needed to operate GMS. These include .bor, .map, .mat, .img, .mat, and .sol files. These files could be zipped together and packaged when transferred.

- SCAPS raw data files generated by the SCAPS during each push

The graphical files could be placed on the webserver and the GMS files would go on the ftp site.

For TRPH results reported by the SCAPS team, the laboratory will prepare and retain full analytical and associated QC documentation. The laboratory will report the data as an analytical batch of 20 samples or less, along with associated QC reporting data. The analytical results will be submitted to USACE via hard copy and electronic files. The formats for electronic deliverables are described in Section 8 of the Work Plan.

The laboratory will provide the following hard copy information regarding TRPH sample results for each analytical data package submitted for the McCormick and Baxter Superfund site field exploration project:

- Date received, extracted, and analyzed
- Sample ID
- Matrix type
- Identification and concentration
- Dilution values for analyses
- Reporting limits for undetected analytes
- Initial and continuing calibration results
- LCS recoveries
- Laboratory duplicate RPD
- Method blank results

FASP and Fixed Laboratories Deliverables

To ensure that project chemical data are sufficient to meet both qualitative and quantitative DQOs, laboratory data deliverables that will permit a data quality assessment are required.

The laboratory will prepare and retain full analytical and associated QC documentation. The laboratory will report the data as an analytical batch of 20 samples or less, along with associated QC reporting data. The final analytical data will be provided in a limited deliverable data format as described below. After receipt of the final data reports, the USACE Project Technical Team Leader will decide which data packages (SDGs) will be requested for submittal of complete Contract Laboratory Progam (CLP)-type deliverable data format (10 percent of all results), and contact the appropriate laboratories.

The analytical results will be submitted to USACE via hard copy and electronic files. The formats for electronic deliverables are described in the Work Plan.

The laboratory will provide the following hard copy information for each analytical data package submitted for the McCormick and Baxter Superfund site field exploration project:

- The cover sheet will list the samples included in the report, provide narrative comments describing problems encountered in analysis, and identify any analyses not meeting quality control criteria, including holding times.
- Chain of custody forms and cooler receipt forms will be provided.
- Tabulated results will be provided with inorganic and organic compounds identified and quantified, and reporting limits for all analytes shown. All analytes will be reported for each sample as a detected concentration or as not detected above the specific limits of quantitation, which must be stated. All soil samples will be reported on a dry-weight basis with percent moisture also reported. The laboratory will also report dilution factors, date of extraction, extraction batch number, date of analysis, and analytical batch number for each sample. Tentatively identified compounds will not be reported.
- Analytical results will be provided for QC sample spikes, laboratory duplicates, initial and continuing calibration verifications of standards and laboratory blanks, standard procedural blanks, LCS, surrogates, laboratory reference materials, ICP interference check samples, and detection limit check samples.
- Raw data system printouts (or legible photocopies) will be provided that identify date of reported analysis, analyst, parameters analyzed, calibration curves, calibration verifications, method blanks, any reported sample dilutions, cleanup logs, laboratory duplicates, spikes, control samples, sample spiking levels, preparation/extraction logs, run logs, and chromatograms.
- Chromatograms will be labeled with analyte peaks, internal standards, and surrogate standards where applicable.
- Mass calibration and mass and spectral tuning will be reported for gas chromatography/mass spectroscopy (GC/MS) analyses.

The narrative accompanying the data package will include the identification of samples not meeting total QC criteria as specified in this SAP, and/or the laboratory QA plans, and cautions regarding non-quantitative use or unusability due to out-of-control QC results. Data reduction and QC review steps will be documented, signed, and dated by an authorized representative.

Deliverables for Full Validation

After receipt of the final data reports, the USACE Project Technical Team Leader will decide which data packages or sample delivery groups (SDGs) will be submitted with complete CLP-like deliverables (10 percent of all results). These data packages will be generated upon request. Deliverables will include all of the information detailed in the preceding, plus the data quality review and quality control summary report described in Sections 10.2 and 10.3, respectively.

10.2 INDEPENDENT DATA QUALITY REVIEW

The second level of review will be performed by USACE (or designee) and will include a review of laboratory performance criteria and sample-specific criteria. One hundred percent of mobile field laboratory and fixed laboratories' data will be reviewed. Additionally, USACE will determine whether the DQOs have been met, and will calculate the data completeness for the project.

The data quality review will be performed according to EPA Region 9 *RCRA Corrective Action Program Data Review Guidance Manual* (U.S. EPA 1996). An example data quality review report is included as Appendix F.

Additionally, Old Mormon Slough sidewall soil dioxin/furans and PAH and PCP data, and all groundwater dioxin/furans data, will receive full validation according to EPA functional guidelines (U.S. EPA 1994b, 1994c). Full data validation will also be performed on 10 percent of all data. SDGs will be selected by the USACE after receipt of all final data packages and following the initial data quality review. Full validation will be performed by DMD, Inc. of Vashon Island, Washington.

Data quality review is a process to determine if the data meet project-specific DQOs. The data quality review will include verification of the following:

- Compliance with the QAPP
- Proper sample collection and handling procedures
- Holding times
- Field QC results
- Instrument calibration verification
- Laboratory blank analysis
- Detection limits
- Laboratory duplicates
- MS/MSD percent recoveries and relative percent differences
- Surrogate percent recoveries
- Data completeness and format

- Data qualifiers assigned by the laboratories

Qualifiers will be added to data during the review as necessary. Qualifiers applied to the data as a result of the independent review will be limited to:

U	The analyte was analyzed for but was not detected above the reporting limit.
J	The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample.
UJ	The analyte was not detected above the sample reporting limit. However, the reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Results of the QA review and/or validation will be included in a data quality review report which will provide a basis for meaningful interpretation of the data quality and evaluate the need for corrective actions and/or comprehensive data validation. This report will be used to generate the quality control summary report.

10.3 QUALITY CONTROL SUMMARY REPORT

After the field work and the final analyses have been completed and reviewed, a final quality control summary report will be prepared by the Project QA/QC Officer. The report will summarize the QA and audit information, indicating any corrective actions taken and the overall results of SAP compliance. The Project QA/QC Officer, in coordination with the laboratory’s QA manager or qualified designee, will prepare the final summary which will be included in the central project file and incorporated as part of the final field exploration report.

The quality control summary report will provide a basis for meaningful interpretation of the data quality and evaluate the need for corrective actions and/or additional comprehensive data validation. Analytical data will be qualified by reviewing the laboratory’s standard analytical QC such as laboratory blanks, duplicates, LCS, PE samples, MS/MSD, and surrogate recoveries. The data quality review will involve checking the laboratory data package against criteria established in the QAPP. The data will be considered valid if they meet the criteria established in this QAPP for the following elements:

- Accuracy

- Precision
- Completeness
- Representativeness
- Comparability

The quality control summary report will include evaluation of sampling documentation/representativeness, technical holding time, instrument calibration and tuning, field and laboratory blank sample analyses, method QC sample results, field duplicates, compound identification and quantitation, elevated reporting limits, and a summary of qualified data.

11.0 PERFORMANCE AND SYSTEM AUDITS

Performance and systems audits may be conducted to determine whether:

- The QA program has been documented in accordance with specified requirements
- The documented program has been implemented
- Any nonconformances were identified and corrective action or identified deficiencies was implemented

The Project QA/QC Officer will be responsible for initiating audits, selecting the audit team, and overseeing audit implementation.

The USACE Project Technical Team Leader is responsible for supervising and checking that samples are collected and handled in accordance with this management plan and that documentation of work is adequate and complete. The USACE Project Technical Team Leader is responsible for overseeing that the project performance satisfies the QA objectives as set forth in this QAPP.

Reports and technical correspondence will be peer reviewed by qualified individuals before being finalized.

11.1 PERFORMANCE AUDITS

Performance audits are utilized to quantitatively evaluate the accuracy of measurement data through the use of PE samples and blind check samples. Independent commercial PE samples will be submitted to the laboratories with the field samples for TRPH, TPH-Dx, and PAH and PCP analysis. The PE samples will be used to monitor the quality of the laboratory data instead of submitting split samples to a fixed analytical laboratory. This allows correction of problems in the field before analytical activities are complete.

All PE samples will be introduced blind to the analytical process. The performance audit will be conducted by the USACE Project Technical Team Leader.

11.2 SYSTEMS AUDITS

Systems audits of the field and laboratory procedures may be conducted during this project. Field audits will be conducted if the USACE Project Technical Team Leader or Project QA/QC

Officer identifies the need. Systems audits of the laboratory will be performed annually and when the laboratory QA manager identifies the need, which may be throughout this project. An additional systems audit may be requested by the Project QA/QC Officer, if warranted. The frequency of on-site audits will depend on the type of interaction and communications the Project QA/QC Officer experiences with the laboratory staff, and on the frequency of observations of noncompliance with QC criteria and SOPs.

The laboratory QA manager will regularly conduct the following internal audits:

- Technical audit including reviews of calibration and equipment monitoring records, laboratory logbooks, maintenance records, and instrument control charts
- Data quality audit reviews, including all aspects of data collection, reporting and review
- Management system audits verifying that management and supervisory staff are effectively implementing and monitoring all QC activities necessary to support the laboratory QA program

External laboratory reviews are conducted by various government agencies and clients, such as the EPA CLP, U.S. Naval Energy and Environmental Support Activity, and the USACE Hazardous Waste Remedial Actions Program.

11.3 AUDIT PROCEDURE

This section provides requirements and guidance for performing internal and external audits to verify compliance with the elements of the SAP.

The USACE Project Manager, the USACE Project Technical Team Leader and, if appropriate, other audited entity (e.g., Field Investigation Manager, laboratory supervisor) will be notified by the Project QA/QC Officer of an audit a reasonable time before the audit is performed. This notification will be in writing and will include information such as the general scope and schedule of the audit, and the name of the audit team leader.

