Appendix F

Investigation Work Plans

Quality Assurance Project Plan
(QAPjP)
Remedial Investigation

Frontier Fertilizer
Davis, CA

EPA Contract Number 68-W9-0060
EPA Work Assignment Number 60-28-9L4R

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Contents

Section		Pages	Rev.	Date
	Distribution List	1	0	4/28/95
1	**Project Objectives and Organization**	54	1	8/27/97
	1.1 Project Description		0	4/28/95
	1.1.1 Objective and Scope		0	4/28/95
	1.1.1.1 Quarterly Groundwater Monitoring		1	8/27/97
	1.1.1.2 Soil Investigation		1	8/27/97
	1.1.1.3 Groundwater Investigation		1	8/27/97
	1.1.1.4 DNAPL Confirmation and Plume Characterization		1	8/27/97
	1.1.1.5 Soil Gas and Flux Chamber Sampling		1	8/27/97
	1.1.2 Data Usage		0	4/28/95
	1.1.2.1 Quarterly Groundwater Monitoring		1	8/27/97
	1.1.2.2 Soil Investigation		0	4/28/95
	1.1.2.3 Groundwater Investigation		1	8/27/97
	1.1.2.4 DNAPL Confirmation and Plume Characterization		1	8/27/97
	1.1.2.5 Soil Gas and Flux Chamber Sampling		1	8/27/97
	1.1.3 Experimental Design and Rationale		0	4/28/95
	1.1.3.1 Quarterly Groundwater Monitoring		1	8/27/97
	1.1.3.2 Soil Investigation		0	4/28/95
	1.1.3.3 Groundwater Investigation		0	4/28/95
	1.1.3.4 DNAPL Confirmation and Plume Characterization		1	8/27/97
	1.1.3.5 Soil Gas and Flux Chamber Sampling		1	8/27/97
	1.2 Data Quality Objectives for Measurement Data		1	8/27/97
	1.2.1 Data Requirements and Decision Levels		1	8/27/97
	1.2.2 Decision Criteria and Acceptable Level of Confidence		1	8/27/97
	1.2.3 PARCC Parameters		0	4/28/95
	1.2.3.1 Precision		0	4/28/95
	1.2.3.2 Accuracy		0	4/28/95
	1.2.3.3 Representativeness		0	4/28/95

Contents (Cont'd)

Section		Pages	Rev.	Date
	1.2.3.4 Completeness		0	4/28/95
	1.2.3.5 Comparability		0	4/28/95
	1.3 Project Organization		1	8/27/97
2	**Measurement Procedures**	10	0	4/28/95
	2.1 Sample Collection		0	4/28/95
	2.1.1 Quarterly Groundwater Monitoring		0	4/28/95
	2.1.2 Soil Investigation		0	4/28/95
	2.1.3 Groundwater Investigation		0	4/28/95
	2.1.4 DNAPL Confirmation and Plume Characterization		1	8/27/97
	2.1.5 Soil Gas and Flux Chamber Sampling		1	8/27/97
	2.2 Sample Custody		0	4/28/95
	2.3 Analytical and Quality Control Procedures		0	4/28/95
	2.3.1 Analytes Matrices, Analytical Procedures, and CRQLs		1	8/27/97
	2.3.1.1 Analysis of Quarterly Groundwater Monitoring Samples		1	8/27/97
	2.3.1.2 Analysis of Soil Samples		0	4/28/95
	2.3.1.3 Analysis of Groundwater Samples		0	4/28/95
	2.3.1.4 Analysis of DNAPL Confirmation and Plume Characterization Samples		1	8/27/97
	2.3.1.5 Analysis of Soil Gas and Flux Chamber Samples		1	8/27/97
	2.3.2 Calibration and Preventative Maintenance		0	4/28/95
	2.3.2.1 Water Levels		0	4/28/95
	2.3.2.2 pH		0	4/28/95
	2.3.2.3 Electrical Conductivity		0	4/28/95
	2.3.2.4 Temperature		0	4/28/95
	2.3.3 Internal Quality Control Checks		0	4/28/95
	2.3.3.1 Equipment Rinsate Samples		0	4/28/95
	2.3.3.2 Background Samples		0	4/28/95
	2.3.3.3 Field Duplicate Samples		0	4/28/95
	2.3.3.4 Laboratory Quality Control Samples		0	4/28/95
	2.3.3.5 Field Spike/Performance Evaluation Samples		0	4/28/95

Contents (Cont'd)

Section		Pages	Rev.	Date
	2.3.4 Data Reduction		0	4/28/95
	2.3.5 Documentation and Deliverables		1	8/27/97
3	**Quality Assurance Management**	7	0	4/28/95
	3.1 Data Quality Management		0	4/28/95
	3.1.1 Data Management		0	4/28/95
	3.1.2 Analytical Data Quality Assessment		0	4/28/95
	3.1.2.1 FASP Laboratory Data Quality Assessment		1	8/27/97
	3.1.2.2 Region 9 Designated Laboratory Data Quality Assessment		0	4/28/95
	3.1.3 Overall Assessment of Data Quality and Usability Procedures		1	8/27/97
	3.1.3.1 DQO Review		0	4/28/95
	3.1.3.2 Contextual Review		1	8/27/97
	3.2 Quality Assurance Oversight		0	4/28/95
	3.2.1 Performance and System Audits		1	8/27/97
	3.2.2 Corrective Action		0	4/28/95
	3.2.3 Quality Assurance Reports to Management		0	4/28/95

List of Figures

Figure		Rev.	Date
1-1	Site Location Map	1	7/2/97
1-2	Site Layout	1	6/24/97
1-3	Locations of Monitoring Wells	1	6/24/97
1-4	Frontier Fertilizer Schedule	1	6/24/97
1-4a	Frontier Fertilizer Schedule, Rev. 1	0	7/14/95
1-5	Onsite Soil Sampling Grid	0	4/28/95
1-5a	New Monitoring Well Locations	0	8/27/97
1-5b	Soil Gas and Flux Chamber Sampling Locations	0	8/27/97
1-6	Principal Personnel Responsible for the Frontier Fertilizer Remedial Investigation	1	6/24/97
3-1	Flow of Remedial Investigation Data	1	6/24/97

Contents (Cont'd)

List of Tables

Table			
1-1	Maximum Observed Concentrations Preliminary Assessment Soil Data Disposal Basin Area	0	4/28/95
1-2	Quarterly Groundwater Monitoring Data	0	4/28/95
1-3	Frontier Sampling Approach Summary	1	8/27/97
1-4	Determination of Volatile Organic Compounds in Groundwater Investigation Samples – FASP Modified 504	0	4/28/95
1-5	Determination of Volatile Organic Compounds in Quarterly Groundwater Monitoring Samples by Contract Laboratory Program Analytical Services TCL VOCs plus EDB and DBCP	2	8/27/97
1-6	Determination of Volatile Organic Compounds in Soil Samples by FASP SOP F93001	0	4/28/95
1-7	Carbamate/Urea Pesticides for Determination in Soil by EPA Method 632	0	4/28/95
1-8	Organophosphorus Pesticides for Determination in Soil by EPA Method 8141	0	4/28/95
1-9	Organochlorine Pesticides and Polychlorinated Biphenyls in Soil by FASP SOP F93006	0	4/28/95
1-10	Total Petroleum Hydrocarbons Determination in Soil	0	4/28/95
1-10a	Determination of Volatile Organic Compounds in Well Sump Sediment By Modified 8010/8020	0	8/27/97
1-10b	Determination of Volatile Organic Compounds in Soil Gas and Flux Chamber Samples by Method TO-14	0	8/27/97
1-11	Precision, Accuracy, and Completeness Goals	1	8/27/97
2-1	Proposed Electronic Data Deliverable Format	0	4/28/95

Section 1

Project Objectives and Organization

This Quality Assurance Project Plan (QAPjP) has been prepared by Bechtel Environmental, Inc. (Bechtel) for the U.S. Environmental Protection Agency (EPA) under contract number 68-W9-0060, as authorized by work assignment form, revision 7, for Frontier Fertilizer (60-28-9L4R). It has been prepared according to U.S. EPA Region 9 *Guidance for Preparing Quality Assurance Project Plans for Superfund Remedial Projects,* 9QA-03-89, September 1989. This plan is designed to ensure that all environmental measurements performed by Bechtel will yield data that are scientifically valid, of known quality, sufficient to meet project objectives, and legally defensible.

This QAPjP was initially issued (Revision 0) in April 1995 to direct the remedial investigation (RI) activities conducted by Bechtel in 1995 as described in the Field Sampling Plan Quarterly Monitoring Program, Bechtel January 1994 (FSP, Quarterly Monitoring Program), Field Sampling Plan Soil Investigation, Bechtel January 1995 (FSP, Soil Investigation), and Field Sampling Plan Groundwater Investigation, Bechtel January 1995 (FSP, Groundwater Investigation). This QAPjP and the associated field sampling plans (FSPs) implement Bechtel's Remedial Investigation Work Plan, January 1995.

This revision of the QAPjP is intended to incorporate additional investigative activities as described in the Field Sampling Plan Soil Gas and Flux Chamber Sampling, Bechtel, 1997 (FSP Soil Gas and Flux Chamber Sampling), and Field Sampling Plan DNAPL Confirmation and Plume Characterization, Bechtel, 1997 (FSP DNAPL Confirmation and Plume Characterization). Much of the investigative activities described in Revision 0 have been conducted as of the writing of Revision 1. The approach of this revision is to provide only essential updated information and not to revise procedures for activities already conducted.

1.1 PROJECT DESCRIPTION

As shown in Figure 1-1, the Frontier Fertilizer site is located in a currently undeveloped area at the eastern edge in Davis, California. The site consists of several warehouses, shops, a pole barn, labor camp complex, tomato grading station, several sumps and culverts, and a disposal basin area. The 18-acre site is bordered to the south by Second Street and Interstate I-80, and to the north, west, and east by agricultural fields. Construction of the Mace Ranch Park industrial and residential development is proposed for most of the agricultural land surrounding the site. The nearest residence is approximately 0.2 mile south of the site. The site layout is illustrated in Figure 1-2.

The site was originally used as the farming headquarters for the C. Bruce Mace Ranch Company. A labor camp for Mexican Nationals was constructed on site between 1952 and 1954. The

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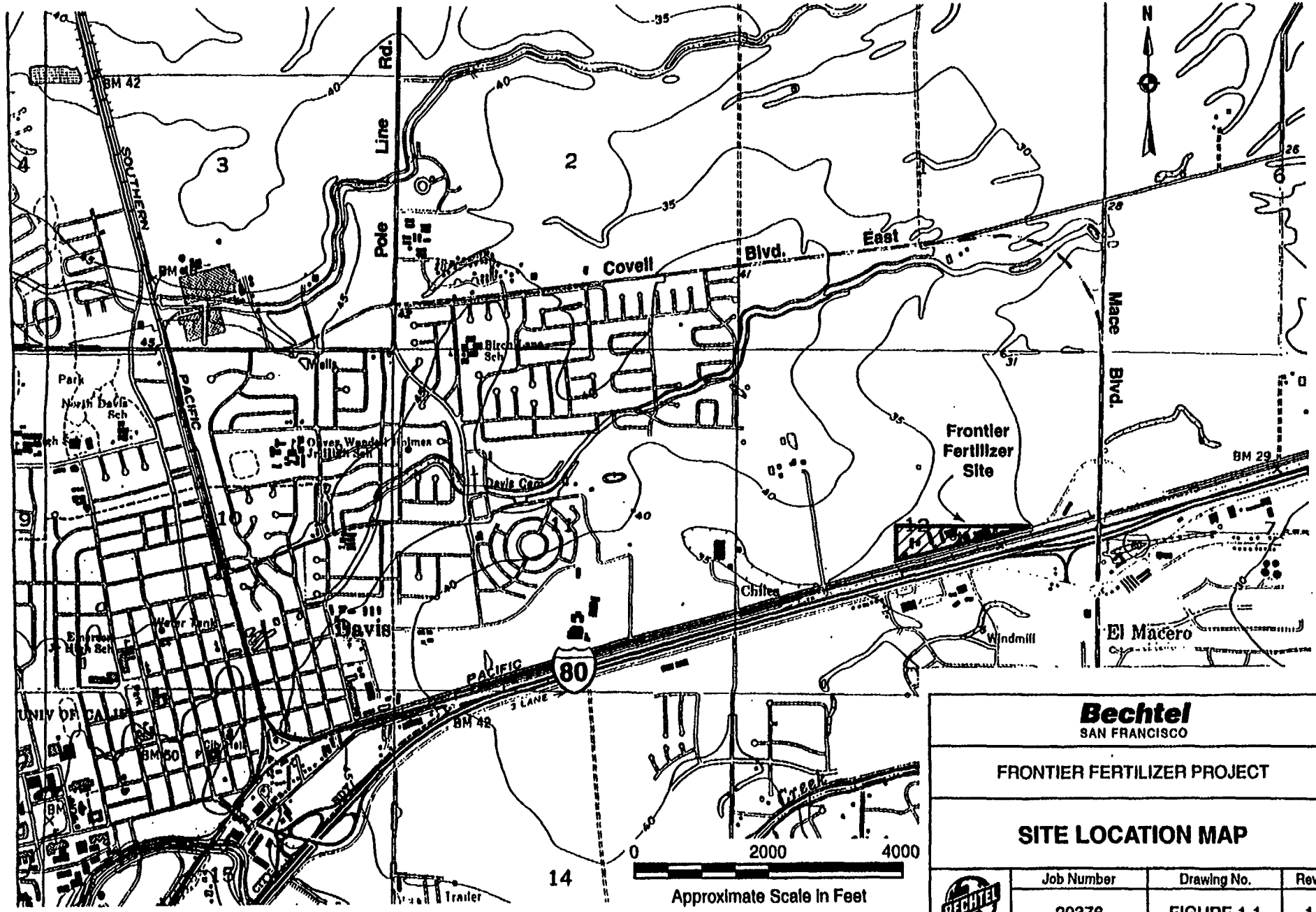

Source: U.S.G.S. Davis, CA 7-1/2 minute series topographic quadrangle 1952, photorevised 1981.