A pre-audit conference will be conducted at the audit site with the appropriate manager or designated representative (e.g., Field Investigation Manager, laboratory supervisor). The purpose of the conference will be to confirm the audit scope, present the audit plan, discuss the audit sequence, and plan for the post-audit conference.

The audit is then implemented by the audit team. Selected elements of the SAP will be audited to the depth necessary to evaluate the effectiveness of implementation. Checklists prepared by the audit team and approved by the Project QA/QC Officer will be sufficiently detailed to document major audit components. Conditions requiring immediate corrective action will be reported immediately to the Project QA/QC Officer.

At the conclusion of the audit, a post-audit conference will be held with the Field Investigation Manager or laboratory supervisor, or their designated representative, to present audit findings and clarify any misunderstandings. A list of audit findings will be concisely stated by the audit team leader. The findings will be acknowledged by signature of the USACE Project Technical Team Leader or designated representative upon completion of the post-audit conferences.

An audit report will be prepared by the audit team leader and signed by the Project QA/QC Officer. The report will include the following:

- Description of the audit scope
- Identification of the audit team
- Persons contacted during pre-audit, audit, and post-audit activities
- A summary of audit results, including an evaluation statement regarding the effectiveness of the SAP elements which were audited
- Details of findings and program deficiencies
- Recommendations for corrective actions to the Project QA/QC Officer, with a copy to the USACE Project Manager, the USACE Project Technical Team Leader, and others as appropriate

11.4 AUDIT RESPONSE

The USACE Project Manager or designated representative will respond to the audit report within 7 days of receipt. The response will clearly state the corrective action for each finding, including action to prevent recurrence and the date the corrective action will be completed.

11.5 FOLLOW-UP ACTION

Follow-up action will be performed by the Project QA/QC Officer or designated representative to:

- Evaluate the adequacy of the USACE Project Manager's response

- Evaluate that corrective action is identified and scheduled for each finding

- Confirm that corrective action is accomplished as scheduled

Follow-up action may be accomplished through written communications, re-audit, or other appropriate means. When all corrective actions have been verified, a memo will be sent to the USACE Project Manager signifying the satisfactory close-out of the audit.

11.6 AUDIT RECORDS

Original records generated for all audits will be retained in the central project files. Records will include audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits which support audit findings and corrective actions as appropriate.

12.0 REFERENCES

American Society for Testing and Materials (ASTM). 1984. Rhodazine D Method for Analysis of Dissolved Oxygen. *ASTM Power Plant Manual*, First Edition. p. 169.

U.S. Army Corps of Engineers (USACE). 1994. *Requirements for the Preparation of Sampling and Analysis Plans.* EM 200-1-3. September 1994.

U.S. Environmental Protection Agency (EPA). 1996. *Region 9 RCRA Corrective Action Program Data Review Guidance Manual.* http://www.epa.gov/region09/ga/r9-gadocs.html. Accessed May 1999.

———. 1994a. *Test Methods for Evaluation of Solid Waste, Vol. II: Field Manual Physical/Chemical Methods (SW-846).* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., 3rd Edition and Revised Update II. September 1994.

———. 1994b. *Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analyses.* EPA Data Review Work Group. February 1, 1994.

———. 1994c. *Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analyses.* EPA Data Review Work Group. July 1, 1994.

———. 1979. *Methods for the Chemical Analysis of Water and Wastes.* EPA600/4-79-020.

APPENDIX A

Laboratory Reporting Limits

Table A-1
SCAPS and Region 9 FASP Laboratory Reporting Limits—Soil

Analyte	Method Reference	Laboratory	Reporting Limit
TPH by Fluorescence	ASTM D 6187 (SCAPS SOP)	SCAPS	Determined in the field
TRPH	SCAPS SOP	SCAPS	100 mg/kg
TPH-Dx	Region 9 SOP - Modified	Region 9 FASP	100 mg/kg

Table A-2
Region 9 FASP Laboratory Reporting Limits—Groundwater

Analyte	Method Reference	Laboratory	Reporting Limit
TPH-Dx	Region 9 SOP - Modified	Region 9 FASP	40 mg/L

Table A-3
Region 9 and Other Fixed Laboratory Reporting Limits—Soil

Analyte	Method Reference	Laboratory	Reporting Limit
TPH-Dx	Region 9 SOP	Region 9	100 mg/kg
PAHs and PCP (rapid TAT)	Region 9 SOP - Modified	Region 9	PAHs and dibenzofuran: 20 mg/kg wet PCP: 50 mg/kg wet
PAHs and PCP - standard TAT	Region 9 SOP	Region 9	PAHs and dibenzofuran: 0.33 mg/kg PCP: 0.83 mg/kg
<u>Dioxin/Furans</u>	EPA 1613B	Pacific Analytical Laboratories	
2,3,7,8-TCDD			1 ng/kg
Total-TCDD			1 ng/kg
2,3,7,8-TCDF			1 ng/kg
Total TCDF			1 ng/kg
1,2,3,7,8-PeCDD			5 ng/kg
Total PeCDD			5 ng/kg
1,2,3,7,8-PeCDF			5 ng/kg
2,3,4,7,8-PeCDF			5 ng/kg
Total PeCDF			5 ng/kg
1,2,3,4,7,8-HxCDD			5 ng/kg
1,2,3,6,7,8-HxCDD			5 ng/kg
1,2,3,7,8,9-HxCDD			5 ng/kg
Total HxCDD			5 ng/kg
1,2,3,4,7,8-HxCDF			5 ng/kg
1,2,3,6,7,8-HxCDF			5 ng/kg
1,2,3,7,8,9-HxCDF			5 ng/kg
2,3,4,6,7,8-HxCDF			5 ng/kg
Total HxCDF			5 ng/kg
1,2,3,4,6,7,8-HpCDD			5 ng/kg
Total HpCDD			5 ng/kg
1,2,3,4,6,7,8-HpCDF			5 ng/kg
1,2,3,4,7,8,9-HpCDF			5 ng/kg
Total HpCDF			5 ng/kg
OCDD			10 ng/kg
OCDF			10 ng/kg
PCBs	CLP SOW - Modified	Region 9	0.25 mg/kg
<u>Metals</u>	CLP RAS	Region 9	
Arsenic			1 mg/kg
Chromium			1 mg/kg
Copper			2.5 mg/kg
Zinc			2.0 mg/kg
Metals Speciation	Kerr Lab SOP	Kerr Lab	NA
TOC	Walkley-Black	PTS	100 mg/kg
Grain Size	ASTM D 422	PTS	NA
Density	ASTM D2937	PTS	0.01 g/cc
Porosity	API RP 40	PTS	NA

Table A-3 (Continued)
Region 9 and Other Fixed Laboratory Reporting Limits—Soil

Analyte	Method Reference	Laboratory	Reporting Limit
Permeability (Hydraulic Conductivity)	Kerr Lab SOP	Kerr Lab	NA
NAPL Saturation (Oil and grease)	PTS SOP	PTS	0.01 g
Cation Exchange Capacity	SW-846 9081	PTS	0.01 meq/g (measured as sodium)

Notes:
mg/kg - milligrams per kilogram
ng/kg - nanograms per kilogram
TAT - turn-around time

Table A-4
Region 9 and Other Fixed Laboratory Reporting Limits—NAPL

Analyte	Method Reference	Laboratory	Reporting Limits
TPH-Dx	SW-846 8015 Modified	Columbia Analytical Services and Kerr Lab	See Section 5.2
SVOC TAL with TICs	SW-846 8270C	Columbia Analytical Services and Kerr Lab	See Section 5.2
Viscosity	Kerr Lab SOP (ASTM D1296)	Kerr Lab	NA
Density	Kerr Lab SOP	Kerr Lab	NA
Solubility	Kerr Lab SOP	Kerr Lab	NA
Wettability	Kerr Lab SOP	Kerr Lab	NA
Boiling Point Distribution/ Distillation (ASTM D86)	Kerr Lab SOP	Kerr Lab	NA
Oil-Water Interfacial Tension	Kerr Lab SOP (ASTM D971)	Kerr Lab	NA

Table A-5
Region 9 and Other Fixed Laboratory Reporting Limits—Groundwater

Analyte	Method Reference	Laboratory	Reporting Limits
PAHs and PCP - rapid TAT	SW-846 8270C	Region 9	
PAHs and dibenzofuran			1 mg/L
PCP			2.5 mg/L
SVOC TAL - standard TAT	SW-846 8270C	Region 9	
Semivolatiles			
Phenol			10 µg/L
bis-(2-Chloroethyl)ether			10 µg/L
2-Chlorophenol			10 µg/L
1,3-Dichlorobenzene			10 µg/L
1,4-Dichlorobenzene			10 µg/L
1,2-Dichlorobenzene			10 µg/L
2-Methylphenol			10 µg/L
2,2′-oxybis (1-Chloropropane)			10 µg/L
4-Methylphenol			10 µg/L
N-Nitroso-di-n-propylamine			10 µg/L
Hexachloroethane			10 µg/L
Nitrobenzene			10 µg/L
Isophorone			10 µg/L
2-Nitrophenol			10 µg/L
2,4-Dimethylphenol			10 µg/L
bis(2-Chloroethoxy)methane			10 µg/L
2,4-Dichlorophenol			10 µg/L
1,2,4-Trichlorobenzene			10 µg/L
Naphthalene			10 µg/L
4-Chloroaniline			10 µg/L
Hexachlorobutadiene			10 µg/L
4-Chloro-3-methylphenol			10 µg/L
2-Methylnaphthalene			10 µg/L
Hexachlorocyclopentadiene			10 µg/L
2,4,6-Trichlorophenol			10 µg/L
2,4,5-Trichlorophenol			25 µg/L
2-Chloronaphthalene			10 µg/L
2-Nitroaniline			25 µg/L
Dimethylphthalate			10 µg/L
Acenaphthylene			10 µg/L
2,6-Dinitrotoluene			10 µg/L
3-Nitroaniline			25 µg/L
Acenaphthene			10 µg/L
2,4-Dinitrophenol			25 µg/L
4-Nitrophenol			25 µg/L
Dibenzofuran			10 µg/L
2,4-Dinitrotoluene			10 µg/L
Diethylphthalate			10 µg/L
4-Chlorophenyl-phenylether			10 µg/L
Fluorene			10 µg/L