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FRONTIER FERTILIZER PROJECT

SITE LOCATION MAP

Job Number	Drawing No.	Rev.
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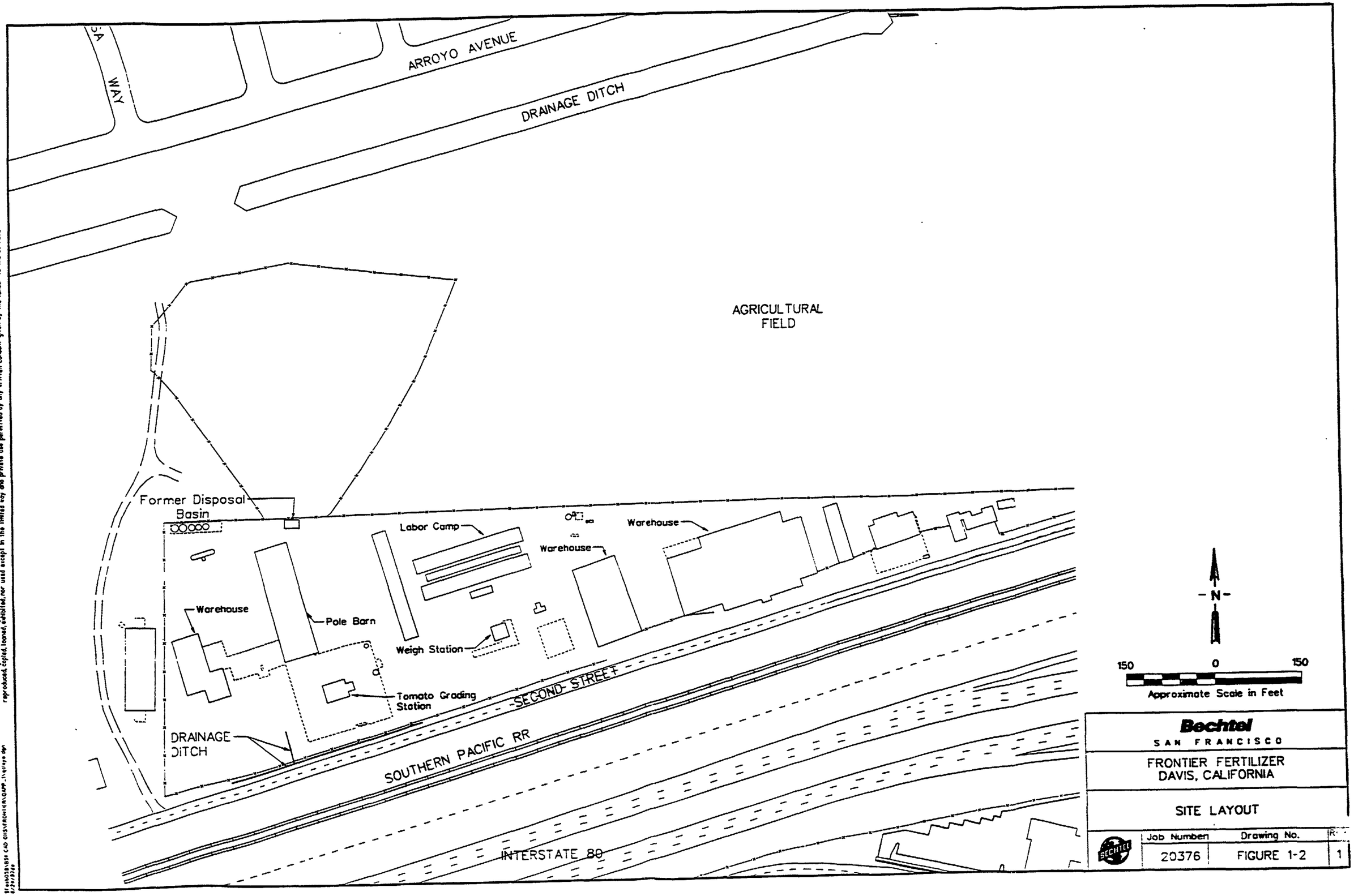

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C. Bruce Mace Ranch Company used the site for grain and machinery storage. In 1970, the site was sold to Anderson Farms, Inc., and a tomato grading station and wash rack for rinsing tomato trucks were installed in 1972. Also in 1972, the Barbara Rowland Company began fertilizer and pesticide distribution operations at the west end of the site. Pesticides and fertilizers were stored and mixed on site and sold to farmers in 500- to 1,000-gallon tank trailers. When the trailers or other containers were returned, residual material was rinsed out and deposited into an unlined disposal basin near the northwest corner of the site. In addition, used pesticide, herbicide, and insecticide containers were crushed and stored inside a pole barn south of the disposal basin. In 1982, the site was leased to Frontier Fertilizer, which continued selling fertilizers and pesticides in bulk or mixed in trailers until 1987. In March 1987, operations on site ceased.

1.1.1 Objective and Scope

The following sections describe the objectives and scope of field activities associated with the RI of the Frontier Fertilizer site. Each section presents general conclusions of previous studies and provides the requirements for new data collection activities.

A target analyte list has been developed based on hazardous substances found at the Frontier Fertilizer site during previous investigations, specifically the EPA preliminary site assessment conducted in Spring 1993. The results of the site assessment indicate volatile organic compounds (VOCs), carbamate/urea pesticides, organophosphorus pesticides, and organochlorine pesticides are present in site soils. The EPA site assessment also indicated groundwater beneath and north of the site is contaminated with VOCs. Tables 1-1 and 1-2 provide a summary of the detected hazardous substances.

Based on the results presented in Tables 1-1 and 1-2, soil samples will be analyzed to determine VOCs, carbamate/urea pesticides, organophosphorus pesticides, and organochlorine pesticides. Groundwater samples will be analyzed to determine VOCs. These target classes of analytes will be augmented by analyses for Total Recoverable Petroleum Hydrocarbons (TRPH). TRPH analyses will detect agricultural spray adjuvants (crop oil) and emulsifying agents (soaps) that are commonly used in large volumes in conjunction with pesticides, fuels, and lubricating oils.

1.1.1.1 Quarterly Groundwater Monitoring

Installation and sampling of groundwater monitoring wells at Frontier Fertilizer have been performed by several parties in the past, including the EPA; California EPA, Department of Toxic Substance Control (DTSC); RAMCO Enterprises and Frontier Fertilizer (see Figure 1-3).

Table 1-1
Maximum Observed Concentrations
Preliminary Assessment Soil Data
Disposal Basin Area

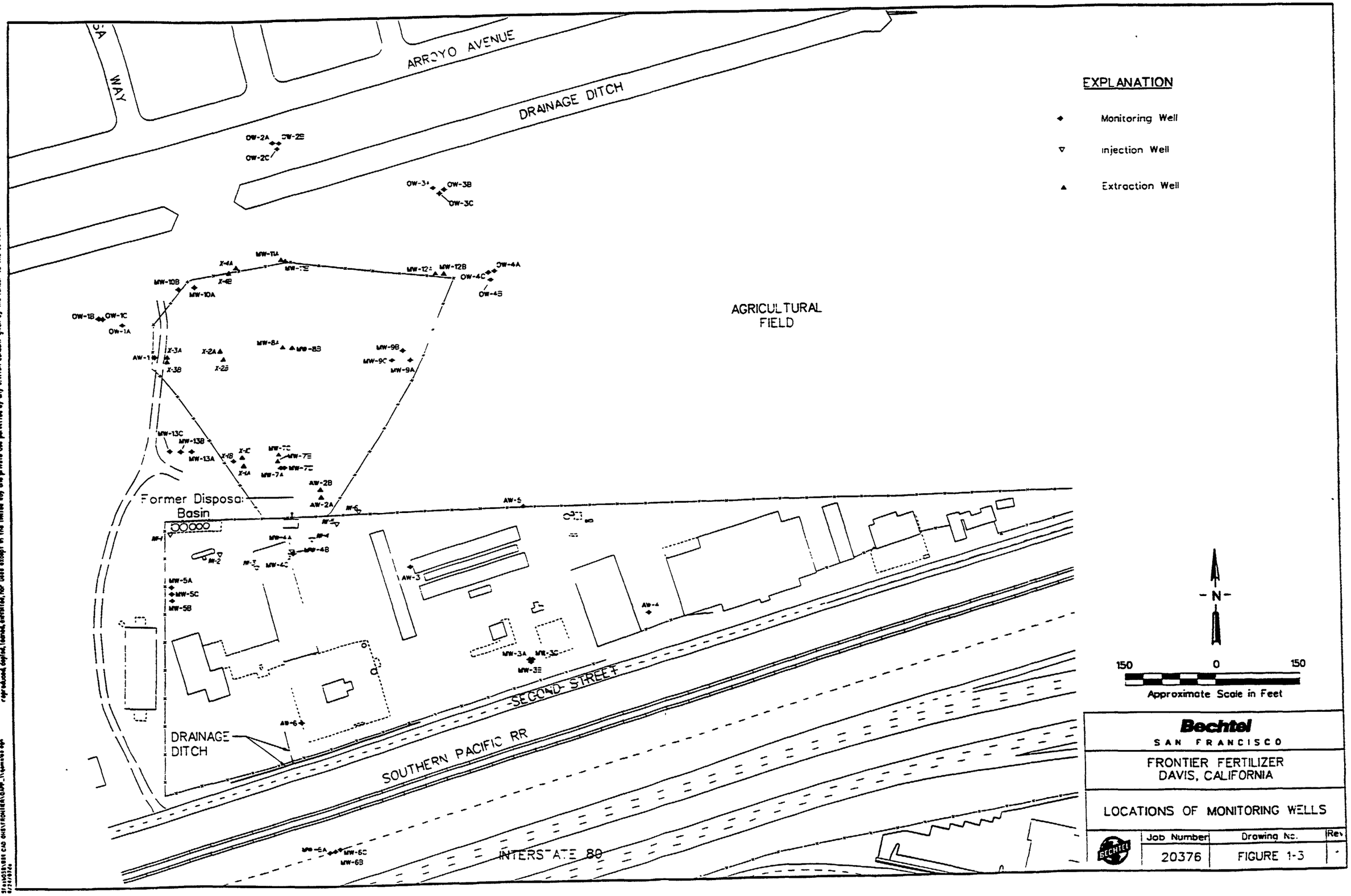
Contaminant	Maximum Observed Concentration (mg/kg)
Volatile Organic Compounds*	
1,2-dibromoethane	24.5
1,2-dibromo-3-chloropropane	61.0
1,2-dichloropropane	8.0
1,3-dichloropropane	0.81
Carbamate/Urea Pesticides*	
Diuron	0.21
Barban	16.0
Chloropropham	6.2
Siduron	5.9
Linuron	0.56
Organophosphorus Pesticides*	
Disulfoton	0.27
Organochlorine Pesticides†	
4, 4'-DDE	0.22
4, 4'-DDD	0.010
4, 4'-DDT	0.21
Toxaphene	1.1

* From *Frontier Fertilizer Site Assessment*, Ecology and Environment for U.S. EPA, January 13, 1994.
† From U.S. EPA split samples collected in September 1994 during a City of Davis sampling event.
mg/kg = milligrams per kilogram

Table 1-2
Quarterly Groundwater Monitoring Data*

Contaminant	Maximum Observed Concentration (µg/l)
Volatile Organic Compounds	
1,2-dibromoethane	13,000
1,2-dibromo-3-chloropropane	750
carbon tetrachloride	220
tetrachloroethene	3,500
1,2-dichloroethane	20
1,2-dichloropropane	34,000

* Based on sampling conducted August 1993, March 1994, and August 1994.
mg/1 = milligrams per liter



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Ongoing quarterly groundwater sampling is performed by Bechtel under the direction of the EPA. The results of this sampling and analysis are presented in quarterly groundwater monitoring reports.

Groundwater levels and gradients vary seasonally with changes in precipitation and pumping rates from agricultural and municipal supply wells in the area. The gradient of the S-1 (25 to 50 feet below ground surface) and S-2 groundwater zones has primarily been toward the north or northeast. Flow directions in the A-1 (115 to 175 feet below ground surface [bgs]) aquifer tend to vary the most, both by season and from location to location on site, but are generally either to the northwest or to the south. During the summer months, a strong downward element is evident in all three zones (see *Final Focused Remedial Investigation Report*, Metcalf and Eddy for DTSC, October 1992, Bechtel Final Interim Remedial Investigation Report, Bechtel, 1997).

The analytical results of the groundwater monitoring program indicate that the S-1 and S-2 groundwater zones contain levels of 1,2-dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP), 1,2-dichloropropane (DCP), chloroform, carbon tetrachloride, methylene chloride, 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), and 1,1,2-trichloroethane (1,1,2-TCA), chlorobenzene, and benzene primarily in the area directly north of the former pesticide disposal basin. In addition, the results indicate that the A-1 aquifer contains low levels of EDB, chloroform, carbon tetrachloride, and methylene chloride. The federal drinking-water maximum contaminant levels for EDB, DBCP, carbon tetrachloride, 1,2-DCA, and 1,2-DCP are 0.05 microgram per liter (µg/l), 0.2 µg/l, 5 µg/l, 5 µg/l, and 5 µg/l, respectively.

In the summer of 1995, a groundwater remediation system was installed on site to control offsite migration of constituents from the S-1 and S-2 groundwater zones underlying the site. The remediation system is designed to extract affected groundwater, and remove particulates and VOCs from the extracted water through the use of bag filters and activated carbon absorbers. The treated water is subsequently discharged to injection wells and to the sanitary sewer (see *Draft Operations and Maintenance Manual Interim Groundwater Remedial System*, Bechtel for EPA, May, 1997.

For quarterly groundwater monitoring activities conducted at the Frontier Fertilizer site, environmental measurements must include:

- Measurement of VOCs in groundwater samples from the monitoring wells
- Measurement of the pH, conductivity, and temperature of groundwater from the monitoring wells
- Measurement of water levels in the monitoring wells

These data will be used as specified in Section 1.1.2 below.

1.1.1.2 Soil Investigation

In January 1993, the EPA Region 9 ERS conducted a site assessment of the Frontier Fertilizer site. The main objective of this effort was to investigate the extent of pesticide contamination remaining in the soil and to determine whether a soil removal action was warranted. The primary concern was the potential continuing impact of contaminated soil on groundwater.

Field work took place from March to May 1993. Two areas of the site – the pesticide disposal basin area and the area adjacent to a sump north of the labor camp, the suspected source of carbon tetrachloride contamination – were sampled using a grid system. Samples were collected at four depth intervals from 2 feet bgs to the saturated zone, approximately 26 feet to 30 feet bgs, and analyzed for VOCs, organochlorine pesticides, carbonate urea pesticides, and organophosphorus pesticides.