Table A-5 (Continued)
Region 9 and Other Fixed Laboratory Reporting Limits—Groundwater

Analyte	Method Reference	Laboratory	Reporting Limits
4-Nitroaniline			25 µg/L
4,6-Dinitro-2-methylphenol			25 µg/L
N-Nitroso-diphenylamine			10 µg/L
4-Bromophenyl-phenylether			10 µg/L
Hexachlorobenzene			10 µg/L
Pentachlorophenol			25 µg/L
Phenanthrene			10 µg/L
Anthracene			10 µg/L
Carbazole			10 µg/L
Di-n-butylphthalate			10 µg/L
Fluoranthene			10 µg/L
Pyrene			10 µg/L
Butylbenzylphthalate			10 µg/L
3,3'-Dichlorobenzidine			10 µg/L
Benzo(a)anthracene			10 µg/L
Chrysene			10 µg/L
bis(2-Ethylhexyl)phthalate			10 µg/L
Di-n-octylphthalate			10 µg/L
Benzo(b)fluoranthene			10 µg/L
Benzo(k)fluoranthene			10 µg/L
Benzo(a)pyrene			10 µg/L
Indeno(1,2,3-cd)-pyrene			10 µg/L
Dibenzo(a,h)-anthracene			10 µg/L
Benzo(g,h,i)perylene			10 µg/L
<u>Dioxin/Furans</u>	SW-846 1613B	Pacific Analytical Laboratories	
2,3,7,8-TCDD			10 pg/L
Total-TCDD			10 pg/L
2,3,7,8-TCDF			10 pg/L
Total TCDF			10 pg/L
1,2,3,7,8-PeCDD			50 pg/L
Total PeCDD			50 pg/L
1,2,3,7,8-PeCDF			50 pg/L
2,3,4,7,8-PeCDF			50 pg/L
Total PeCDF			50 pg/L
1,2,3,4,7,8-HxCDD			50 pg/L
1,2,3,6,7,8-HxCDD			50 pg/L
1,2,3,7,8,9-HxCDD			50 pg/L
Total HxCDD			50 pg/L
1,2,3,4,7,8-HxCDF			50 pg/L
1,2,3,6,7,8-HxCDF			50 pg/L
1,2,3,7,8,9-HxCDF			50 pg/L
2,3,4,6,7,8-HxCDF			50 pg/L
Total HxCDF			50 pg/L
1,2,3,4,6,7,8-HpCDD			50 pg/L

Table A-5 (Continued)
Region 9 and Other Fixed Laboratory Reporting Limits—Groundwater

Analyte	Method Reference	Laboratory	Reporting Limits
Total HpCDD			50 pg/L
1,2,3,4,6,7,8-HpCDF			50 pg/L
1,2,3,4,7,8,9-HpCDF			50 pg/L
Total HpCDF			50 pg/L
OCDD			100 pg/L
OCDF			100 pg/L
TOC	EPA 415.1	Region 9	2,000 µg/L
Density	Kerr Lab SOP	Kerr Lab	NA
Total and dissolved manganese	EPA 200.7	Region 9	200 µg/L
Anions	EPA 300 series	Region 9	
Sulfate			1,000 µg/L
Chloride			1,000 µg/L
Nitrate as N			100 µg/L
Nitrite as N			100 µg/L

Notes:
µg/L - micrograms per liter
mg/L - milligrams per liter
pg/L - picograms per liter
TAT - turn-around time

APPENDIX B

Laboratory Control Limits

Table B-1
SCAPS and Region 9 FASP Laboratory Control Limits—Soil

Analyte	Method Reference	Laboratory	Control Limits
TPH by Fluorescence	ASTM D 6187 (SCAPS SOP)	SCAPS	NA
TRPH	SCAPS SOP	SCAPS	RPD: 50
TPH-Dx	Region 9 SOP - Modified	Region 9 FASP	Surrogate, MS %R: 50-150% Duplicate RPD: 50

Table B-2
Region 9 FASP Laboratory Control Limits—Groundwater

Analyte	Method Reference	Laboratory	Control Limits
TPH-Dx	Region 9 SOP - Modified	Region 9 FASP	Surrogate, MS %R: 50-150% Duplicate RPD: 50

Table B-3
Region 9 and Other Fixed Laboratory Control Limits—Soil

Analyte	Method Reference	Laboratory	Control Limits
TPH-Dx	Region 9 SOP	Region 9	Surrogate, MS %R: 50-150% Duplicate RPD: 50
PAHs and PCP	Region 9 SOP	Region 9	See Table B-4
Dioxin/Furans	SW-846 1613B	Region 9	See analytical request form (Appendix D)
PCBs	CLP SOW - Modified	Region 9	Surrogate, MS %R: 75-125% Duplicate RPD: 35
Metals	CLP RAS	Region 9	Surrogate, MS %R: 75-125% Duplicate RPD: 35
Metals Speciation	Kerr Lab SOP	Kerr Lab	NA
TOC	Walkley-Black	PTS	MS %R: ±5% Duplicate RPD: 20
Grain Size	ASTM D 422	PTS	RPD: 20
Density	ASTM D2937	PTS	RPD: 20
Porosity	API RP40	PTS	± 0.02% pore volume
Permeability (Hydraulic Conductivity)	Kerr Lab SOP	Kerr Lab	NA
NAPL Saturation (Oil and Grease)	PTS SOP	PTS	Calibration Std: 80-120%
Cation Exchange Capacity	SW-846 9081	PTS	MS and LCS: 80-120% RPD: 20

Table B-4
Region 9 Laboratory Control Limits—Soil
Semivolatile SOP 315 (1)

Surrogate % Recovery		
Compound	**Soil %R**	**Notes**
2-Fluorophenol	25 - 121	
Phenol-d5	24 - 113	
Nitrobenzene-d5	23 - 120	
2-Fluorobiphenyl	30 - 115	
2,4,6-Tribromophenol	19 - 122	
Terphenyl-d14	18 - 137	
2-Chlorophenol-d4	20 - 130	(advisory)
1,2-Dichlorobenzene-d4	20 - 130	(advisory)
Matrix Spike and Matrix Spike Duplicate		
Compound	**%Recovery**	**RPD**
Phenol	26 - 100	35
2-Chlorophenol	25 - 102	50
1,4-Dichlorobenzene	28 - 104	27
n-Nitroso-di-n-propylamine	41 - 126	38
1,2,4-Trichlorobenzene	38 - 107	23
4-Chloro-3-methylphenol	26 - 103	33
Acenaphthene	31 - 137	19
2,4-Dinitrotoluene	28 - 100	50
4-Nitrophenol	11 - 114	47
Pentachlorophenol	17 - 109	107
Pyrene	35 - 142	36

(1) Rapid TAT analyses will have limited surrogates and matrix spikes (see Section 5.0)

Table B-5
Region 9 and Other Fixed Laboratory Control Limits—NAPL

Analyte	Method Reference	Laboratory	Control Limits
TPH-Dx	SW-846 8015 Modified	Kerr Lab	LCS: 80-120%; CV:10
SVOC TAL with TICs	SW-846 8270C	Kerr Lab	LCS: 80-120%; CV:10
TPH-Dx	SW-846 8015 Modified	Columbia Analytical Services	Surrogate: 50-150% RPD : 40
SVOC TAL with TICs	SW-846 8270	Columbia Analytical Services	Surrogate: 50-150% RPD : 40
Viscosity	Kerr Lab SOP (ASTM D1296)	Kerr Lab	CV: 01
Density	Kerr Lab SOP	Kerr Lab	CV: 0.01
Solubility	Kerr Lab SOP	Kerr Lab	CV: 10%
Wettability	Kerr Lab SOP	Kerr Lab	NA
Boiling point distribution/ distillation (ASTM D86)	Kerr Lab SOP	Kerr Lab	RPD: 10
Oil-Water Interfacial Tension	Kerr Lab SOP (ASTM D971)	Kerr Lab	NA

Note:
CV - coefficient of variation

Table B-6
Region 9 and Other Fixed Laboratory Control Limits—Groundwater

Analyte	Method Reference	Laboratory	Control Limits
PAHs and PCP (rapid TAT) and SVOC TAL (standard TAT)	SW-846 8270C	Region 9	See Table B-7
Dioxin/Furans	SW-846 1613B	Region 9	See analytical request form (Appendix D)
TOC	EPA 415.1	Region 9	Spikes %R: 75-125% Duplicate RPD: 20
Density	Kerr Lab SOP	Kerr Lab	CV: <0.1
Total and Dissolved Manganese	EPA 200.7	Region 9	Spikes %R: 70-130% Duplicate RPD: 20
Sulfate, Chloride, Nitrate, Nitrite	EPA 300 series	Region 9	Spikes %R: 75-125% Duplicate RPD: 20

Note:
TAT - turn-around time

Table B-7
Region 9 Laboratory Control Limits—Groundwater
Semivolatile SOP 315 (1)

Surrogate % Recovery		
Compound	**Water %R**	**Notes**
2-Fluorophenol	21 - 110	
Phenol-d5	10 - 110	
Nitrobenzene-d5	35 - 114	
2-Fluorobiphenyl	43 - 116	
2,4,6-Tribromophenol	10 - 123	
Terphenyl-d14	33 - 141	
2-Chlorophenol-d4	33 - 110	
1,2-Dichlorobenzene-d4	16 - 110	
Matrix Spike and Matrix Spike Duplicate		
Compound	**%Recovery**	**RPD**
Phenol	12 - 110	21
2-Chlorophenol	27 - 123	16
1,4-Dichlorobenzene	36 - 100	22
n-Nitroso-di-n-propylamine	41 - 116	38
1,2,4-Trichlorobenzene	39 - 100	28
4-Chloro-3-methylphenol	23 - 100	42
Acenaphthene	46 -118	31
2,4-Dinitrotoluene	24 - 100	38
4-Nitrophenol	10 - 100	50
Pentachlorophenol	9 - 103	50
Pyrene	26 - 127	31

(1) Rapid TAT analyses will have limited surrogates and matrix spikes (see Section 5.6)

Note:
TAT - turn-around time

APPENDIX C

Standard Operating Procedures

CONTENTS

CONTENTS (Continued)

FINAL

INVESTIGATION-DERIVED WASTE PLAN FOR NAPL FIELD EXPLORATION

McCormick and Baxter Superfund Site
Stockton, California

June 16, 1999

Prepared for

EPA
REGION 9

U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California 94105-3901

Prepared by

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98134

URS Greiner Woodward Clyde
2401 4th Avenue, Suite 808
Seattle, Washington 98121-1459
53F0072166

CONTENTS

ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
FASP	Field Analytical Support Program
FR	Federal Register
FSP	field sampling plan
IDW	investigation-derived waste
IR TRPH	infrared total recoverable petroleum hydrocarbons
LIF	laser-induced fluorescence
NAPL	nonaqueous-phase liquid
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
SCAPS	Site Characterization and Analysis Penetrometer System
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbon
TRPH	total recoverable petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

Investigation-derived waste (IDW) generated during the McCormick and Baxter Superfund site field exploration will be stored, handled, and disposed of according to this IDW Plan. This IDW Plan describes expected types of IDW (Section 2), storage and handling procedures (Section 3), evaluation of IDW to determine disposal methods and disposal options (Section 4), and a disposal plan (Section 5).

The field exploration is being conducted by the U.S. Army Corps of Engineers (USACE) Seattle, Sacramento, and Albuquerque Districts, in support of the U.S. Environmental Protection Agency (EPA) Region 9. As a federal Superfund site, federal, state, or local permits are not required for actions conducted pursuant to Comprehensive Environmental Response, Liability, and Compensation Act (CERCLA) Section 104 [40 CFR 300.400(e)]. Therefore, this IDW Plan follows guidelines set forth and regulations referenced in EPA Document 540-G-91-009, Management of Investigation-Derived Wastes During Site Inspections (U.S. EPA 1991) and the EPA Guide to Management of Investigation-Derived Wastes (U.S. EPA 1992).

IDW removed from the site will comply with the off-site disposal rule (FR Vol. 58, No. 182, September 22, 1993). The USACE will determine the manner in which waste will be characterized and will coordinate with the EPA for authority to dispose of IDW at an approved facility. The Region 9 CERCLA Off-Site Rule coordinators are Ms. Kandice Bellamy (415-744-2091) and Ms. Eve Levin (415-744-2110).

2.0 EXPECTED TYPES OF INVESTIGATION-DERIVED WASTE

The sampling methods and field laboratory analyses employed during this field exploration will generate IDW that may include soil, decontamination water, well development water, well purge water, personal protective equipment (PPE), disposable sampling equipment, and field laboratory waste. Based on the site history and on results of past investigations, potential contaminants in IDW may include semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), petroleum hydrocarbons, and metals.

2.1 SOIL

Twenty soil and groundwater samples will be collected using a Site Characterization and Analyses Penetrometer system (SCAPS) probe, equipped with a laser-induced fluorescence (LIF) sensor, and a drilling rig (sonic drilling method) equipped with a 2-inch-diameter split-spoon and Shelby tube sampler. The LIF sensor will be calibrated in the field to detect the presence of hydrocarbons in the bulk soil matrix throughout the vadose zone, capillary fringe, and saturated zone. Soil cuttings generated from the borings will be placed in 55-gallon drums in preparation for disposal. All drums will be immediately labeled with boring identification, depth, sampler identification, date, time, and suspected contaminant level.

Minimal soil cuttings are anticipated to be generated using the SCAPS soil sampling system or if microwells are installed. Approximately 0.2 cubic foot of soil cuttings may be generated for every 1 foot drilled with the drilling rig (except for continuous sampling) for the contingency borings. For the purposes of this IDW Plan, it is assumed that 10 SCAPS borings will meet refusal at 50 feet bgs, and that a drill rig will be required to complete the subsurface borings. This will result in a total of 500 feet (10 borings X 50 feet) of drilling and approximately 100 cubic feet (assuming a 6-inch diameter borehole) (approximately 3.5 cubic yards or 750 gallons) of cuttings. Continuous cores will be collected from the two 250-foot-deep soil borings, so cuttings that will require disposal will not be generated.

2.2 DEVELOPMENT AND PURGE WATER

Groundwater samples will be collected using the groundwater-sampling device on the SCAPS rig. A maximum of 20 groundwater samples will be collected from 40 SCAPS boring locations, using tubing and a peristaltic pump for wells that are less than 28 feet bgs. Deeper wells will be sampled using either a stainless steel or disposable polyethylene bailer. SCAPS wells are generally sampled within 24 hours of completion, and are not purged if sampled during this timeframe. If the wells are not sampled within 24 hours, they are purged prior to sampling and a small volume (approximately 0.5 gallon) of purge water is generated for each well.

ddition to the SCAPS borings, 15 existing monitoring wells will be sampled as part of the site investigation. Prior to sampling, the wells will be purged using low-flow rates that will limit the volume of purge water generated. One round of groundwater samples will be collected. It is estimated that, collectively, approximately 100 gallons of purge water may be generated during groundwater sampling activities.

The two 250-foot deep soil borings will be completed as monitoring wells; however, groundwater sampling is not part of this investigation. After construction of the monitoring wells, the wells will be developed by bailing, pumping, and surging. Approximately 200 gallons of water may be generated from each of the wells. Therefore, approximately 400 gallons of development water may be generated.

The groundwater wells to be installed during the site investigation are expected to contain evidence of contamination, such as stained soils, odors, or nonaqueous-phase liquid (NAPL). Because of existing knowledge of the site and the likely locations of the monitoring wells to be installed, it is anticipated that the development water generated from the monitoring wells may contain contaminants. However, if the wells are suspected to contain a significant level of NAPL, they will not be developed.

2.3 DECONTAMINATION WATER

Sampling equipment including stainless steel spoons and bowls, down-hole drilling equipment and non-disposable PPE will be decontaminated between each use and/or at the end of each workday. Decontamination activities will be conducted in the pole wash area, which includes a structure that will be used to contain the decontamination water. Decontamination water will be obtained from a source on site. The decontamination water will contain a minimum of phosphate-free detergent (Liquinox), and trace quantities of soil. Approximately 200 gallons may be generated during the SCAPS investigation, 100 gallons during soil boring and monitoring well drilling and installation, and 100 gallons during groundwater sampling. Therefore, approximately 400 gallons of decontamination water may be generated during this investigation.

Small quantities of solvent waste will be generated when nondisposable sampling equipment that has contacted NAPL is given a final rinse with isopropyl alcohol and hexane. This solvent waste will be containerized in buckets and evaporated on site.

2.4 PERSONAL PROTECTIVE EQUIPMENT AND DISPOSABLE SAMPLING EQUIPMENT

Disposable PPE used during sample collection and handling may include Tyvek and/or paper coveralls, and latex, solvex, or cloth gloves. Each member of the field crew may use two Tyvek or paper coveralls, several pairs of latex gloves, and one or two pairs of solvex gloves per day. Occasionally, cloth outer gloves may be used in order to grip sample containers more effectively.

Disposable sampling equipment may include polyethylene bailers, plastic bags, and/or glass sample jars that will not be submitted to a laboratory. These items may contain small quantities of soil or groundwater and will be decontaminated prior to disposal.

The disposable polyethylene tubing used for sampling with the SCAPS sampling device may become contaminated with NAPL, which cannot be easily cleaned from the tubing. The potentially NAPL-contaminated tubing will be segregated from the tubing that has not contacted NAPL. The potentially NAPL-contaminated tubing will be stored in a 55-gallon drum and stored at the site for future disposal. All non-contaminated solid waste will be disposed of in a dumpster on site that will be taken to the local municipal landfill.

2.5 FIELD LABORATORY WASTE

During the site investigation, the USACE SCAPS and EPA Field Analytical Support Program (FASP) on-site field laboratories will analyze soil and groundwater for infrared total recoverable petroleum hydrocarbons (IR TRPH) and total petroleum hydrocarbon (TPH) fingerprinting. Waste material from the field lab will consist of the following:

- Excess sample material (soil and water)
- Used glass sample containers
- Solvent waste
- Miscellaneous lab waste (paper towels, gloves, etc.)

3.0 HANDLING AND STORAGE OF INVESTIGATION-DERIVED WASTE

This section describes handling and storage procedures for the IDW described in Section 2. As advocated in the EPA guidelines (U.S. EPA 1991), the procedures are designed to minimize the amount of waste generated and for managing containerized waste in a protective manner until disposal options are evaluated.