Analytical results indicated that 1,2-dibromoethene contamination existed in soils in and around the pesticide disposal basin area at levels exceeding 24,500 parts per billion (ppb), approximately 1,000 times the EPA Region 9 preliminary remediation goal (PRG) for residential soil. Samples collected from other areas of the site did not contain significant levels of pesticides or carbon tetrachloride. See *Frontier Fertilizer Site Assessment*, Ecology and Environment for EPA, January 1994.

The EPA considers the site assessment data sufficient to support an engineering evaluation/cost analysis for a disposal basin area soil removal action. However, the focus of the site assessment on the disposal basin area led to a need for additional soil sampling. The additional sampling was required to:

- Verify that all possible sources of contamination have been identified and characterized
- Determine the volume of contaminated soil associated with other sources if additional sources are identified
- Evaluate if site surface soils are generally contaminated
- Construct a conceptual model of site hydrogeology

This sampling was accomplished by Bechtel in 1995 and is reported in the Final Interim Remedial Investigation Report (Bechtel, 1997).

1.1.1.3 Groundwater Investigation

Between June 1985 and March 1986, the owners of Frontier Fertilizer conducted a groundwater investigation and installed 24 groundwater monitoring wells on or near the site. Analytical

results of groundwater samples collected at that time and as part of the current Quarterly Monitoring Program indicate the presence of EDB, DBCP, and DCP in the area of the disposal basin and to the north in the direction of the shallow groundwater gradient. See *Preliminary Assessment Report and Work Plan for Remedial Investigation/Feasibility Study* and *Groundwater Investigation Monitoring and Cleanup;* Luhdorff and Scalmamine Consulting Engineers for Frontier Fertilizer; November 1987 and May 1985, respectively.

After the owners' groundwater investigation, RAMCO Enterprises, owners of the Mace Ranch Park Property north of the site, installed 12 groundwater monitoring wells. See *Remedial Investigation/Feasibility Study, Frontier Fertilizer/Mace Ranch Park;* Groundwater Technology, Inc. for RAMCO Enterprises; February 1990. The DTSC also installed one deep monitoring well and abandoned two water supply wells suspected of acting as conduits to downward migration of contaminants. See *Final Focus and Remedial Investigation Report* and *Final Focused Feasibility Study;* Metcalf and Eddy for DTSC; October 1992 and December 1992, respectively.

In 1995, Bechtel conducted a groundwater investigation which included plume characterization using HydroPunch™ sampling, installation, and sampling of monitoring wells; and groundwater sampling and analysis. The data collected, which are reported in the Interim Final Remedial Investigation Report (Bechtel, 1997), delineated the general extent of the pesticide and carbon tetrachloride plumes. However, additional groundwater data must be collected to define the leading edge of the contaminated groundwater north, northeast, and northwest of the site, as described in Section 1.1.1.4. These data will be used as specified in Section 1.1.2 below.

1.1.1.4 DNAPL Confirmation and Plume Characterization

The objectives of DNAPL confirmation and plume characterization sampling are to:

- Provide more conclusive evidence of the presence and nature of a DNAPL (dense non-aqueous phase liquid) in the subsurface. This evidence is needed for assessing the technical practicability of site cleanup and to delineate a DNAPL zone for a possible technical impracticability evaluation
- Delineate the extent of the pesticide plume to the north and northwest of the OW-2 well cluster in the S-1 and S-2 zones, and the extent of A-1 aquifer and the carbon tetrachloride plume to the east and north of the OW-4 well cluster
- Reduce the potential for cross-contamination of aquifer zones through existing wells

To address the objective of confirming the presence of DNAPLs in the subsurface, well sump sediment samples will be collected from several wells and qualitative DNAPL testing will be

performed in the field. If no DNAPL is detected, then groundwater sampling with the dialysis multiple-level sampler (DMLS) will be conducted in several wells.

To address the objective of defining the northern and western boundaries of the pesticide plume and the northern and eastern boundaries of the carbon tetrachloride plume, a well installation and sampling program will be conducted. The proposed well installation program will include up to 21 new monitoring wells. The wells will be installed in up to seven clusters of three wells each, one each screened in the S-1, S-2, and A-1 zones, respectively. In the three deeper borings(to the A-1 aquifer), soil samples will be collected every 5 feet to determine the depth of the water-bearing zones at each well cluster location.

Groundwater sampling and quick turnaround analysis will be used to determine the presence and concentration of the pesticides and carbon tetrachloride in groundwater at four new monitoring locations. Monitoring well clusters will be installed and sampled at two other locations if the EDB and carbon tetrachloride concentrations are at or above their respective MCLs in samples collected from the first four well clusters.

To address the objective of reducing the potential for cross-contamination of aquifer zones through existing wells, a program of well decommissioning will be conducted. MW-4B, MW-7C, and OW-2C will be decommissioned, because hydrographs at these cluster locations indicate interconnection between the water bearing zones. OW-2A and OW-2C will also be decommissioned because they are currently located in an area planned for residential development.

1.1.1.5 Soil Gas and Flux Chamber Sampling

The objective of the soil-gas and flux- chamber sampling is to obtain sufficient data to support evaluation of the human health risk associated with inhalation of chemicals emanating from the ground at Frontier Fertilizer. To meet this objective, a minimum of 10 soil-gas samples and soil-gas flux chamber samples will be collected from disposal basin area and a minimum of 14 soil - gas samples will be collected from locations spaced 50 feet apart along a north-trending transect extending from the disposal basin area to the proposed Mace Ranch Park development. Flux chamber samples will be collected along this transect if soil-gas concentrations exceed 100 time ambient air preliminary remediation goals.

1.1.2 Data Usage

For each environmental measurement, the following sections describe the intended uses of the data collected, the decisions to be made using the data, and the data users.

1.1.2.1 Quarterly Groundwater Monitoring

Data collected during quarterly groundwater monitoring activities will be used to:

- Document the presence and concentrations of VOCs including EDB and DBCP in groundwater in the wells that are on site or downgradient of the Frontier Fertilizer site within the detection limits achievable by currently identified analytical methods.
- Monitor trends in the areal distribution of VOCs in groundwater in each of three saturated zones beneath the Frontier Fertilizer site
- Monitor trends in the vertical distribution of VOCs in groundwater between the shallow saturated zones and the deeper aquifer
- Monitor water level changes in the monitoring wells and on a quarterly basis
- Provide chemical concentration data necessary to prepare charts graphing seasonal changes in VOC concentrations in groundwater, and comparing these changes with seasonal water level variations
- Further define and document seasonal variation in groundwater flow direction
- Provide groundwater elevation data necessary to prepare groundwater contour maps
- Describe the nature and extent of VOC contamination in groundwater within the site boundaries
- Describe the nature and extent of VOC contamination in groundwater downgradient of the site
- Monitor groundwater quality beyond the leading edge of the contaminated groundwater to detect movement of contaminated groundwater
- Evaluate potential groundwater exposure pathways and remedial technologies for further groundwater treatment
- Assess the performance of the groundwater extraction and water treatment system.

1.1.2.2 Soil Investigation

Data collected during the soil investigation will be used to:

- Ascertain whether all sources of contamination have been identified
- Determine if site surface soil has been contaminated by wind and/or rain dispersion
- Detect the presence and measure the concentrations of VOCs in surface and subsurface soil. Gather data to characterize subsurface hydrogeologic conditions,

and develop a vadose zone leaching model using VLEACH in the former disposal basin area

- Characterize disposal basin soil for removal and disposal
- Determine if contaminated soil has been transported off site by wind and/or water runoff
- Evaluate background soil concentrations of contaminants of concern
- Construct a conceptual model of site stratigraphy and hydrogeology

1.1.2.3 Groundwater Investigation

Data collected during the groundwater investigation will be used by Bechtel to:

- Define the leading edge of VOC/pesticide contaminated groundwater and carbon tetrachloride/pesticide contaminated groundwater in the S-1 and S-2 groundwater zones
- Determine the locations for additional monitoring wells
- Define the lithology between the ground surface and the A-1 aquifer

1.1.2.4 DNAPL Confirmation and Plume Characterization

The data from the DNAPL confirmation and plume characterization sampling will be used to:

- Support a technical impracticability evaluation for the DNAPL-contaminated portions of the aquifer
- Provide monitoring locations beyond the extent of the pesticide and carbon tetrachloride plumes, so the data may be used to evaluate the effectiveness of the groundwater treatment system
- Provide early warning of migration of contaminants toward municipal wells
- Determine the current groundwater flow direction in the A-1 aquifer and assess it's seasonal variability

1.1.2.5 Soil Gas and Flux Chamber Sampling

Since the contaminants of concern at Frontier Fertilizer are VOCs, the release of VOCs from contaminated soil and groundwater to the air may be of concern to prospective home buyers north of the site. While standard EPA risk assessment procedures consider the risk associated with the

release of VOCs from soil into the air, the risk is estimated based on measurements of the total concentration of contaminants in soil. The soil flux chamber samples will provide a direct measure the flux of contaminants from the soil surface and thus provide better quality data for use in a human health risk assessment.

1.1.3 Experimental Design and Rationale

For each environmental measurement, the following sections describe the experimental design and rationale for conducting the measurements. Figure 1-4 presents an integrated schedule of activities associated with quarterly groundwater sampling, the soil investigation, and the groundwater investigation. Figure 1-4a provided a schedule of activities associated with DNAPL confirmation, plume characterization, soil-gas and flux chamber sampling. Table 1-3 presents a summary of the experimental design as described below and detailed in the FSPs for the quarterly groundwater monitoring program, soil investigation, and groundwater investigation, soil-gas and flux chamber sampling, and DNAPL confirmation and plume characterization.

1.1.3.1 Quarterly Groundwater Monitoring

The procedure described in detail in the FSP, Quarterly Monitoring Program, must be followed when collecting quarterly groundwater monitoring data.

1.1.3.2 Soil Investigation

The procedures described in detail in the FSP Soil Investigation must be followed when collecting soil data. A statistically based experimental design is required to verify that:

- All sources of contamination will be identified and characterized
- The human health risk presented by the carcinogenic chemicals of concern present in site surface soil is less than 1×10^{-6} (based on the Region 9 PRGs for industrial use)

To evaluate if all sources of contamination have been located, the site has been divided into three zones (Figure 1-5) which have been established based on the likelihood of observing contamination. These zones are (1) an area of suspected contamination, primarily the northwestern portion of the site; (2) an area of potential surface soil contamination, primarily the southwestern portion of the site; and (3) an area where use or disposal of hazardous substances is not indicated, primarily the eastern portion of the site.

A sampling grid must be established in each zone to search for undiscovered areas of soil contamination (hot spots) and to determine the vertical and lateral extent of contamination, should hot spots be encountered. The grid size must vary from 30 x 30 feet in the area of suspected

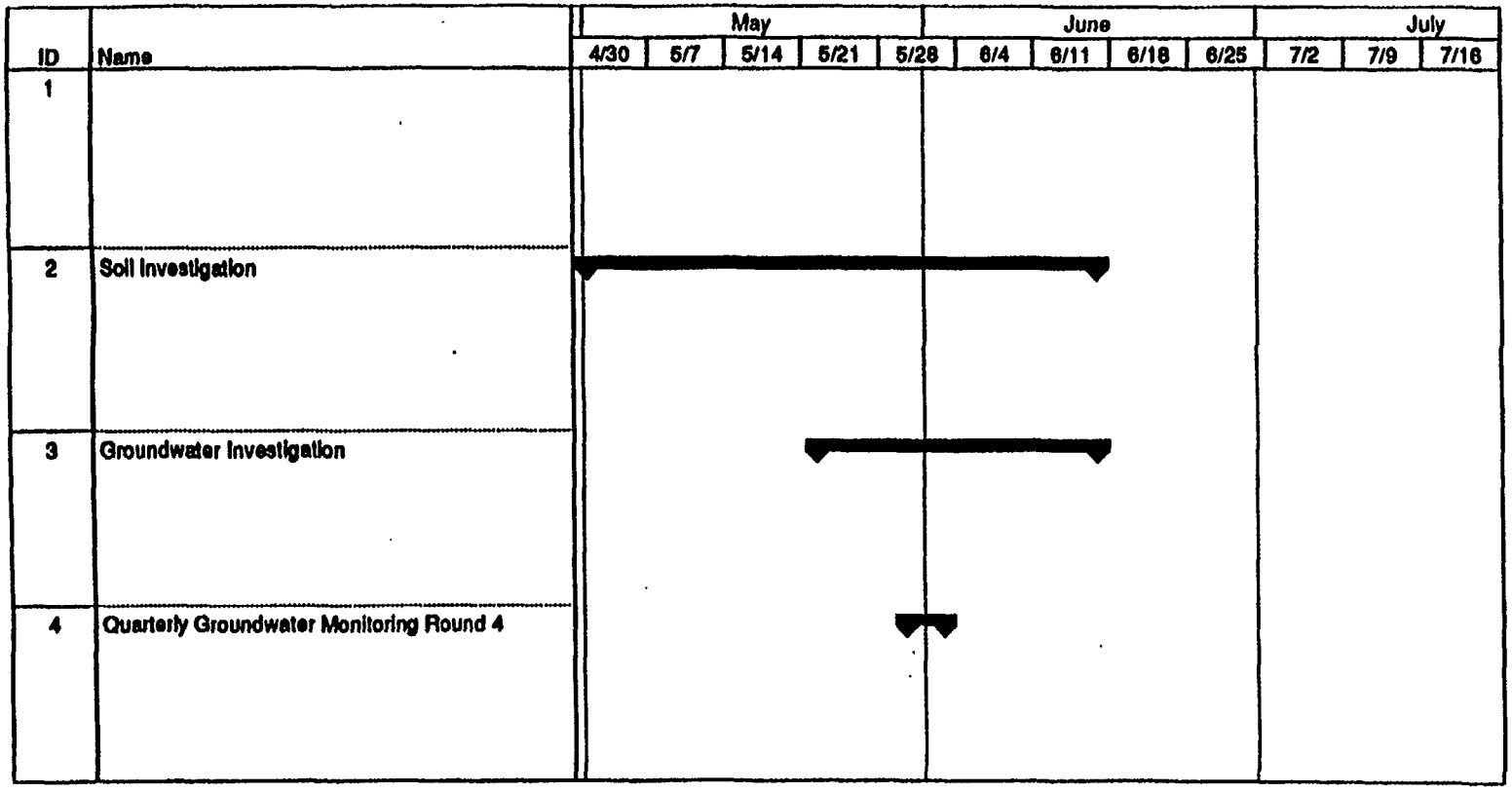

Figure 1-4 Frontier Fertilizer Schedule

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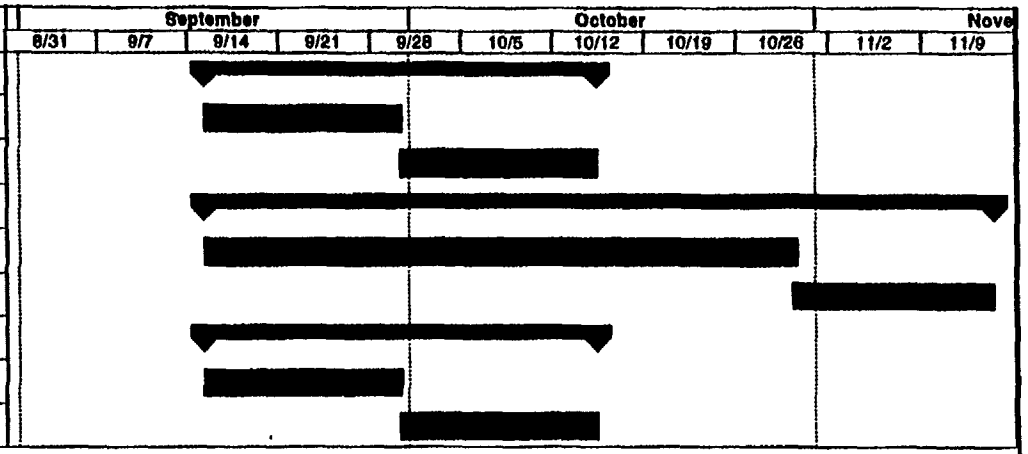
ID	Task Name
1	Soil Gas Investigation
2	Soil Gas Sampling
3	Flux Chamber Sampling
4	Groundwater Investigation
5	Monitoring Well Installation
6	Monitoring Well Sampling
7	DNAPL Investigation
8	Well Sediment Sampling
9	Dialysis Multi-level Sampling



Project:
Date: Wed 8/27/97

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

Table 1-3
Frontier Sampling Approach
Summary

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Groundwater – Quarterly Monitoring							
	Monitor trends in the areal and vertical distribution of VOCs beneath and down-gradient of the site. Monitor the three saturated groundwater zones just beyond the edge of the contaminated groundwater to detect expansion and movement of the contamination.	Sample existing 36 wells every quarter. Commence quarterly sampling of 12 new wells just beyond the groundwater contamination after installation in the summer of 1995.	VOCs + EDB, DBCP and carbon tetrachloride	Region 9	CLPAS TCL VOCs plus EDB and DBCP and Method 504	Analyze all samples	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
Groundwater – Investigation							
	Locate edge of contaminated groundwater to drill and install four groups of three monitoring wells at each location, one to each saturated zone.	Initially sample by HydroPunch at locations calculated to be beyond edge of contaminated groundwater. Continue sampling until edge is confirmed by analyses showing no site contaminants. Install and develop wells based on results and resample to confirm.	VOCs + EDB, DBCP and carbon tetrachloride	FASP	Modified 504	Analyze all samples	Split 10% to Region 9 Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil - 30-Foot Grid Area							
Surface	Evaluate general surface contamination to determine mean cumulative risk index [2] 10^{-6} based on published PRGs for industrial use with 90% confidence.	Initially, sample every fourth grid point staring with first point every other row and starting with third point on alternate rows.	Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10/ or 1/wk Rinsates @ 1/day/ or 1/20 MS/MSD @ 1/20 or 1/wk
		After initial sampling, if based on mean and standard deviation of cumulative risk index results, mean cumulative risk index ≥1 or < 1 with a ≥90% confidence stop sampling. Mean cumulative risk index < 1 with < 90% confidence, take additional samples at mid-grid points and reevaluate.	Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Analyze all samples	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze all split samples from FASP	

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Subsurface	Hot spot search to locate additional sources at 80% confidence level	Sample every grid point at 3 feet bgs. If a detection ≥PRG, take additional samples at 5-foot intervals until two consecutive sampling intervals are < PRG or groundwater is encountered.	VOCs + EDB, DBCP	FASP	FASP F93001	NDs only one column; detects with second column confirmation	Spikes @ 1/wk (FASP VOCs only) Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Systematic bias; analyze 10% - select sample with a bias toward selection of one having detects of VOCs. If there are no detects in a group of 10 samples, analyze every tenth grid point beginning with the first and fifth (alternate rows).	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze all split samples from FASP	

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil – 40- and 50-Foot Grid Areas							
Surface	Evaluate general surface *contamination to* determine mean cumulative risk index $\leq 10^{-6}$ based on published PRGs for industrial use with 90% confidence.	Initial – Sample every *fourth grid point staring* with first point every other row and starting with third point on alternate rows.	Organochlorine *pesticides*	FASP	FASP F93006	Analyze all samples	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
		After initial sampling, if based on mean and standard deviation of cumulative risk index results, mean cumulative risk index ≥1 or < 1 with a ≥90% confidence, stop sampling. x < 1 with < 90% confidence, take additional samples at mid-grid points and reevaluate.	Organophosphorus pesticides	Region 9	8141	Systematic bias; analyze 10%. Select samples with a bias toward selection of one having OC detects or visual indications. If there are no detects in a group of 10 samples, analyze every tenth grid point beginning with the first and fifth (alternate rows).	
			Carbamate/urea pesticides	Region 9	Modified 632	Systematic bias; analyze 10%. Same sample as selected for OP analysis.	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze all split samples from FASP	

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Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Subsurface	Hot spot search to locate additional sources at 80% confidence level.	Sample every grid point at 3 feet bgs. If a detection ≥ PRG, take additional samples at 5-foot intervals until one sample interval is < PRG or groundwater is encountered.	VOCs + EDB, DBCP	FASP	FASP F93001	NDs only one column; detects with second column confirmation	Spikes @ 1/wk (FASP VOCs only) Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
		In the 50-foot grid area, if four consecutive sample points are ND for all target analytes, revise sampling to every other grid point, alternating between rows.	Organochlorine pesticides	FASP	FASP F93006	Systematic bias; analyze 10%. Select samples with a bias toward selection of one having VOC detects or visual indications. If there are no detects in a group of 10 samples, analyze every tenth grid point beginning with the first and fifth (alternate rows).	
			Organophosphorus pesticides	Region 9	8141	Systematic bias, analyze 10%. Same sample as selected for OC analysis.	
			Carbamate/urea pesticides	Region 9	Modified 632	Systematic bias, analyze 10%. Same sample as selected for OC analysis.	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze all split samples from FASP	

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil – USTs							
	To determine if and how much contamination is present for the purpose of planning the removal.	Sample locations to be directly adjacent to each UST, at each side and end (four locations). Samples to be taken at ground surface and at 5-foot intervals until groundwater is encountered.	VOCs + EDB, DBCP	FASP	FASP F93001	NDs only one column. Detects with second column confirmation.	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/10 or 1/wk
			TPH	Region 9	Gasoline and Diesel	Analyze all samples	
Soil and Sediment – Sump Sampling							
Surface	To determine if sumps are contaminated with hazardous substances.	Surface sample locations will be directly in each sump. Subsurface samples are to be collected directly adjacent to each sump when the sump has a concrete bottom. All subsurface samples from unlined sumps will be taken from within the sump area.	Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	Split 10% to Region 9 (FASP OC pesticides Only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			TPH	Region 9	Gasoline and Diesel	Analyze all samples	
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Only analyze if other target analytes are detected	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze FASP split samples	

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil and Sediment – Sump Sampling							
Subsurface		Collect one sample at 3 feet. If target analytes are detected ≥ PRG, collect samples at 5-foot intervals until one interval is < PRG or groundwater is encountered.	VOCs + EDB, DBCP	FASP	FASP F93001	NDs only one column. Detects with second column confirmation.	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	
			TPH	Region 9	Gasoline and Diesel	Analyze all samples	
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Only analyze if other target analytes are detected.	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze FASP split samples	

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Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil – Bias Sampling							
Surface	To determine if areas that show visual indications of contamination contain hazardous site substances.	Six locations have been identified to be potentially contaminated. Additional locations may be identified during the field investigation.	Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			TPH	Region 9	Gasoline and Diesel	Analyze all samples	
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Only analyze if other target analytes are detected	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze FASP split samples	
Subsurface		Collect one sample at 3 feet. If target analytes are detected ≥ PRG, collect samples at 5-feet intervals until one interval is < PRG or groundwater is encountered.	VOCs + EDB, DBCP	FASP	FASP F93001	NDs only one column. Detects with second column confirmation.	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	
			TPH	Region 9	Gasoline and Diesel	Analyze all samples	
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Only analyze if other target analytes are detected	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze FASP split samples	

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil – Offsite Sampling							
Surface	Determine if site hazardous substances have been carried offsite by windblown site soil or site soil deposited by surface water runoff.	Biased sampling to be done in areas likely to have received windblown soil or surface water runoff.	Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Only analyze if other target analytes are detected	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze all split samples from FASP	

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil – Disposal Basin Sampling							
Subsurface	To determine presence and measure concentrations of pesticides in surface and subsurface soils to support disposal of removed soil in a landfill.	One boring will be made in the middle of the disposal basin area and grab sampled at 3-foot intervals to groundwater.	VOCs + EDB, DBCP	FASP	FASP F93001	NDs only one column; detects with second column confirmation.	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
	To characterize subsurface hydrogeologic conditions to support the development of a VLEACH vadose zone leaching model.		Total metals	Region 9	CLPAS TCL metals	Analyze all samples	
			Total semivolatiles	Region 9	CLPAS TCL SVOCs	Analyze all samples	
			TCLP	Region 9	40 CFR 261	Only analyze if the total concentration of metals or pesticides >20 x regulatory limit	
		Undisturbed samples taken, at a minimum, from each strata or change in soil characteristics to groundwater.	Dry bulk density	Contract Lab	Core method *	Analyze all samples	
			Specific gravity	Contract Lab	ASTM D854	Analyze all samples	
			Volumetric water content	Contract Lab	ASTM D2216	Analyze all samples	
			Organic carbon fraction	Contract Lab	9060A	Analyze all samples	

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Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
Soil – Background Sampling							
	Establish background conditions	Three areas unlikely to have received site contaminants. Each location to be sampled at the surface and at 5-foot intervals until groundwater is encountered:	VOCs + EDB, DBCP	FASP	FASP F93001	Analyze only subsurface samples. NDs only one column.; detects with second column confirmation.	Split 10% to Region 9 (FASP OC pesticides only) Field Dup @ 1/10 or 1/wk Rinsates @ 1/day or 1/20 MS/MSD @ 1/20 or 1/wk
			Organochlorine pesticides	FASP	FASP F93006	Analyze all samples	
			TPH	Region 9	Gasoline and Diesel	Analyze all samples	
			Organophosphorus pesticides	Region 9	8141	Analyze all samples	
			Carbamate/urea pesticides	Region 9	Modified 632	Analyze all samples	
			Organochlorine pesticides	Region 9	8080A/ 8081S	Analyze FASP split samples	
Soil Gas and Flux Chamber Sampling							
	Measure Soil Gas concentrations in Disposal Basin Area	Collect 10 Soil Gas samples on grid with random origin.	Chemicals of concern defined by groundwater screening risk assessment	Subcontract	Method TO-14	Analyze all samples	Field Dup @ 1/10 or 1/wk
	Measure Soil Gas concentration gradient	Collect Soil Gas samples every 50 feet along north trending transect.					
	Measure Soil Gas flux	Collect Flux Chamber sample at each location in disposal basin area and at each transect location where Soil Gas concentrations exceed 100 times PRGs.					

Table 1-3
Frontier Sampling Approach
Summary (Cont'd)

	Purpose	Sampling Strategy	Analyses	Laboratory	Method	Analysis Strategy	Field QC
DNAPL Confirmation and Plume Characterization							
	Determine the presence of DNAPLs	Collect two to four well sump sediment samples. X-1A and X-1B first, then MW-7B and MW-7C, if not detected in X-1A or X-1B	Qualitative testing for non-aqueous phase	Field testing	UV Fluorescence *Sudan IV* dye test	Analyze all samples	None (Confirm DNAPL presence through laboratory analysis)
		If DNAPL detected by qualitative tests, then submit sample for laboratory analysis to determine composition	VOCs + EDB + DBCP	Region 9	CLPAS TCL VOCs plus EDB & DBCP (5ml purge)	Analyze all samples with positive detection of DNAPL from qualitative testing	Field Dup @ 1/10 Rinsates @ 1/day MS/MSD @ 1/20
		Collect DMLS groundwater samples (1 per foot of 10-foot length of well screen) in 3 wells.	VOCs + EDB + DBCP	Region 9	CLPAS TCL VOCs plus EDB & DBCP (5 ml purge)	Analyze all samples	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day MS/MSD @ 1/20 or 1/wk
	Locate edge of pesticide plume	Install up to 15 monitoring wells	VOCs + EDB + DBCP	Region 9	CLPAS TCL VOCs plus EDB & DBCP (25 ml purge) and Method 504	Analyze samples from monitoring well clusters OW-5 and OW-6. Based on results, may/may not install clusters OW-9, OW-10	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day MS/MSD @ 1/20 or 1/wk
	Locate edge of carbon tetrachloride plume	Install 3 monitoring wells	VOCs + EDB + DBCP	Region 9	CLPAS TCL VOCs plus EDB & DBCP (25 ml purge) and Method 504	Analyze all samples	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day MS/MSD @ 1/20 or 1/wk
	Replace wells to be abandoned	Install 3 monitoring wells	VOCs + EDB + DBCP	Region 9	CLPAS TCL VOCs plus EDB & DBCP (25 ml purge) and Method 504	Analyze all samples	Field Dup @ 1/10 or 1/wk Rinsates @ 1/day MS/MSD @ 1/20 or 1/wk

*Due to the nature of this investigation, exact numbers of samples to be analyzed are not known.

contamination to 50 x 50 feet in the areas of the site where there is no indication of the use or disposal of hazardous substances. Decisions must be made in the field based on EPA Field Analytical Services Program (FASP) analytical data, about whether additional sampling is required to determine the vertical and lateral extent of contamination or to reduce the frequency of sampling.