3.1 SOIL

During the investigation, approximately 100 cubic feet (3.5 cubic yards or 750 gallons) of drill cuttings are anticipated to be produced. The typical handling/storage options for drill cuttings are:

- Spreading all cuttings at each individual drilling site
- Containerizing all cuttings in 55-gallon drums
- Field-screening the cuttings with a photoionization detector to evaluate which cuttings can be spread and which should be containerized

It is anticipated that all of the cuttings will be stored in drums. Sampling personnel will record the approximate volume of cuttings and the boring location number for each batch of cuttings retained in the drums. Each drum containing cuttings will be clearly labeled with the following information:

- Quantity of materials contained
- Date the drum was filled
- Project number
- Name and phone number of the USACE project manager and person in charge of containerizing soil
- Sample location numbers and depth from which the soil originated
- Suspected contaminant level

The information will be entered on weatherproof labels affixed to the side of the drum. Label information along with copies of field documentation related to the drum contents will be kept in the project file. In addition to the weatherproof label, a code for tracking applicable field information will be painted with oil-based paint on the side and lid of each drum.

The drums will be stored on site in the lined and fenced drum storage area. Prior to storage, the outside of the drums will be cleaned and dried. The drums will remain in this location until laboratory analysis is complete and IDW disposal options are evaluated, as described in Section 4.

3.2 DEVELOPMENT AND PURGE WATER

Development and purge water generated during monitoring well installation and groundwater sampling will be stored in 55-gallon drums placed in the on-site drum storage area. The drums will be labeled with information similar to that used for the drums containing soil (Section 3.1 above). At the completion of the site investigation, the contents of the drums will be tested for TPH and SVOCs to evaluate disposal alternatives.

3.3 DECONTAMINATION WATER

Down-hole drilling equipment will be steam-cleaned in the pole wash area between each soil boring to remove excess soil from the SCAPS rig equipment and drilling rods from the drill rig and to avoid cross contamination between borings. In addition, sampling equipment, such as split spoons, stainless steel spoons and bowls, implements used to handle sample cores, and a submersible pump, will also be cleaned in the pole wash area between uses.

Hand-held sampling equipment and PPE will also be washed and rinsed. Detailed description of decontamination procedures is included in Section 3.8 of the Field Sampling Plan.

Approximately 400 gallons of decontamination solution are estimated to be generated during the site investigation. Water will either be evaporated or placed in 55-gallon drums with well purge water. Decontamination solvents will be minimized, collected in tubs, and allowed to evaporate.

3.4 PERSONAL PROTECTIVE EQUIPMENT AND DISPOSABLE SAMPLING EQUIPMENT

Personal protective equipment will be decontaminated as described in Section 3.3 and double-bagged after use or at the end of each workday. The disposal bags will be tied shut and disposed of in the manner determined by the EPA, in accordance with the Off-Site Disposal Rule (FR Vol.

58, No. 182, September 22, 1993). A dumpster will be rented to dispose of PPE and other non-contaminated solid waste for the duration of the field investigation.

The fluid pumped through the disposable polyethylene tubing used with the SCAPS rig will be screened in the field for NAPL. If NAPL has contacted the tubing, the tubing will be stored in a 55-gallon drum for future disposal. If NAPL has not contacted the tubing, it will be cleaned in the same manner as other sampling equipment and disposed of with the PPE.

3.5 FIELD LABORATORY WASTE

Waste material from the field laboratory used during the site investigation will be handled as follows:

- Excess soil sample material and wastewater will be placed in separate 55-gallon drums in preparation for disposal.
- Used sample containers will be disposed of with PPE. This waste is usually non-regulated; however, if regulated, it will be properly transported, treated, and disposed of by a licensed disposal facility.
- All solvent waste or other potentially contaminated laboratory waste will be lab-packed in preparation for disposal. The USACE will coordinate the appropriate disposal of the lab-packs in accordance with the CERLCA Off-Site Disposal Rule and with EPA Region 9 coordinators Ms. Kandice Bellamy and Ms. Eve Levin.
- If other field laboratory wastes (paper towels, gloves, etc.) are considered hazardous, the waste will be stored in 55-gallon drums in preparation for future disposal. If the waste is non-hazardous, it will be double-bagged and disposed of by the laboratory in a garbage container.

4.0 EVALUATION TO DETERMINE PROPER DISPOSAL

Containerized soil, decontamination water, well development water, and well purge water will be evaluated for proper disposal methods. The first step in evaluating IDW includes characterizing the waste to determine the types and concentrations of contaminants that it contains. Based on the results of characterization, appropriate treatment and/or disposal options may then be selected.

4.1 SOIL

During the site investigation, the drill cuttings generated will be containerized in 55-gallon drums. If laboratory analyses indicate that the drill cuttings are a Resource Conservation and Recovery Act (RCRA) hazardous waste, the soil is expected to be held on site and addressed during implementation of the final remedy, in accordance with EPA guidance.

4.2 WATER

Development, purge and decontamination water generated during monitoring well installation and groundwater sampling is estimated to total a maximum of 900 gallons, and will be stored in 55-gallon drums. At the completion of the site investigation, the contents of the drums will be tested for TPH and SVOCs to evaluate disposal alternatives.

4.3 DISPOSABLE EQUIPMENT

Proper disposal of containerized polyethylene tubing potentially contaminated with NAPL during the SCAPS groundwater sampling will be performed by a licensed waste disposal contractor.

4.4 FIELD LABORATORY WASTE

As discussed in Section 3.5, excess soil sample material from the borings will be placed in 55-gallon drums and excess water samples will also be stored in 55-gallon drums in preparation for future disposal. Glass sample containers will be crushed, tested and properly disposed of. Solvent waste will be lab-packed and disposed of in accordance with the CERCLA Off-Site Disposal Rule.

5.0 DISPOSAL OVERSIGHT

Off-site disposal, if performed, will comply with the Off-Site Disposal Rule. The USACE will coordinate with the EPA CERCLA Off-Site Rule coordinators for authority to dispose of IDW at an approved facility. Off-site disposal of hazardous IDW will require contracting an appropriate waste disposal company.

6.0 REFERENCES

Federal Register, Volume 58, Number 182. 1993. CERLCA Off-Site Disposal Rule. September 1993.

U.S. Environmental Protection Agency (U.S. EPA). 1991. *Management of Investigation-Derived Wastes During Site Inspections.* EPA Document 540-G-91-009. Office of Emergency and Remedial Response Directive 9345.3-02. May 1991.

———. 1992. *Guide to Management of Investigation-Derived Wastes.* Office of Emergency and Remedial Response Directive. 9345.3-03FS.

FINAL

SITE SAFETY AND HEALTH PLAN FOR NAPL FIELD EXPLORATION

McCormick and Baxter Superfund Site
Stockton, California

June 16, 1999

Prepared for

EPA
REGION 9

U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, California 94105-3901

Prepared by

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98134

URS Greiner Woodward Clyde
2401 4th Avenue, Suite 808
Seattle, Washington 98121-1459
53F0072166

TULSA DISTRICT
SITE CHARACTERIZATION AND ANALYSIS PENETROMETER SYSTEM (SCAPS)

SITE SAFETY AND HEALTH PLAN

APRIL 1999

US ARMY CORPS OF ENGINEERS
TULSA DISTRICT

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TABLES AND FORMS

1.0 OVERVIEW AND PLAN APPROVAL

This Site Safety and Health Plan (SSHP) establishes procedures and work practices to protect Tulsa District Corps of Engineers (COE) employees and authorized on-site visitors from potential safety and health hazards during investigative activities. This SSHP will be supplemented as necessary with a site specific SSHP addressing procedures, requirements and safety and health hazards unique to each particular SCAPS project and location.

This SSHP along with the site specific SSHP have been prepared in accordance with Occupational Safety and Health Administration regulations outlined in 29 CFR 1910.120 along with US Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1.

All site personnel, subcontractors and visitors are required to be familiar with the requirements contained within the SSHP and comply with SSHP requirements prior to site entry. Supervisors and site safety and health personnel are to ensure that project personnel understand and follow the requirements set forth within this plan.

The SSHP and all site activities will be in compliance with the following regulations and guidelines:

United States Department of Labor, OSHA Standards
- 29 CFR 1910 (General Industry)
- 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response)
- 29 CFR 1910.1200 (Hazard Communication)
- 29 CFR 1910.146 (Confined Space)
- 29 CFR 1926 (Construction Standards)

USACE Safety and Health Requirements Manual, EM 385-1-1, latest revision
NIOSH/OSHA/USCG/EPA, Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities, October 1985.
American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices, latest revision
NIOSH, Pocket Guide to Chemical Hazards, June 1994

This SSHP for Tulsa District SCAPS operations, has been prepared and approved by the following:

GREG SNIDER DATE:
PROJECT INDUSTRIAL HYGIENIST

SITE SAFETY AND HEALTH ACKNOWLEDGMENT FORM

I have read, understand and agree to follow the guidelines described in this Site Safety and Health Plan

SIGNATURE	ORGANIZATION	DATE

2.0 SITE LOCATION AND HISTORY

2.1 Site History

Site specific locations and site histories for this project can be found in the main project workplan.

3.0 PROJECT SCOPE OF WORK

Detailed descriptions of project work tasks are described in the main project workplan. Anticipated work can be broken down into tasks listed below and were the basis for the development of generic SSHP requirements.

- Mobilization and Site Setup
- SCAPS Operations
- Groundwater monitoring well installation

- LIF Operations
- Soil Sampling
- Groundwater Sampling
- Decontamination
- IDM Management
- Site Restoration and Demobilization

4.0 SAFETY AND HEALTH PERSONNEL RESPONSIBILITIES

The following personnel are responsible for site safety and health during project activities and ensuring compliance with the requirements and procedures contained within this SSHP.