Biased sampling must be conducted within each zone at designated locations based upon visual evidence (e.g., staining) that is highly suspect and has the potential to be a source of contamination. Biased sampling locations and other hot spots located during the investigation must be evaluated as a fourth zone and must not be considered part of the three zones identified above. Biased sampling locations must include:

- Areas directly adjacent to two underground storage tanks (USTs). Soil samples must be collected to determine if contamination is present, and, if so, to determine the extent of that contamination. Soil samples must be collected from north, south, east, and west of the USTs at the surface and at 5-foot-deep intervals until groundwater is encountered. There must be four soil sample locations for each UST.
- Five sumps located on site. Soil and/or sediment samples must be collected from within the five sumps. In addition, subsurface soil samples must be collected from beneath the sumps at 5-foot-deep intervals until groundwater is encountered.
- Areas showing visual signs of contamination (e.g., oil stains, distressed vegetation). If contamination is detected in surface samples or in the initial subsurface sample, samples will be collected at 5-foot-deep intervals until concentrations in a single interval are below the PRGs, or until groundwater is encountered.
- The disposal basin, to support development of a vadose zone leaching model using VLEACH. Two types of soil samples must be collected: discrete grab samples and undisturbed samples. Discrete grab samples for chemical analyses must be collected at the surface and at 3-foot-deep intervals until groundwater is encountered. Undisturbed soil samples must be taken in thin-wall (Shelby) tubes for geologic testing at depths designated by the geologist in the field.
- Offsite surface soil samples, to determine if contaminated soil has been carried off site by wind or rain. Six offsite surface soil samples must be collected from areas likely to receive windblown site soil and/or site soil deposited by surface water runoff. The prevailing wind direction in the Davis area is to the south and, during stormy weather, to the north. Therefore, two surface soil samples must be collected to the north and south of the site. In addition, two surface soil samples must be collected from the surface water drainage ditch adjacent to the southern boundary of the site.

- Background samples must be collected from three areas in the site vicinity that are unlikely to have received contaminants. Background samples must be taken in similar geological strata to the other sample locations, and at similar depths. Three borings must be completed and samples must be collected at the soil surface and at 5-foot-deep intervals until groundwater is encountered.

1.1.3.3 Groundwater Investigation

The procedures described in detail in the FSP, Groundwater Investigation, must be followed when collecting groundwater data. As described in the FSP, Groundwater Investigation, HydroPunch exploratory borings must be made to locate the leading edge of the groundwater contamination. The locations of the first four HydroPunch exploratory borings must be as follows: B-1 will be approximately 300 feet west of well MW-1; B-2 must be approximately 300 feet north of well MW-11A; B-3 must be approximately 300 feet north of well MW-12A; and B-4 must be approximately 300 feet east of well MW-12A. These locations have been chosen based on previous sampling results and the results of contaminant transport modeling conducted in 1990.

The contaminant transport modeling estimated that the EDB contaminated groundwater migrates within the S-1 groundwater zone at a rate of less than 80 feet/year (ft/yr) and within the S-2 groundwater zone at a rate of less than 35 ft/yr. Previous sampling results indicate that these estimates are reasonable. EDB was detected in samples collected from well MW-7A in 1987 and not detected in well MW-11A until 1992. These analytical results indicate that the EDB contaminated groundwater migrated approximately 375 feet in 5 years, which is at a rate of approximately 75 ft/yr. Since it appears as though the EDB contaminated groundwater migrates at a faster rate in the S-1 groundwater zone, this zone has been used to predict the boundary of the contamination for the locations of the first four borings.

Each boring must be drilled to the S-1 and S-2 groundwater zones and groundwater samples must be extracted from each groundwater zone using a HydroPunch sampling tool for chemical analysis. The stratigraphic and chemical data from each preceding boring must be used to adjust the depth and location of the next boring.

If contaminants are detected in samples collected from the S-1 and S-2 groundwater zones, that boring must not be advanced to the A-1 aquifer. If contaminants are not detected, the borings that define the leading edges of the carbon tetrachloride/pesticide contaminated groundwater in the S-1 and S-2 zones must be advanced to the A-1 aquifer and groundwater extracted for chemical analysis. If concentrations in the A-1 aquifer are less than the Federal maximum contaminant levels (MCLs) for EDB and carbon tetrachloride, the boring will be considered as representing the leading edge of the contaminated groundwater. If concentrations in the A-1 aquifer are greater

than the MCLs, additional borings will be drilled to define the leading edge of all three water-bearing zones.

Based on the information collected during the HydroPunch survey, four specific areas for groundwater monitoring must be selected. Monitoring well clusters must be constructed at the northern and western leading edges of groundwater pesticide contamination, and at the northern and eastern leading edges of the groundwater carbon tetrachloride/pesticide contamination. Each well cluster must be composed of three wells, screened in the S-1, S-2, and A-1 units, respectively. Since these monitoring wells must be located beyond the area of groundwater contamination; they must serve as observation wells.

Following installation of the new wells, each well must be developed, and samples must be collected and submitted for the laboratory analyses. The analytical data must be compared to the initial water quality data for groundwater samples collected during exploratory HydroPunch drilling to confirm that the appropriate monitoring well cluster locations have been selected, and to form a baseline for future groundwater sampling at those locations.

In addition, three of the monitoring well borings to the A-1 aquifer must be continuously sampled and logged during drilling to define lithology between the ground surface and the A-1 aquifer. The exact sample depths must be designated by the geologist in the field based on changes in soil appearance. The lithologic characteristics of the soil samples and drill cuttings must be described and logged by a geologist in accordance with the Unified Soil Classification System (USCS).

1.1.3.4 DNAPL Confirmation and Plume Characterization

This section presents recommendations for monitoring well sump sediment sampling and analysis; multiple level groundwater sampling and analysis; and monitoring well installation, sampling, and decommissioning.

Monitoring Well Sump Sediment Sampling and Analysis. Wells X-1A and X-1B have well sumps that are 2 to 3 feet of blank casing with an end cap. These wells were installed in 1995 and therefore, accumulated sediments should not be very thick. A stainless steel bailer will be lowered to the bottom of these wells to collect sump sediments and liquids for testing. Testing will consist of UV fluorescence and Sudan IV dye-shaker tests. If no DNAPL is positively identified in either of these wells, similar sump sampling will be conducted in wells MW-7B and MW-7C.

Wells MW-7C and MW-7B were installed about 4 years after the disposal basin was closed in late 1983. At the time these wells were installed, a DNAPL released from the basin may have been mobile. If either MW-7B or MW-7C intercepted a DNAPL pool, the DNAPL may have entered

the well and flowed to the well sump. If this occurred, then the DNAPL will be present in the well sump, probably mixed with sediment. This situation makes these wells more likely to contain a DNAPL, but these wells were constructed with sumps that are 10 feet deep and well screens with 0.040-inch openings. The large screen openings likely permitted a fairly large amount of silt and clay to enter the well, and the deep sumps allow a deep column of these sediments to accumulate. Therefore, if initial soundings for total well depth indicate less than four feet of sediment are present, a stainless steel bailer will be used to collect sump sediments. If more than four feet of accumulated sediments are present, the sump materials will be sampled with piston coring equipment.

In the event any of the sampled well sumps contain a DNAPL that can be positively identified by UV fluorescence or Sudan IV, the investigation will be concluded and a sample of the DNAPL containing sediments will be submitted for VOC analysis. If DNAPL is not identified in the four well sump sediment samples, then multiple level groundwater sampling and analysis will be conducted.

Multiple Level Groundwater Sampling and Analysis. If DNAPL is not identified as discussed above, groundwater sampling using DMLS will be conducted in order to determine if such high-concentration zones are present. The DMLS is a sampler designed to passively collect samples of groundwater as it flows horizontally across a well screen. DMLS permits sampling at discrete, thin depth intervals to assess the distribution of potential DNAPLs, and to measure the true maximum groundwater concentrations. For example, in well X-1B, where there has been up to 21,000 µg/l DCP, there is up to 20 feet of saturated well screen. If DNAPL is present near this well, it is likely that there is a thin zone (1 to 5 feet) that is supplying very high DCP concentrations to the well as it is pumped, and the remainder of the saturated zone supplies much lower DCP concentrations. The 21,000 µg/l represents an average concentrations across the entire screen zone. DMLS permits sampling at discrete, thin depth intervals to assess the distribution of potential DNAPLs, and to measure the true maximum groundwater concentrations.

Wells X-1A, MW-7C, and OW-4B are proposed for sampling with the DMLS. Well X-1A is an S-1 zone well located within the EDB plume. Well MW-7C is an S-2 zone well in the plume, and has historically contained some of the highest concentrations of dissolved pesticides. Well OW-4B, located in the carbon tetrachloride plume, contains. the highest concentrations of dissolved carbon tetrachloride (300 µg/l). Each well will be sampled at 1-foot intervals along 10 feet of the well screen. A total of thirty investigative samples will be collected.

Information obtained with the DMLS sampling will not unequivocally answer whether DNAPL is present, but it will provide much stronger inferential data for the presence, nature, and extent of a DNAPL.

Monitoring Well Installation, Sampling, and Decommissioning. The groundwater flow direction in the S-1 and S-2 zones is to the north, based on numerous rounds of groundwater elevation data collected from 1985 through 1997, as well as the plume configuration in these zones. The groundwater chemistry data from HydroPunch™ sampling done during the remedial investigation indicate that the leading edge of the pesticide and carbon tetrachloride plumes extend farther north than the OW-2 and OW-3 well clusters. Similarly, although the previously HydroPunch™ sampling delineated the eastern extent of carbon tetrachloride, there is no monitoring well cluster located to delineate the eastern edge of the plume. To address these data gaps, six additional groundwater sampling locations are proposed. The six locations are designated OW-5, OW-6, OW-7, OW-8, OW-9, and OW-10. At each location, three wells will be installed, one well in each of the S-1 and S-2 zones and one in the A-1 aquifer, Figure 1-5a.

Well cluster OW-5 will be located approximately 550 feet northwest of the OW-2 well cluster. The OW-5 site was selected to accommodate some uncertainty in groundwater flow directions in the three water-bearing zones in the region beyond OW-2. In other words, groundwater flow directions may change from north to northwest in the area beyond OW-2, and the OW-5 wells will provide plume delineation in that direction.

The OW-6 well cluster will be located approximately 725 feet north of the OW-2 well cluster. The site was selected because the plume's northern extent in 1995 was likely near previous boring B5, based on the very low pesticide concentrations detected in the S-1 and S-2 zones and the A-1 aquifer. It is anticipated that the groundwater at proposed location OW-6 will not be affected by the site-related pesticides in any of the upper water-bearing zones.

The OW-7 well cluster will be located approximately 900 feet northeast of the OW-3 well cluster. This well cluster is intended to delineate the northern extent of the carbon tetrachloride plume in the S-1, S-2, and A-1 zones.

The OW-8 well cluster will be located approximately 550 feet east of OW-4. The OW-8 wells will be used to delineate and monitor the eastern extent of the carbon tetrachloride plume.

The OW-5 and OW-6 wells will be installed, developed, and sampled so that analytical results will be available during the field program. The OW-9 wells, to be located 400 to 500 feet northwest from the OW-5 cluster, will be installed only if the OW-5 wells contain concentrations of any pesticide above the maximum contaminant level (MCL). Similarly, the OW-10 wells will be installed if the OW-6 wells contain pesticide concentrations above MCLs. The OW-10 wells will be located on Alhambra Avenue, approximately 400 to 500 feet north of the OW-6 wells.

The rationale for the well siting is that monitoring wells at these locations will satisfy the need to delineate the pesticide plume and the carbon tetrachloride plume in the S-1, S-2, and A-1 zones to