Tulsa District Safety Officer	Bob Vandegriff	office	(918) 669-7360
Project Industrial Hygienist	Greg Snider	office	(918) 832-4122
		mobile	(918) 629-1927
Site Safety and Health Officer/ SCAPS Field Manager	Steve Brewer	office	(918) 832-4122
		mobile	(918) 625-6463
Sampling Team Leader	Eddie Mattioda	office	(918) 669-7445
	Chris Kennedy	office	(918) 669-7072
	Frank Roepke	office	(918) 669-7444
		mobile	(918) 629-8702
SCAPS Rig Operator	Jeff Lacquement	office	(918) 832-4122
		mobile	(918) 625-6463

4.1 Safety Officer

- Overall responsibility for safety and health on COE projects.
- Oversight and approval of safety and health plan requirements.
- Direction of air monitoring and PPE requirements.
- Implementation of medical surveillance and training program.
- Ensure project is performed in accordance with SSHP, OSHA and EM 385-1-1 requirements.

4.2 Project Industrial Hygienist

- Development and preparation of SSHP.
- Direct field implementation of SSHP.
- Approve PPE upgrade and downgrades as outlined in SSHP.
- Perform and direct air monitoring as outlined in SSHP.

- Oversee implementation of site specific training as outlined in SSHP.
- Coordinate with SSHO on implementation of SSHP.
- Ensure project is performed in accordance with SSHP, OSHA and EM 385-1-1 requirements.

4.3 Site Safety and Health Officer (SSHO) / SCAPS Field Manager

- Direct safety and health activities on-site.
- Direct on-site implementation of SSHP.
- Coordinate with project industrial hygienist on implementation of SSHP.
- Perform on-site air monitoring and maintain documentation of air monitoring results.
- Establish and enforce site zonation requirements.
- Suspend field activities if action levels are exceeded or site conditions change.
- Implement SSHP on-site training requirements.
- Ensure project is performed in accordance with SSHP, OSHA, activity hazard analysis and EM 385-1-1 requirements.

4.4 SCAPS Rig Operator

- Inspect all SCAPS and associated equipment daily and ensure equipment is in a safe operating condition.
- Perform necessary maintenance and make repairs to ensure equipment operates as designed in a safe manner.
- Ensure equipment is operated in accordance with SSHP, OSHA, activity hazard analysis and EM 385-1-1 requirements.
- Suspend unsafe SCAPS operations and report unsafe conditions to SSHO.

4.5 Sampling Team Leader

- Inspect all sampling and associated equipment daily and ensure equipment is in a safe operating condition.
- Perform necessary maintenance and make repairs to ensure equipment operates as designed and in a safe manner.
- Ensure equipment is operated in accordance with SSHP, OSHA, activity hazard analysis and EM 385-1-1 requirements.
- Suspend unsafe sampling activities and report unsafe conditions to the SSHO.

5.0 PROJECT HAZARD ANALYSIS

Site specific chemical contaminants of concern will be included in the site specific SSHP.

5.1 Chemical Hazard Evaluation

A variety of chemical hazards potentially exist at SCAPS investigation sites with primary routes of exposure through inhalation, ingestion, contact and absorption. Exposure potentials will be reduced by employee experience and safe work practices along with adherence to the procedures and requirements set forth in this SSHP. Contaminants of concern consist of volatile organics, semi volatile organics, pesticides, herbicides, petroleum hydrocarbons and heavy metals. The potential for overexposure will be minimal due to the non-confined nature of the work site. The potential for exposure will be reduced through good work practices, engineering controls, decontamination, and proper use of personal protective equipment. Exposure potentials will be evaluated daily in relation to air monitoring data, work activities being performed and field analytical data. Exposure values for potential site contaminants are summarized below.

CONTAMINANT EXPOSURE LEVELS / EXPOSURE ROUTES

CONTAMINANTS	**ACGIH TLV**	**OSHA PEL**	**EXPOSURE**
DDT	1 mg/m3 (A3)	1 mg/m3, skin	Ih, Ig, Cn, Ab
Chlordane	0.5 mg/m3, skin (A3)	0.5 mg/m3, skin	Ih, Ig, Cn, Ab
Heptachlor	0.05 mg/m3, skin (A3)	0.5 mg/m3, skin	Ih, Ig, Cn, Ab
Dieldrin	0.25 mg/m3, skin	0.25 mg/m3, skin	Ih, Ig, Cn, Ab
Diazinon	0.1 mg/m3, skin	n/a	Ih, Ig, Cn, Ab
Malathion	10 mg/m3, skin	15 mg/m3, skin	Ih, Ig, Cn, Ab
Diethyl phthalate	5 mg/m3	n/a	Ih, Ig, Cn
Di(2-ethylhexyl)phthalate	5 mg/m3 (A3)	n/a	Ih, Ig, Cn
Phenol	5 ppm	5 ppm, skin	Ih, Ih, Cn, Ab
Parathion	0.1 mg/m3, skin	0.1 mg/m3, skin	Ih, Ig, Cn, Ab
Styrene	20 ppm	100 ppm	Ih, Ig, Cn
2,4-D	10 mg/m3	10 mg/m3	Ih, Ig, Cn
Dioxin	n/a	n/a	Ih, Ig, Cn, Ab
PCBs	n/a	n/a	Ih, Ig, Cn, Ab
Arsenic	0.01 mg/m3	0.01 mg/m3	Ih, Ig, Cn
Barium	0.5 mg/m3	0.5 mg/m3	Ih, Ig, Cn
Cadmium	0.01 mg/m3 (A2)	0.2 mg/m3	Ih, Ig, Cn
Chromium	0.5 mg/m3	1.0 mg/m3	Ih, Ig, Cn
Lead	0.05 mg/m3	0.05 mg/m3	Ih, Ig, Cn
Mercury	0.01 mg/m3, skin	0.01 mg/m3	Ih, Ig, Cn
Selenium	0.2 mg/m3	0.3 mg/m3	Ih, Ig, Cn
Silver	0.1 mg/m3	0.01 mg/m3	Ih, Ig, Cn
Dichloroethane	100 ppm	100 ppm	Ih, Ig, Cn
Trichloroethene	50 ppm	50 ppm	Ih, Ig, Cn
Methyl ethyl ketone	200 ppm	200 ppm	Ih, Ig, Cn
Benzene	0.5 ppm, skin (A1)	1.0 ppm	Ih, Ig, Cn
Toluene	50 ppm, skin	100 ppm	Ih, Ig, Cn
Xylene	100 ppm	100 ppm	Ih, Ig, Cn
Ethyl benzene	100 ppm	100 ppm	Ih, Ig, Cn
Gasoline	300 ppm	n/a	Ih, Ig, Cn
Diesel	n/a	n/a	Ih, Ig, Cn
Napthalene	10 ppm	10 ppm	Ih, Ig, Cn, Ab
Acetone	500 ppm	500 ppm	Ih, Ig, Cn
Aldrin	0.25 mg/m3	0.25 mg/m3	Ih, Ig, Cn, Ab
Asbestos	0.1 f/cc (A1)	0.1 f/cc (A1)	Ih, Ig, Cn

Carbon Black	3.5 mg/m3	3.5 mg/m3	Ih, Ig, Cn
Carbon tetrachloride	5 ppm, skin (A2)	5 ppm, skin (A2)	Ih, Ig, Cn, Ab
Vinyl chloride	1 ppm (A1)	1 ppm (A1)	Ih, Ig, Cn, Ab
Perchloroethylene	25 ppm	25 ppm	Ih, Ig, Cn
TNT	0.1 mg/m3, skin	0.1 mg/m3, skin	Ih, Ig, Cn, Ab

A1- Confirmed Human Carcinogen Ih-Inhalation Ig- Ingestion
A2- Suspected Human Carcinogen Cn- Skin and/or eye contact Ab- Absorption

5.2 Physical Hazard Evaluation

Physical hazards associated with the project consist of hazards associated with the operation of SCAPS equipment, soil sampling equipment, groundwater sampling equipment and site support equipment. Employee experience in the operation of equipment will reduce exposure potential.

All equipment operations will be in accordance with EM 385-1-1, standard equipment operating procedures and activity hazard analysis.

5.3 Noise Hazard Evaluation

The Tulsa District Hearing Conservation Program requires all personnel working in potential noise hazardous environments to receive an annual audiometric evaluation. Hearing protection procedures will be implemented when noise levels exceed 85 dB(A). Noise level surveys will be performed as necessary throughout the project. Noise level protection requirements are based on previous noise level surveys conducted during similar operations and are summarized below:

HEARING CONSERVATION REQUIREMENTS

ACTIVITY	HEARING PROTECTION
SCAPS Operations	Ear muffs or foam inserts (as necessary)
Soil and Groundwater Sampling Operations	Ear muffs or foam inserts (as necessary)
Decontamination Operations	Ear muffs or foam inserts (as necessary)

5.4 Biological Hazards

Biological hazards associated with this project consist of contact with snakes, vermin, and poisonous plants and insects. Avoidance of poisonous plants and animals will limit exposure. Good work practices, protective clothing and insect repellents will also reduce exposure. **Care must be taken to prevent contamination of environmental samples with insect repellents.**

<u>Snake Bite Procedures</u>

- Seek immediate medical attention.

- Keep victim calm and immobile.
- Hold affected extremity lower than body while waiting for medical assistance.
- **Do not** cut the bite area as it will accelerate the affect of the venom.
- **Do not** apply suction to the wound.
- **Do not** apply a tourniquet since the venom is most dangerous when concentrated in a small area.
- **Do not** allow the victim to run for help or move rapidly as this will accelerate circulation.

Animal Bite Procedures

- Get description of animal if possible.
- Keep victim calm and immobile.
- Seek immediate medical attention.

5.5 Severe Weather

Meteorological conditions will be closely watched when field operations are being performed. The SCAPS operator, field sampling team leader and SSHO will be responsible for determining if weather conditions are creating an unsafe work environment for equipment and personnel. In the event that unsafe conditions are present, work operations will be terminated until it is safe to proceed with field activities. Extreme caution must be taken when severe weather conditions are present during drilling operations and field sampling activities. The SCAPS rig operator, sampling team leader and SSHO will be responsible for terminating field operations when severe weather and lightening conditions are present.

Severe Thunderstorm or Tornado Watch

A severe thunderstorm or tornado watch indicates that conditions in the area are favorable for severe thunderstorms or tornadoes. Site conditions will be closely watched and work activities will be evaluated during thunderstorm and tornado watches. In the event that conditions become unfavorable for fieldwork creating an unsafe environment, fieldwork activities will be terminated.

Severe Thunderstorm or Tornado Warning

A severe thunderstorm or tornado warning indicates that a thunderstorm or tornado has been sighted or is present in the area of the warning. Field activities will be terminated during a severe thunderstorm or tornado warning.

Tornado Procedures

In the event that personnel are in the field during a tornado event the following steps should be taken:

- Evacuate office trailers and vehicles.
- If outdoors, lie flat in a nearby surface depression or ditch.
- Stay away from power poles, electrical equipment and metal objects.
- Seek some form of structural shelter if possible.
- **Do not** try to outrun a tornado.

5.6 Heat Stress

Heat produced by the body and the environmental heat together determine the total heat load in which field personnel are exposed. When work activities are being performed in high temperature environments the potential exists for the following:

- Heat rash
- Heat cramps
- Heat exhaustion
- Heat stroke

Impermeable Work Ensembles (PPE)

An action level of 75^{o} F ambient temperature will be established when site personnel are working in chemical protective clothing. The following work/rest schedule is recommended, with personnel drinking fluids at rest periods. If possible site personnel should remove chemical protective clothing during rest periods and take breaks in shaded areas.

Ambient Temperature (degrees F)	Work Period (minutes)	Rest Period (minutes)
75 - 80	120	15
80 - 85	90	15
85 - 90	60	15
90 - 95	30	15
95 - 100	15	15

The actual work/rest schedule may be adjusted by conducting pulse monitoring before and after the work period. The action level for adjusting the work/rest schedule will be 110 beats per minute (bpm), obtained immediately after the work period in a seated position.

When a person's pulse exceeds 110 bpm, that person is considered to be undergoing heat stress which will require the work period to be reduced in 15-minute intervals while maintaining the same rest period until post work period pulse monitoring is maintained below 110 bpm.

Field activities in which site personnel are required to wear chemical protective clothing at ambient temperatures higher than 95° F will be avoided whenever feasible by scheduling these activities during the work day to avoid peak ambient temperatures (10 a.m. - 2 p.m.).

Heat rash may result from continuous exposure to heat or humid air.

Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. To reduce occurrence of heat cramps increase amount of fluid consumption. Signs and symptoms include:

- muscle spasms
- pain in the hands, feet and abdomen

Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. In the event of heat exhaustion, measures need to be taken to cool the body and replace body electrolytes. Signs and symptoms include:

- pale, cool, moist skin
- heavy sweating
- dizziness
- nausea
- fainting

Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must by taken to cool the body before serious injury and death occurs. Competent medical attention must be obtained. Sign and symptoms include:

- red, hot, usually dry skin
- lack of /or reduced perspiration
- nausea
- dizziness and confusion
- strong, rapid pulse
- unconsciousness / coma

5.7 Cold Stress

Fatal exposure to cold among workers have almost always resulted from accidental exposure involving failure to escape from low air temperatures or from immersion in low temperature water. The single most import aspect of life-threatening hypothermia is the fall in deep core temperature of the body. Employees should be protected from exposure to cold so that the deep core temperature does not fall below 36 °C (96.8 °F).

Evaluation and Control

For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill index of -32 °C. At temperatures of 2 ° C or less wet clothing should be immediately replaced. Special precautions for the protection of hands, face, ears and feet should be taken.

For work activities at or below 4 ° C the following provisions shall be implemented:

- Employees shall wear cold protective clothing appropriate for the level of cold and physical activity.
- If air velocity at the site is increased by wind or artificial ventilation, the cooling effect of the wind shall be reduced by shielding the work area, or by wearing outer wind breaking garments.
- If protective clothing is not available or does not give adequate protection to prevent hypothermia or frostbite, work shall be modified or suspended.
- Employees handling and working around liquids shall take special precaution to avoid soaking of clothing or gloves.

For work activities at or below -12 ° C the following provisions shall be implemented.

- Employees shall be under constant protective observation (buddy system).
- Rest periods must be taken in heated shelters and opportunity for changing into dry clothing must be provided.
- New employees shall not be required to work full-time in cold environments for a few days until they become acclimated to cold weather conditions.
- Work conditions should be structured in a way that minimizes sitting or standing still for long periods of time.
- Workers must be properly trained in safe work practices, first aid treatment, rewarming techniques, clothing requirements, eating and drinking habits and recognition of hypothermia and frostbite conditions.

5.8 Buried/Overhead Utilities

Prior to initiating intrusive field operations, drilling and digging clearance permits will be obtained from appropriate agencies which could potentially have underground utility lines in the vicinity of the work site. Safe clearance distances from overhead electrical utilities will be maintained in accordance with Section 11 (Table 11-3) of EM 385-1-1.

5.9 Confined Space Entry

Confined space entry hazards are not anticipated for the field work tasks associated with this project. In the event that confined space entry is required, the Project Industrial Hygienist will be notified and confined space entry requirements outlined in 29 CFR 1910.146 and the Tulsa District Confined Space Entry Program will be implemented

5.10 Laser Hazards

Hazards associated with the operation of SCAPS laser equipment will minimized by employee experience and training with the SCAPS laser system. Employees engaged in SCAPS laser operations will adhere the standard operating procedures outlined in the SCAPS operations manual. Eye protection will used when the laser system is in operation. Employees engaged in SCAPS laser operations will participate in the Tulsa District Laser Safety Program, which includes annual eye examinations.

6.0 SITE CONTROL AND WORK ZONES

Due to the varied nature of work activities and operations associated with this project and remote nature of the work site, specific zonation requirements will be determined based upon site activities and the nature of surrounding activities. The goal of site zonation is to prevent potential exposure to chemical, physical and equipment hazards at the site by non-authorized personnel. Site zonation will also help make site personnel aware of the hazards which are present at the site. The SSHO will be responsible for determining the degree and extent of site specific requirements for each specific work task based upon work activities being performed and site specific conditions. Only authorized personnel will be allowed to access the site during field investigations. The SSHO will be responsible for controlling access to the site by non-authorized personnel.

In the event that access to the site by non-authorized personnel cannot be controlled and the hazards present at the site require formal site zonation, printed hazard tape will be used to establish an exclusion zone around the specific work location. Entry into the exclusion zone will be controlled by a contamination reduction corridor entry point.

For most SCAPS operations the push room and area directly under the push room will be considered to be the exclusion zone. The control room will be considered the contamination reduction zone. Unauthorized personnel are not permitted in either the control room or push room during intrusive activities. Personnel not meeting requirements outlined in 29 CFR 1910.120 are not permitted in the control room or push room during SCAPS operations.

7.0 PERSONAL PROTECTIVE EQUIPMENT

In order to minimize bodily contact and exposure to hazardous substances potentially present at the site, and reduce exposure to physical and equipment hazards, the following personal protective equipment requirements shall apply for site investigative activities.

Due to the wide degree of activities performed in support of this project, personal protective equipment (PPE) levels will be evaluated daily based on site specific conditions and hazards associated with the specific activity being performed to determine the most effective level of protection. If necessary, changes in levels of protection (upgrades or downgrades) will be made after consultation with the SSHO, project industrial hygienist and safety officer.

Level D

- standard work uniform
- boots, steel toe/shank
- safety glasses
- hard hat (as necessary where overhead hazards are present)
- cotton work gloves (drilling personnel)
- chemical resistant gloves (sampling personnel/decontamination)
- hearing protection (as necessary)

Level D Modified

- tyvek coveralls
- boots, steel toe/shank
- chemical resistant boots or boot covers
- safety glasses
- hard hat (as necessary where overhead hazards are present)
- cotton work gloves (drilling personnel)
- chemical resistant gloves (sampling personnel / decontamination)
- coated tyvek coveralls (as necessary)
- face shield (as necessary)
- hearing protection (as necessary)

Level C

- full face air purifying respirator (OV/HEPA cartridge)
- tyvek coveralls
- boots, steel toe/shank
- chemical resistant boots or boot covers
- hard hat (as necessary)
- chemical resistant gloves
- coated tyvek coveralls (as necessary)
- face shield (as necessary)
- hearing protection (as necessary)

PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

	INITIAL	**UPGRADE**

SITE ACTIVITY	PPE LEVEL	PPE LEVEL
Mobilization and Site Setup	D	D
SCAPS Operations	D	D Mod / C
Soil and Groundwater Sampling Operations	D	D Mod / C
Decontamination Operations	D	D Mod / C
Site Restoration/Demobilization	D	D

7.1 Respiratory Protection

All personnel involved in HTRW investigative activities will have a physician's interpretation as to the employee's ability to wear a respirator. Appropriate respirators and cartridges will be made available to field personnel as necessary determined by site conditions. Respirator use will be in accordance with the requirements outlined in the Tulsa District Respiratory Protection Program. Respirator use is not authorized without notification of the project industrial hygienist and Tulsa District Occupational Safety and Health Office.

8.0 AIR MONITORING

Air monitoring will be conducted in order to determine airborne contamination levels at site work areas. Air monitoring procedures will be used to determine if personal protective equipment levels are appropriate to prevent exposure of site personnel and evaluate chemical hazards present at the site. The following air monitoring procedures will be implemented during intrusive site investigations Air monitoring protocols may be modified based upon site specific conditions as determined by the SSHO and project industrial hygienist.

8.1 Air Monitoring Instrumentation

Air monitoring instrumentation will be calibrated daily and air monitoring data will be documented. Air monitoring data will include instrument used, calibration data, instrument reading, site location, type of reading (breathing zone or work area), and site specific operations being performed. The SSHO and project industrial hygienist will periodically review air monitoring data. Calibration, operation and maintenance of air monitoring instrumentation will adhere to manufacturer guidelines.