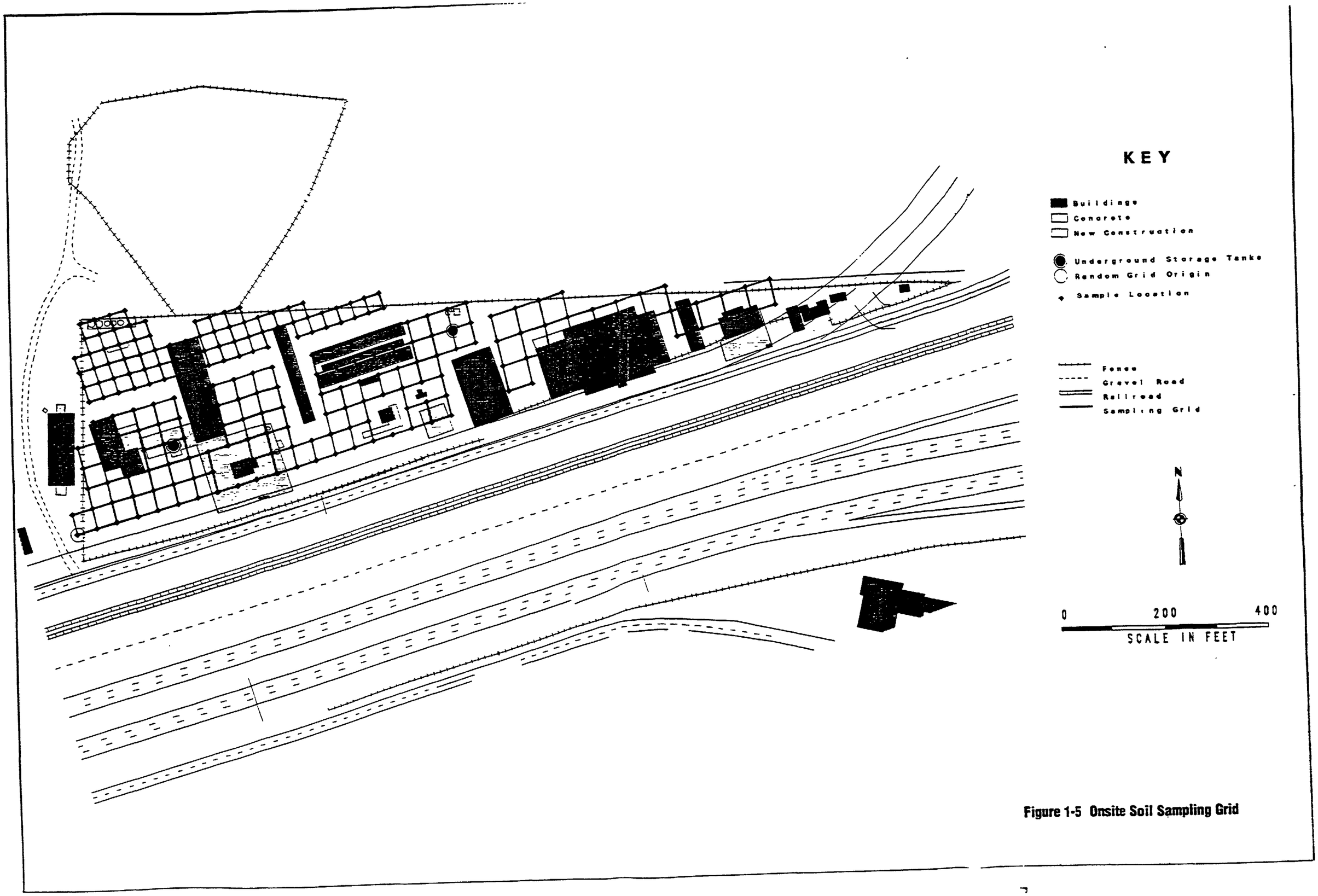
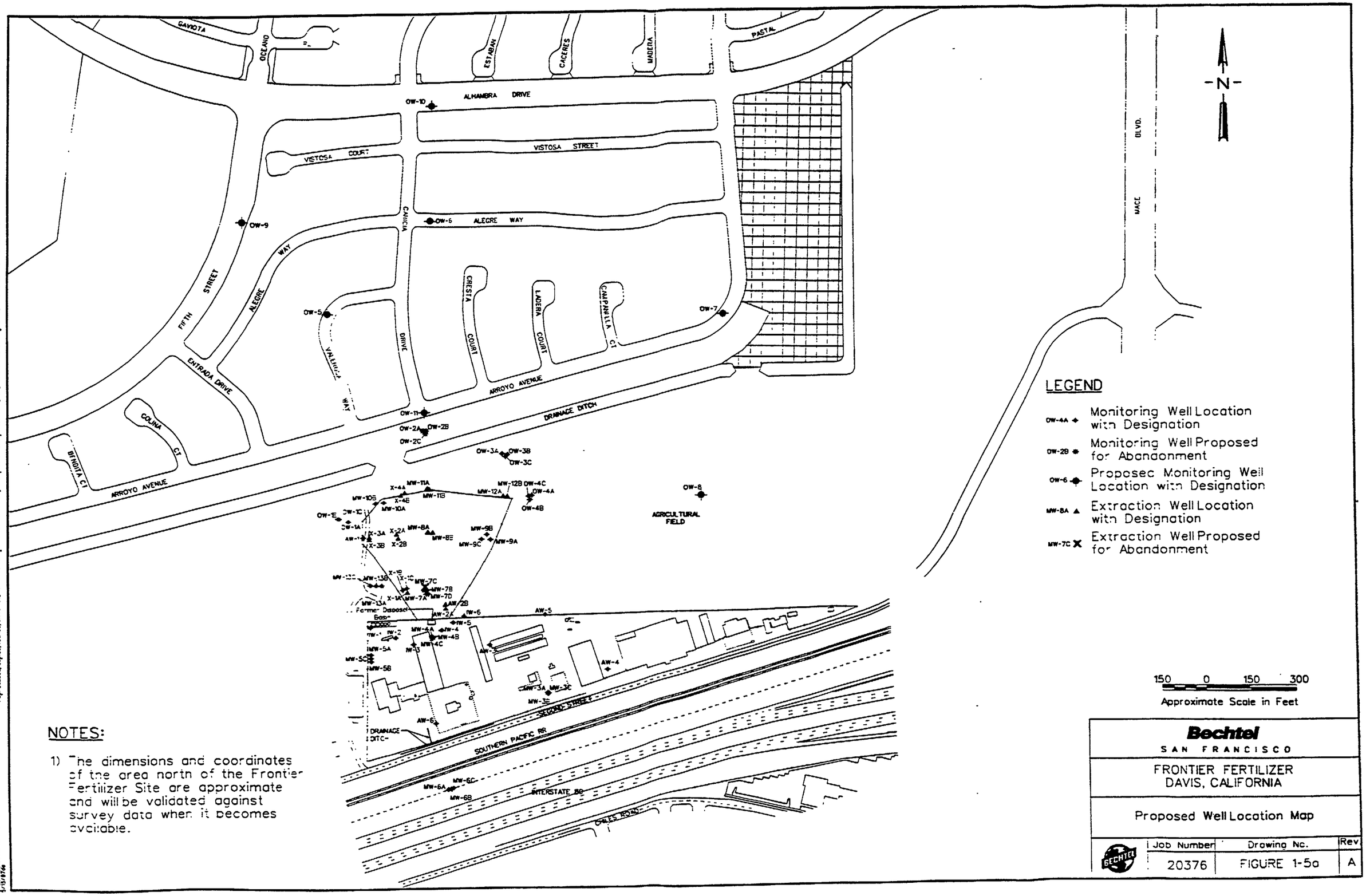


Figure 1-5 Onsite Soil Sampling Grid



NOTES:

1) The dimensions and coordinates of the area north of the Frontier Fertilizer Site are approximate and will be validated against survey data when it becomes available.

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DAVIS, CALIFORNIA

Proposed Well Location Map

Job Number	Drawing No.	Rev
20376	FIGURE 1-5a	A

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concentrations at or below MCLs. These wells will also serve as sentinel wells or guard wells to monitor groundwater conditions between the site and the nearest municipal water supply wells. The placement of the sentinel wells is such that there will be sufficient time to respond before any Frontier Fertilizer contaminants can reach the water supply wells. There are two water supply wells of concern. One is located approximately 5,000 feet northwest of the Frontier Fertilizer site and one well is located approximately 3,000 feet north of the site.

The first four well clusters, drilled in the sequence indicated by the assigned numbers, will be used to define the "leading edge" of the pesticide-contaminated groundwater and carbon tetrachloride/pesticide-contaminated groundwater in the S-1 and S-2 groundwater zones. The leading edge is defined by EDB and carbon tetrachloride concentrations less than or equal to their MCLs of 0.05 µg/l and 0.5 µg/l, respectively.

Following installation of the wells, each well will be developed and sampled and the samples will be analyzed as described in Section 3.2. Each monitoring well in the clusters will have a unique well identification number. The location name will be appended with either the letter A, B, or C for the S-1, S-2, and A-1 zones, respectively.

Each groundwater sample collected will be analyzed for EDB and DBCP using EPA Method 504 to achieve a detection limit of 0.05 µg/l and by CLPAS VOCs plus EDB and DBCP using a 25 ml purge volume. The analyses will be used to characterize the concentration of pesticides and carbon tetrachloride in groundwater at each monitoring well location. Specific conductance, pH, and temperature will also be measured in the field for every groundwater sample collected.

1.1.3.5 Soil Gas and Flux Chamber Sampling

To evaluate the average soil-gas concentration and the average contaminant soil-gas flux in the former disposal basin area, 10 soil-gas borings will be drilled and 10 soil-gas samples collected in the approximately half acre area. These samples will be collected on a regular square grid designed, with randomly selected origin coordinates, to cover the full half acre (see Figure 1-5b). Samples will be collected from 5 feet below ground surface.

In addition to the samples in the disposal basin area, samples will be collected along a north-south transect originating in the disposal basin area. Initially, soil-gas samples will be collected along this transect at 50-foot intervals. If the soil-gas samples contain contaminants of concern at concentrations above one hundred times the associated ambient air PRG, then a soil-gas flux chamber sample will be collected at the same location. If a soil-gas sample does not contain contaminants of concern at concentrations above one hundred times the associated ambient air PRG, then no flux sample will be collected at that location. Soil-gas and flux chamber sampling

will be analyzed for contaminates of concern via Method TO-14. The samples will be analyzed by a Bechtel subcontract laboratory.

1.2 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

For each environmental measurement, the following sections describe the required measurement parameters, samples matrices, and applicable action levels. As applicable, a discussion is provided of the summary statistics which must be used when comparing measured data to action levels. A discussion is also provided that addresses the precision, accuracy, representativeness, completeness, and comparability (PARCC) goals for each measurement. When necessary, decisions regarding appropriate data evaluation criteria will be made by the EPA remedial project manager and EPA risk assessor assigned to Frontier Fertilizer.

1.2.1 Data Requirements and Decision Levels

Tables 1-4 through 1-10 present the lists of analytes that must be determined during quarterly groundwater monitoring, the soil and groundwater investigations, the DNAPL confirmation and plume characterization, and the soil-gas and flux chamber sampling. These tables include VOCs plus EDB and DBCP for water; VOCs plus EDB and DBCP for soil; organochlorine, organophosphorus, and carbamate/urea pesticides for soil; total recoverable petroleum hydrocarbons for soil; and VOCs for soil-gas and soil flux samples: and VOCs plus EDB and DBCP in well sump sediment.

Each table lists the target analyte and the contract-required quantitation limit (CRQL) associated with the analytes available for the analytical method selected. The tables also list maximum contaminant levels (MCLs) for water and PRGs. These tables indicate if each analyte is a carcinogen or a non-carcinogen (NC). The PRGs associated with each of the Frontier Fertilizer target analytes must be used as the decision criteria to evaluate the human-health risks. Groundwater must be evaluated against the human health risk associated with eventual residential use and soil must be evaluated against the human health risk associated with industrial use. Soil gas and flux data must be evaluated agains the human health risk associated with exposure to ambient air.

The analytical methods and required quantitation limits selected provide data consistent with and comparable to data collected by the EPA in September and October 1993. The analytical methods and required quantitation limits enable evaluation of whether the contamination levels at the site are below or above the published PRG. The Region 9 PRGs focus on dominant exposure pathways and may not consider all exposure pathways encountered at Frontier Fertilizer. They do not consider impact to groundwater or address ecological concerns. The Region 9 PRGs are specifically not intended as a (1) stand-alone, decision-making tool; (2) substitute for EPA guidance for preparing baseline risk assessments; (3) source of site-specific cleanup levels; or (4) rules to determine if a waste is hazardous under RCRA.

Table 1-4
Determination of Volatile Organic Compounds in Groundwater Investigation Samples – FASP Method 504

Volatile Organic Compound	Carcinogen (c) or Non-carcinogen* (nc)	CAS Number	Lowest Available FASP CRQL (µg/l)	Federal Maximum Contaminant Level† (µg/l)	PRG (µg/l)*
1,2-Dibromoethane	c	106-93-4	0.05	0.05	0.00076
1,2-Dibromo-3-chloropropane	c	96-12-8	0.05	0.2	0.048

*Region 9 Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† 40 code of Federal Regulations Part 141.61.

Table 1-5
Determination of Volatile Organic Compounds in Quarterly Groundwater Monitoring Samples, DMLS Groundwater Samples, and Plume Characterization Groundwater Samples by Contract Laboratory Program Analytical Services TCL VOCs plus EDB and DBCP

Volatile Organic Compound	Carcinogen (c) or Non-carcinogen* (nc)	CAS Number	Lowest Available CRQL (µg/l)	Federal Maximum Contaminant Levels† (µg/l)	PRG (µg/l)*
Methylene Chloride	c	75-09-2	1	na	4.3
1,1-Dichloroethene	c	75-35-4	1	na	0.046
1,1-Dichloroethane	nc	75-34-3	1	5.0††	810
Chloroform	c	67-66-3	1	na	0.16
1,2-Dichloroethane	c	107-06-2	1	5.0	0.12
1,1,1-Trichloroethane	nc	71-55-6	1	200	1300
Carbon Tetrachloride	c	56-23-5	1	5.0	0.17
Bromodichloromethane	c	75-27-4	1	na	0.18
1,2-Dichloropropane	c	78-87-5	1	5.0	0.16
1,3-Dichloropropane	c	na	1	na	na
cis-1,3-Dichloropropene	c	10061-01-5	1	na	0.081
Trichloroethene	c	79-01-6	1	na	1.6
Dibromochloromethane	c	124-48-1	1	na	1
1,1,2-Trichloroethane	c	79-00-5	1	5.0	0.2
Benzene	c	71-43-2	1	5.0	0.39
trans-1,3-Dichloropropene	c	10061-02-6	1	na	0.081
Bromoform	c	75-25-2	1	na	8.5
Tetrachloroethene	c	127-18-4	1	na	1.1
Toluene	nc	108-88-3	1	1.0	720
1,1,2,2-Tetrachloroethane	c	79-34-5	1	1.0††	0.055
Chlorobenzene	nc	108-90-7	1	na	39
Ethylbenzene	nc	100-41-4	1	700	1300
Styrene	nc	100-42-5	1	100	1600
Xylenes (total)	nc	1330-20-7	1	10,000	1400
1,2-Dibromoethane	c	106-93-4	1	0.05	0.00076
1,2-Dibromo-3-chloropropane	c	96-12-8	1	0.2	0.048

*Region 9 Tap Water Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† 40 code of Federal Regulations Part 141.61.
†† Title 22 California Code of Regulations Part 6444.5
na = not available

Table 1-6
Determination of Volatile Organic Compounds in Soil Samples by FASP SOP F93001

Volatile Organic Compound	Carcinogen (c) or Non-carcinogen* (nc)	CAS Number	Lowest Available CRQL (µg/kg)	PRG (µg/kg)*
Chloromethane	c	74-87-3	10	6,100
Bromomethane	nc	74-83-9	10	79,000
Vinyl Chloride	c	75-01-4	10	3.5
Chloroethane	c	75-00-3	10	22†
Methylene Chloride	c	75-09-2	2	11,000
1,1-Dichloroethene	c	75-35-4	2	120
1,1-Dichloroethane	nc	75-34-3	2	3,900,000
Chloroform	c	67-66-3	2	1,600
1,2-Dichloroethane	c	107-06-2	2	1,400
1,1,1-Trichloroethane	nc	71-55-6	2	3,000,000
Carbon Tetrachloride	c	56-23-5	2	1,500
Bromodichloromethane	c	75-27-4	2	4,600
1,2-Dichloropropane	c	78-87-5	2	2,100
cis-1,3-Dichloropropene	c	10061-01-5	2	1,600
Trichloroethene	c	79-01-6	2	7,300
Dibromochloromethane	c	124-48-1	2	23,000
1,1,2-Trichloroethane	c	79-00-5	2	1,500
Benzene	c	71-43-2	2	4,400
trans-1,3-Dichloropropene	c	10061-02-6	2	1,600
Bromoform	c	75-25-2	2	240,000
Tetrachloroethene	c	127-18-4	2	18,000
Toluene	nc	108-88-3	2	2,700,000
1,1,2,2-Tetrachloroethane	c	79-34-5	2	1,200
Chlorobenzene	nc	108-90-7	2	810,000
Ethylbenzene	nc	100-41-4	2	3,100,000
Styrene	nc	100-42-5	2	2,200,000
Xylenes (total)	nc	1330-20-7	2	980,000
1,2-Dibromoethane	c	106-93-4	2	22
1,2-Dibromo-3-chloropropane	c	96-12-8	2	1,400

*Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† PRG for 1.2-Dibromoethane used in absence of compound specific PRG.

Table 1-7
Carbamate/Urea Pesticides for Determination in Soil by EPA Method 632

Carbamate and Urea Pesticides	Carcinogen (c) or Non-carcinogen* (nc)	CAS Number	Lowest Available CRQL (ng/m³) (cubic meter)	PRG (ng/m³)* (cubic meter)
Aminocarb	nc	2032-59-9	70	1,400,000†
Barban	nc	101-27-9	330	1,400,000 †
Carbaryl	nc	63-27-2	13	68,000,000
Carbofuran	nc	1563-66-2	33	3,400,000
Chlorpropham	nc	101-21-3	70	13,000,000
Diuron	nc	330-54-1	20	1,400,000
Fenuron/Fenuron-TCA*	nc	101-42-8/4482-55-7	33	1,400,000 †
Fluometuron	nc	2164-17-2	170	8,900,000
Linuron	c	330-55-2	330	1,400,000
Methiocarb	nc	2032-65-7	330	1,400,000 †
Methomyl	nc	16752-77-5	130	17,000,000
Mexacarbate	nc	315-18-4	70	1,400,000 †
Monuron/Monuron-TCA*	nc	150-68-5/140-41-0	20	1,400,000 †
Neburon	nc	555-37-3	33	1,400,000 †
Oxamyl	nc	23135-22-0	130	17,000,000
Propham	nc	122-42-9	330	14,000,000
Propoxur	nc	114-26-1	330	1,400,000 †
Siduron	nc	1982-49-6	130	1,400,000 †
Swep	nc	1918-18-9	130	1,400,000 †

*Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† PRG for Diuron used in absence of compound specific PRG.

Table 1-8
Organophosphorus Pesticides for Determination in Soil by EPA Method 8141

Organophosphorus Pesticides	Carcinogen (c) or Non-Carcinogen (nc)	CAS Number	Lowest Available CRQL (µg/kg)	PRG (µg/kg)*
Azinphos methyl	nc	86-50-0	50	6,600 †
Bolstar (Sulprofos)	nc	35400-43-2	35	6,600 †
Chlorpyrifos	nc	2921-88-2	50	2,000,000
Coumaphos	nc	56-72-4	100	6,600 †
Demeton, O,S	nc	8065-48-3	60	27,000
Diazinon	nc	333-41-5	100	610,000
Dichlorvos	c	62-73-7	400	6,600
Dimethoate	nc	60-51-5	130	140,000
Disulfoton	c	298-04-4	35	27,000
EPN	nc	2104-64-5	20	6,600 †
Ethoprop	nc	13194-48-4	100	6,600 †
Fensulfothion	nc	115-90-2	40	6,600 †
Fenthion	nc	55-38-9	50	6,600 †
Malathion	nc	121-75-5	55	14,000,000
Merphos	nc	150-50-5	100	20,000
Mevinphos	nc	7786-34-7	250	6,600 †
Naled	nc	300-76-5	250	1,400,000
Parathion-ethyl	nc	56-38-2	30	6,600 †
Parathion-methyl	nc	298-00-0	60	6,600 †
Phorate	nc	298-02-2	20	140,000
Ronnel	nc	299-84-3	35	34,000,000
Sulfotep	nc	3689-24-5	35	6,600 †
TEPP	nc	21646-99-1	400	6,600 †
Stirophos (Tetrachlorovinphos)	nc	22248-79-9	400	6,600 †
Tokuthion (Protothiofos)	nc	34643-46-4	55	6,600 †
Trichloronate	nc	327-98-0	400	6,600 †

*Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† PRG for Dichlorous used in absence of compound specific PRG.

Table 1-9
Organochlorine Pesticides and Polychlorinated Biphenyls for Determination in Soil by FASP SOP F93006

Organochlorine Pesticides and Polychlorinated Biphenyls	Carcinogen (c) or Non-carcinogen (nc)*	CAS Number	Lowest Available FASP CRQL (µg/kg)	PRG (µg/kg)*
alpha-BHC	c	319-84-6	50	300
beta-BHC	c	319-85-7	50	1,100
delta-BHC	c	319-86-8	50	110 †
gamma-BHC (Lindane)	c	58-89-9	50	1,500
Heptachlor	c	76-44-8	50	420
Aldrin	c	309-00-2	50	110
Heptachlor epoxide	c	1024-57-3	50	210
Endosulfan I	c	959-98-8	50	34,000
Dieldrin	c	60-57-1	100	120
4,4'-DDE	c	72-55-9	100	5,600
Endrin	nc	72-20-8	100	200,000
Endosulfan II	nc	33213-65-9	100	34,000
4,4'-DDD	c	72-54-8	100	7,900
Endosulfan sulfate	c	1031-07-8	100	110 †
4,4'-DDT	c	50-29-3	100	5,600
Methoxychlor	nc	72-43-5	500	3,400,000
Endrin Ketone	c	53494-70-5	100	110 †
Endrin aldehyde	c	7421-93-4	100	110 †
alpha-Chlordane	c	5103-71-9	50	110 †
gamma-Chlordane	c	5103-74-2	50	110 †
Toxaphene	c	8001-35-2	5000	1,700
Aroclor-1016	nc	12674-11-2	1000	65,000
Aroclor-1221	c	11104-28-2	2000	340
Aroclor-1232	c	11141-16-5	1000	340
Aroclor-1242	c	53469-21-9	1000	340
Aroclor-1248	c	12672-29-6	1000	340
Aroclor-1254	c	11097-69-1	1000	340
Aroclor-1260	c	11096-82-5	1000	340

* Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† PRG for Aldrin used in absence of compound specific PRG

Table 1-10
Total Petroleum Hydrocarbons Determination in Soil

Compound	CAS Number	*Lowest Available CRQL* (mg/kg)	PRG (µg/l)
Total Petroleum Hydrocarbon	14280-30-9	1	na

Table 1-10a
Determination of Volatile Organic Compounds in Well Sump Sediment by CLPAS VOCs EDB and DBLP

Volatile Organic Compound	Carcinogen (c) or Non-carcinogen* (nc)	CAS Number	Lowest Available CRQL (µg/kg)	PRG (µg/kg)*
Chloromethane	c	74-87-3	10	6,100
Bromomethane	nc	74-83-9	10	79,000
Vinyl Chloride	c	75-01-4	10	3.5
Chloroethane	c	75-00-3	10	22†
Methylene Chloride	c	75-09-2	2	11,000
1,1-Dichloroethene	c	75-35-4	2	120
1,1-Dichloroethane	nc	75-34-3	2	3,900,000
Chloroform	c	67-66-3	2	1,600
1,2-Dichloroethane	c	107-06-2	2	1,400
1,1,1-Trichloroethane	nc	71-55-6	2	3,000,000
Carbon Tetrachloride	c	56-23-5	2	1,500
Bromodichloromethane	c	75-27-4	2	4,600
1,2-Dichloropropane	c	78-87-5	2	2,100
cis-1,3-Dichloropropene	c	10061-01-5	2	1,600
Trichloroethene	c	79-01-6	2	7,300
Dibromochloromethane	c	124-48-1	2	23,000
1,1,2-Trichloroethane	c	79-00-5	2	1,500
Benzene	c	71-43-2	2	4,400
trans-1,3-Dichloropropene	c	10061-02-6	2	1,600
Bromoform	c	75-25-2	2	240,000
Tetrachloroethene	c	127-18-4	2	18,000
Toluene	nc	108-88-3	2	2,700,000
1,1,2,2-Tetrachloroethane	c	79-34-5	2	1,200
Chlorobenzene	nc	108-90-7	2	810,000
Ethylbenzene	nc	100-41-4	2	3,100,000
Styrene	nc	100-42-5	2	2,200,000
Xylenes (total)	nc	1330-20-7	2	980,000
1,2-Dibromoethane	c	106-93-4	2	22
1,2-Dibromo-3-chloropropane	c	96-12-8	2	1,400

*Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) Second Half 1994, Stanford Smucker, August 1, 1994.
† PRG for 1,2-Dibromoethane used in absence of compound specific PRG.

Table 1-10b
Determination of Volatile Organic Compounds in Soil Gas and Flux Chamber Samples by Method TO-14

Volatile Organic Compound	Carcinogen (c) or Non-carcinogen (nc)	CAS Number	Lowest Available CRQL µg/m³	Ambient Air PRG* (µg/m³)
Benzene	c	71-43-2	0.08	0.23
Bromodichloromethane	c	75-27-4	0.017†	0.11
Bromoform	c	75-25-2	0.08	1.7
Bromomethane	nc	74-83-9	0.28	5.2
Carbon tetrachloride	c	56-23-5	0.013†	0.13
Chlorobenzene	nc	108-90-7	0.19	21
Chloroform	c	67-66-3	0.01†	0.084
1,2-Dibromo-3-chloropropane	c	96-12-8	0.08	0.21
1,2-Dibromoethane	c	106-93-4	0.008†	0.0087
1,2-Dichlorobenzene	nc	95-50-1	0.4	210
1,4-Dichlorobenzene	c	106-46-7	0.04†	0.28
1,2-Dichloroethane	c	107-06-2	0.008†	0.074
1,1-Dichloroethane	nc	75-34-3	0.08	520
1,1-Dichloroethene	c	75-35-4	0.03†	0.038
1,2-Dichloropropane	c	78-87-5	0.01†	0.099
cis-1,3-Dichloropropene	c	10061-01-5	0.025†	0.052
trans-1,3-Dichloropropene	c	10061-02-6	0.025†	0.052
Methylene chloride	c	75-09-2	0.18	4.1
Tetrachloroethene	c	127-18-4	0.14	3.3
Toluene	nc	108-88-3	0.40	400
1,1,1-Trichloroethane	nc	71-55-6	0.06	1,000
1,1,2-Trichloroethane	c	79-00-5	0.06	0.12

Table 1-10b (Cont'd)
Determination of Volatile Organic Compounds in Soil Gas and Flux Chamber Samples by Method TO-14

Volatile Organic Compound	Carcinogen (c) or Non-carcinogen* (nc)	CAS Number	Lowest Available CRQL µg/m³	Ambient Air PRG* (µg/m³)
Trichloroethene	c	79-01-6	0.06	1.1
1,2,3-Trichloropropane	c	96-18-4	0.008†	0.00096
Vinyl chloride	ca	75-01-4	0.016†	0.022
Xylene (total)	nc	1330-20-7	0.31	730

*Region 9 Industrial Soil Preliminary Remediation Goals (PRGs), Stanford Smucker, August 1, 1996.
†Indicates that Lowest Available CRQL is associated with GC/MS operated in the selected ion mode other wise CRQLs are for GC/MS operated in the standard mode.

It is evident from Table 1-4 that the lowest available CRQLs exceed the Region 9 PRGs for 40 percent of the compounds on the groundwater analyte list. Since the laboratory may attain lower instrument detection limits, the significance of this discrepancy will be fully evaluated using the actual analytical results and the associated instrument detection limits reported by the laboratory. The results of this evaluation may lead to a decision to use MCLs as evaluation criteria for analytes where it is technically impossible to measure concentrations near the PRG.

1.2.2 Decision Criteria and Acceptable Level of Confidence

During the soil and groundwater investigations, there are three questions that must be answered:

- Has an analyte been detected at concentrations above the PRG?
- Does the mean of the cumulative risk of target analytes exceed 1×10^{-6} for groundwater and 1×10^{-6} for soil? and
- Have additional sources (hot spots) of contamination been detected?

As stated in Section 1.1.3.2 and in the FSP, Soil Investigation, soil sampling grids will be established in zones based on the likelihood of finding contamination to search for undiscovered areas of soil contamination (hot spots). As specified by the EPA, a probability of not locating a hot spot of 20 percent and a confidence of locating a hot spot of 80 percent have been used to establish the grid spacing in each zone. In areas of the site presumed clean (50-foot grid), the plan will ensure that all potential circular hot spots with a radius greater than 25 feet will be detected at the 80 percent confidence level. In areas of suspected contamination, the sampling plan will provide a 80 percent level of confidence that all potential circular hot spots with a radius greater than 20 feet (40-foot grid area) and 15 feet (30-foot grid area) will be detected. See *Statistical Methods for Environmental Pollution Monitoring,* Gilbert, R. O., Van Nostran Reinhold, New York, 1987.

Site surface soils will also be evaluated to ensure that contamination has not been distributed across the site by wind and/or by surface water. The same three zones will be used in the same manner as established for the hot spot search grid. Each analyte concentration will be converted to a fraction of the PRG for that analyte. This is the fraction of the risk (or risk index, RI) that the analyte represents. All of the RIs will be added for each sample. The result is a cumulative risk index (CRI) for that sample. Each zone must be evaluated to assess if the mean of the CRI for all the surface soil samples taken in that zone is ≤ 1 at the 90 percent confidence level. If the mean is ≤ 1 but the confidence level is not 90 percent, additional samples may have to be taken to

Table 1-11
Precision, Accuracy, and Completeness Goals

Measurement	Precision (Total*/ Analytical**)	Accuracy (Total*/ Analytical**)	Completeness
VOCs plus EDB and DBCP in Water	±40/±30%†	na/60-140%††	90% (Quarterly GW) 95% (GW Investigation)
VOCs plus EDB and DBCP in Soil	±60%/±50%†	60-135%/65-130%††	95%
Organochlorine Pesticides in Soil	±50%/±30%†	45-140%/50-135%††	95%
Organophosphorus Pesticides in Soil	±50%/±30%†	na/65-135%††	95%
Carbamate/Urea Pesticides in Soil	±50%/±30%†	na/50-135%††	95%
TRPH in Soil	±50%/±30%†	na/65-135%††	95%
VOCs plus EDB and DBCP in Well Sump Sediment	±60%/±50%†	60-135%/65-130%††	95%
VOCs Soil Gas and Flux Chamber Samples	±60%/±50%†	60-135%/65-130%††	95%
pH in Water	±0.2 S.U.	na	100%
Temperature in Water	±1°C	na	100%
Conductivity in Water	±10 µohms	na	100%
Depth to Water	±0.1 foot	na	100%

* Measured using field QC samples
** Measured using laboratory QC samples
† Measured as relative percent difference between duplicate samples
†† Measured as percent recovery of the compound from a spiked solution
na not applicable
S.U. Standard Units

raise the confidence level that the mean is ≤1. See *Methods for Evaluating the Attainment of Cleanup Standards,* EPA 230/02-89-042, EPA, 1989. If the CRI is > 1, but less than 3, an evaluation must be performed again using only those analytes that are carcinogenic. For those analytes that do not currently have established PRGs, the lowest PRG available for the other analytes of that analyte group will be used.