8.2 Photoionization Detector (PID) Monitoring

As necessary, a Photoionization detector (PID) will be used as necessary to monitor airborne concentrations of ionizable compounds potentially present at the site. PID monitoring frequency will be determined by the SSHO and project industrial hygienist as determined by site specific conditions and work activity being performed.

PID MONITORING ACTION LEVELS

METER RESPONSE	RESPONSE ACTION
< 10 PID units above background (sustained, breathing zone)	- Continue activities in level D/D Mod PPE
10 PID units above background (sustained, breathing zone)	- Monitor for site specific air contaminants with detector tubes, direct reading instrumentation or integrated air sampling - Notify project industrial hygienist - PPE upgrade as determined by site specific air monitoring results and site specific chemical PELs and TLVs
> 10 PID units above background (sustained, breathing zone)	- Terminate work operations, contact project industrial hygienist for recommended procedures

8.3 Lower Explosive Limit (LEL)/Oxygen (O2) Monitoring

As necessary, a combustible gas indicator (CGI) and oxygen meter will be used as necessary to monitor explosive gas and oxygen concentration present at the site. LEL/O2 monitoring frequency will be determined by the SSHO and project industrial hygienist as determined by site conditions and work activity being performed.

LEL/O2 MONITORING ACTION LEVELS

METER RESPONSE	RESPONSE ACTION
< 19.5 % O2, **oxygen deficient atmosphere** > 23.5 % O2, **oxygen enriched atmosphere** > 10% LEL, **explosive atmosphere**	- Terminate work operations. - Exit exclusion zone. - Contact project industrial hygienist for recommended procedures.

8.4 Compound Specific Air Monitoring

Based on photoionization detector monitoring and site condition, compound specific air monitoirng procedures may be implemented. Compound specific monitoirng will consist of integrated air sampling in the workers breathing zones. Compound specific air monitoring paramaters will be selected based on potential site contaminants of concern. Workers will notified of air sampling results and calculated time weighted averages (TWA).

9.0 DECONTAMINATION PROCEDURES

The purpose of decontamination procedures is to ensure that personnel and equipment are free from contamination when they leave the work site and prevent cross contamination between sites. Decontamination procedures listed in this SSHP are primarily for the purpose of protecting site personnel from contamination. Detailed environmental sampling decontamination procedures are included in the project workplan.

9.1 Personnel Decontamination

Decontamination procedures for site personnel will consist of disposal of PPE (gloves, coveralls, boot covers) into designated waste containers upon exit of the exclusion zone or between investigation sites based upon site conditions and location of individual investigation areas. Sampling gloves will be changed between each sample. All site personnel will wash hands and exposed skin prior to breaks, lunch and at the end of the work day. Disposal of PPE will be in accordance with waste management plan requirements.

9.2 Equipment Decontamination

Sampling and SCAPS equipment and associated site support equipment will be water washed or steam cleaned between sampling locations or between investigation sites as determined by site conditions and project requirements. Decontamination fluids will be managed in accordance with waste management plan requirements.

SCAPS rods will be decontaminated by steam cleaning as push rods are extracted. Care will be taken to minimize bringing potentially contaminated soil into the push room as rods are being extracted.

10.0 EMERGENCY RESPONSE

Careful consideration must be given to the relative possibility to fire, explosion, environmental incident, spill, or release of vapors, dusts or gasses which may impose on nearby facilities. The most likely off-site impact from this investigation involves the potential for increased airborne contaminants as a result of intrusive activities. Control measures will be employed as necessary to preclude any possibility of off-site migration of contaminants. As a result of the hazards on site and the conditions under which investigations will be conducted, the possibility of an emergency situation exists. An emergency plan is required by 29 CFR 1910.120 to be available for use and is included below.

10.1 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO) shall implement this emergency plan whenever conditions at the site warrant such action. The SSHO will be responsible for assuring the evacuation, emergency treatment, emergency transport of site personnel as necessary, and notification of emergency response units and appropriate management functions.

10.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of contaminants, etc., the SSHO will notify all site personnel indicating the initiation of evacuation procedures. All personnel in both the restricted and nonrestricted areas of the site will evacuate and assemble in the support zone or other safe area as identified by the SSHO. The SSHO will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency has been identified. The SSHO shall see that access for emergency response personnel is provided and that all equipment has been shut down if possible once the emergency situation has been identified. Once the safety of all site personnel and the environment is established, personnel listed below will be notified of the situation by the SSHO.

Bob Vandegriff	Tulsa District Safety Officer	(918) 669-7360
Greg Snider	Project Industrial Hygienist	(918) 832-4122

10.3 Personnel Exposure

In the event of personnel exposure, skin contact, inhalation or ingestion the following procedures shall be implemented:

Skin/Eye Contact - Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention if required. Eyes should be rinsed for at least 15 minutes following chemical exposure.

Inhalation - Move to fresh air and if necessary decontaminate and transport to nearest hospital for professional medical attention..

Ingestion - Decontaminate and transport to nearest hospital for professional medical attention.

Puncture Wound or Laceration - Decontaminate and transport to nearest hospital for professional medical attention.

Fire or Explosion - Immediately evacuate the site and notify the local fire and/or police departments, and appropriate emergency response groups.

Environmental Incident - Secure spread of contamination if possible. Notify appropriate response group if assistance is required. If a significant release has occurred, the National Response Center or similar agency should be contacted.

10.4 Accident/Incident Reporting

All serious incidents/accidents resulting in equipment damage, emergency response, lost work time, medical treatment or fatality will be reported through the supervisory chain to the Tulsa District Safety and Occupational Health Office. A written report (ENG FORM 3394) will be forwarded to the Safety and Occupational Health Office, at the address listed below, within 48 hours of the accident/incident.

US Army Corps of Engineers
Safety and Occupational Health Office
P.O. Box 61
Tulsa, Oklahoma 74121

Emergency and non-emergency phone numbers are listed below. A hospital location map is included in Figure 9-1 of the APP.

EMERGENCY / NON EMERGENCY PHONE NUMBERS

Ambulance	911 /
Police	911 /
Fire Department	911 /
Hospital	911 /
COE Tulsa, SCAPS Coordinator Angie Burckhalter	918-669-4957
COE Tulsa, Project Industrial Hygienist Greg Snider	918-832-4122 mobile (918) 629-1927
COE Tulsa, Safety Officer Bob Vandegriff	918-669-7360
COE Tulsa, Investigations Section Jim McDonald	918-832-4122
COE Tulsa, SCAPS Field Manager Steve Brewer	918-832-4122 (918) 625-6463

11.0 TRAINING REQUIREMENTS

All personnel entering the site during field investigative activities must meet training requirements outlined in 29 CFR 1910.120. Personnel performing intrusive activities or personnel entering the project site will be required to receive 40 hour hazardous waste operations training and an annual 8 hour refresher. Training documentation for Tulsa District COE personnel are managed by the Tulsa District Occupational Safety and Health Office. Supervisors are responsible for ensuring personnel sent to the project site are in compliance with OSHA training requirements.

11.1 Site-Specific Training

Prior to initiating field activities project personnel will receive additional site specific training addressing the unique hazards which are potentially present at the site. Site specific training will be conducted by the SSHO and/or the field manager under the direction of the project industrial hygienist. Site specific training will address the following areas:

History of the site.
- Field activities planned.
- Safety and health hazards present at the site.
- Personal protective equipment requirements.
- Safe work practices.
- Air monitoring activities.

- Industrial hygiene sampling activities.
- Signs and symptoms of potential chemical exposure.
- Decontamination procedures.
- Emergency response and evacuation procedures.

11.2 First Aid and CPR Training

All Tulsa District COE field personnel receive first aid and CPR training every 3 years. A minimum of one person trained in first aid and CPR will be on the project site at all times during field activities.

11.3 Hazard Communication Program

The Tulsa District COE has developed a Hazard Communication Program in accordance with 29 CFR 1910.1200. MSDS for chemicals brought onto or used at the site will be made available to project personnel. All COE personnel receive Hazard Communication Training in the following areas:

- Chemicals and their hazards in the work area.
- How to prevent exposure to these hazardous chemicals.
- Procedures to follow if chemical exposures occur.
- How to read and interpret labels and MSDS .

12.0 MEDICAL SURVEILLANCE

All COE employees (and COE contractors) working at hazardous waste sites are required to participate in the Tulsa District (or contractor) Medical Surveillance Program as required by 29 CFR 1910.120. Each employee is also required to receive a physician’s interpretation as to the employee’s ability to wear a respirator. Employee medical surveillance records are managed by the Tulsa District Safety and Occupational Health Office.

Category	Frequency
Occupational Physical Examination	Annual
Medical History	Annual
Work History	Annual
Audiogram (OSHA 1910.95 criteria)	Annual
Blood Chemistry Profile	Annual
Complete Blood Count	Annual
Urinalysis	Annual
Pulmonary Function Testing	Annual
Vision Screening	Annual
Chest x-ray	Every 4 Years

EKG	Baseline
Laser Eye Exam	Job Specific
Blood, Urine (Mercury Screening)	Job Specific
Blood Lead	Job Specific
Cholinesterase	Job Specific

13.0 SAFETY AND HEALTH STANDARD OPERATING PROCEDURES

The following is a table of contents of the US Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1) that serves as minimum safety and health procedures that must be implemented as part of this SSHP. EM 385-1-1 will be available on-site during all field work activities. Tulsa District Confined Space Entry Program is included as attachment one to this section. Activity Hazard Analysis for site operations is included in the APP.

US ARMY CORPS OF ENGINEERS
SAFETY AND HEALTH REQUIREMENTS MANUAL