Decisions for the groundwater investigation, soil investigation, USTs, biased, offsite, soil-gas, and sump samples will be based on whether an analyte has been detected. Analytical methods have been selected based on their associated CRQL for the target analytes. The ability of a laboratory to attain the CRQLs must be determined by each laboratory statistically at the 97 percent confidence level. Since the current objective of the quarterly groundwater monitoring program is to evaluate trends in contaminant concentration and groundwater level, a statistical approach to data analysis is not required.

1.2.3 PARCC Parameters

The quantitative analytical precision, accuracy, and completeness goals for each measurement parameters determined during quarterly groundwater monitoring, the groundwater investigation and the soil investigation are presented in Table 1-11. The goals for each analytical group of measurements are based on the requirements of analytical methods; as such, they do not represent allowable total measurement uncertainty (analytical plus sampling). Total analytical precision, accuracy, and completeness goals (analytical plus sampling) are also established and must be evaluated based on field QC results (duplicates and spikes). While goals are established for total measurement precision, accuracy, and completeness, professional judgment will be used to determine if data should be qualified based solely on field QC results.

1.2.3.1 Precision

Sampling precision (total precision) must be evaluated by analysis of field duplicate samples. Analytical precision will be evaluated by analysis of matrix spike duplicates. The precision of pH, temperature, conductivity, and water depth measurements will not be independently assessed. The precision of these measurements must be assured by following manufacturers instruction on the use of each instrument, including all calibration requirements and a review of field data for consistency.

1.2.3.2 Accuracy

Sampling accuracy (total accuracy) will not be evaluated for groundwater. Total accuracy must be evaluated for soil analyzed by the FASP laboratory through the use of soil samples spiked with

site specific contaminants of concern at or near the CRQL. These samples may be independently prepared performance evaluation (PE) samples or spiked site soils. Analytical accuracy must be evaluated by analysis of matrix spike samples. The accuracy of pH, temperature, conductivity, and water depth measurement will not be independently assessed. The accuracy of these measurements must be ensured by following the manufacturer's instructions on the use of each instrument, including all calibration requirements and a review of the field data for consistency.

1.2.3.3 Representativeness

For quarterly groundwater monitoring, the monitoring wells have been located and screened at depths to provide access to groundwater that represents each saturated zone beneath the site. For the HydroPunch groundwater investigation, samples will be taken from each saturated zone. Soil sample locations are specifically designed to be representative of site conditions. To ensure the representativeness of all samples collected, the procedures provided in the FSPs must be strictly followed.

1.2.3.4 Completeness

For quarterly groundwater monitoring, the required level of completeness is 100 percent, or one analytical result must be obtained for each parameter for each of the monitoring wells. The collection of duplicate samples at a rate of 1 per 10 routine samples provides for collection of 110 percent of the amount of valid data required. Therefore, the quarterly groundwater monitoring completeness goal is 90 percent, provided one analytical result is obtained for each parameter for each well. The required level of completeness for all other sampling activities is 95 percent based on the duplicate sample rate of 1 per 20 routine samples.

1.2.3.5 Comparability

The comparability of data will be assured by reporting data in consistent units as specified in Tables 1-1 through 1-10. In addition, the sampling and analytical methods required by this QAPjP are consistent with those used in previous rounds of groundwater sampling. Subsequent rounds of sampling and analysis should be performed in accordance with these same or equivalent procedures.

1.3 PROJECT ORGANIZATION

Figure 1-6 presents the principle personnel responsible for quarterly groundwater monitoring, soil investigation, and groundwater investigation at Frontier Fertilizer. Bechtel's work must be directed by EPA Work Assignment Manager (remedial project manager) in coordination with the EPA QAMS.

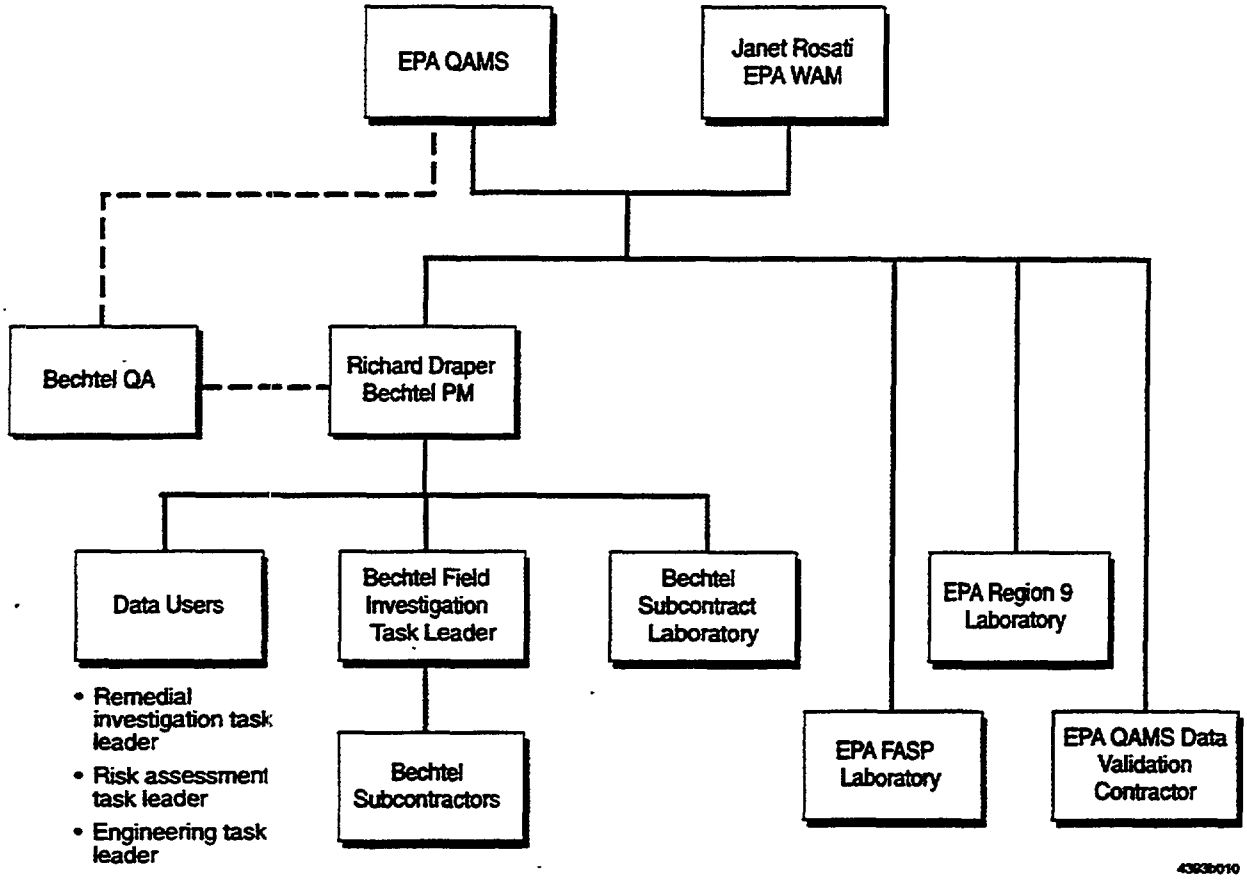

Figure 1-6 Principal Personnel Responsible for the Frontier Fertilizer Remedial Investigation

The Bechtel Project Manager, Richard Draper, is responsible for overseeing all sampling and for ensuring that samples are immediately provided to the onsite FASP laboratory, or shipped to the EPA Region 9 designated laboratory. Groundwater sampling must be performed by an EPA-approved Bechtel subcontractor and soils sampling must be performed by Bechtel field personnel and an EPA-approved Bechtel subcontractor under the direction of a Bechtel field engineer.

Validation of the Region 9 designated laboratory data must be performed by the EPA QAMS. Limited data review (verification, QC, and blank check) must be performed by FASP supervisory personnel. Validated data must be used by Bechtel's remedial investigation, risk assessment, and engineering task leaders to prepare their respective reports.

During phase II of the remedial investigation the EPA QA Program will be responsible for review and approval of work plans, for coordination of EPA Region IX analytical laboratory services and for validation of data. The EPA work assignment manager will be responsible for overseeing and directing Bechtel's work. During the phase II investigation, the Bechtel QA officer will be responsible for review and approval of work plans, for oversight of field work and laboratory subcontractor performance. The Bechtel PM will have overall responsibility for execution of the field work including direction of the Bechtel field task leader, Bechtel subcontract laboratory, and other Bechtel subcontractors.

Section 2

Measurement Procedures

Sample collection procedures are described in activity-specific FSPs. The following sections describe quality assurance requirements applicable to field sampling activities.

2.1 SAMPLE COLLECTION

Techniques and guidelines established in EPA references, such as *Test Methods for Solid Wastes,* SW-846, EPA, 1990; *Compendium of Superfund Field Operation Methods,* EPA, 1987; or guidance, such as the *Manual of Ground-water Quality Sampling Procedures,* NWWA, 1981, must be used as appropriate for each field activity. These guidelines must be used in the selection of sampling points, frequency, and number, and for selection of appropriate sampling equipment and methods. The following sections present sample collection requirements for each field activity.

2.1.1 Quarterly Groundwater Monitoring

Quarterly groundwater monitoring samples must be collected in accordance with the procedures and other requirements found in the FSP, Quarterly Monitoring Program.

2.1.2 Soil Investigation

Soil investigation samples must be collected in accordance with the procedures and other requirements found in the FSP, Soil Investigation.

2.1.3 Groundwater Investigation

Groundwater investigation samples must be collected in accordance with the procedures and other requirements found in the FSP, Groundwater Investigation.

2.1.4 DNAPL Confirmation and Plume Characterization

DNAPL confirmation and plume characterization samples must be collected in accordance with the procedures and other requirements found in FSP, DNAPL Confirmation and Plume Characterization.

2.1.5 Soil Gas and Flux Chamber Sampling

Soil gas and flux chamber sampling samples must be collected in accordance with the procedures and other requirements found in FSP, Soil Gas and Flux Chamber Sampling.

2.2 SAMPLE CUSTODY

The sample custody, handling, and shipment procedures found in each FSP must be followed through sample collection, transfer, analysis, and disposal to ensure that the integrity of samples is maintained. As specified in the FSPs, all samples must be collected in accordance with EPA Region 9 requirements; EPA chain-of-custody guidelines, as described in *U.S. EPA NEIC Policies and Procedures National Enforcement Investigations Center,* Denver, Colorado, Revised 1984; and procedures in *Sampler's Guide to the Contract Laboratory Program,* EPA 540/P-90/006, December 1990. Each FSP describes the forms, notebooks, and procedures used to record the exact location and ambient conditions associated with each sample collected. Sample documentation is provided, including sample labels, custody seals, and chain-of-custody forms.

2.3 ANALYTICAL AND QUALITY CONTROL PROCEDURES

Analyses performed by the EPA Region 9 designated laboratory must be in accordance with the EPA CLP Statement of Work (SOW) and applicable Client Request Forms. Analyses performed by the FASP laboratory must be in accordance with the EPA FASP SOW, applicable Client Request Forms, and FASP SOPs.

2.3.1 Analytes, Matrices, Analytical Procedures, and CRQLs

The following subsections present the analytes, matrices, analytical procedures and CRQLs required for analysis of quarterly groundwater samples, soil investigation samples, groundwater investigation samples, DNAPL and plume characterization groundwater samples, and soil gas and flux chamber samples.

2.3.1.1 Analysis of Quarterly Groundwater Monitoring Samples

Each quarterly groundwater monitoring sample must be analyzed as indicated by Table 1-3 for the VOCs listed in Table 1-5. The three required analytical procedures for quarterly monitoring are described below.

For monitoring wells MW-7A, MW-7B, and MW-7C, groundwater samples must be analyzed using the Contract Laboratory Program Analytical Services (CLPAS) for TCL VOCs plus EDB and DBCP by multi-media, multi-concentration SOW (OLM01.9, July 1993 revision), because previous groundwater sampling data indicated that EDB and DBCP were present in groundwater samples collected from these wells at concentrations up to 13,000 µg/l and 57 µg/l, respectively.

Therefore, the 25 ml purge method for VOCs, which lowers the CRQL for these compounds from 10 µg/l to 1 µg/l, is not required for samples collected from these wells.

For all monitoring wells except MW-7A, MW-7B, MW-7C, MW-2A, MW-2B, MW-6A, MW-6B, MW-6C, and the one new well, groundwater samples must be analyzed using the CLPAS for TCL VOCs plus EDB and DBCP by the 25 ml purge method because previous groundwater sampling data indicates that several VOCs were present in groundwater samples collected from these wells at concentrations below the CRQL specification of the CLPAS SOW. Therefore, the 25 ml purge method for VOCs, which lowers the CRQL from 10 µg/l to 1 µg/l, is required for samples collected from these wells.

If the concentration of EDB or DBCP is less than 1 µg/l for any groundwater samples analyzed by the 25 ml purge method, that sample must be re-analyzed for EDB and DBCP using EPA Method 504. EPA Method 504 has CRQLs for EDB and DBCP of 0.05 µg/l. These low CRQLs are required to obtain good quality data in the concentration range of interest to risk assessors.

2.3.1.2 Analysis of Soil Samples

As shown in Figure 1-5 and described in the FSP, Soil Investigation, soil samples must be collected from grid locations in three zones and at other selected onsite and offsite locations. Each sample must be analyzed as indicated by Table 1-3 for the VOCs and pesticides listed in Tables 1-6 through 1-10. The two analytical programs for site investigation soil analyses are described below.

The EPA onsite FASP laboratory must analyze all soil samples for VOCs plus EDB and DBCP and organochlorine pesticides. VOC analyses must be performed by FASP SOP F93001, *Analysis of Halogenated and Aromatic Volatile Organic Compounds in Soil and Water by Purge and Trap Gas Chromatography*, with second column confirmation for samples with detections of site TCL analytes. Organochlorine pesticide analyses must be performed by FASP SOP F93006, *Pesticide/PCB Analysis by Gas Chromatography*. Ten percent of samples analyzed by FASP SOP F93006 must be split and analyzed by the EPA Region 9 designated laboratory. Both detects and non-detects must be included in split samples.

The EPA Region 9 designated laboratory must analyze all soil samples for organophosorus pesticides by EPA Method 8141 and carbamate/urea pesticides by EPA Method 632. The Region 9 designated laboratory must also analyze bias and offsite soil samples for total petroleum hydrocarbons (TPH) as gasoline and diesel. Split samples received from the FASP laboratory must be analyzed for organochlorine pesticides by SW846 Method 8080A/8081S.

2.3.1.3 Analysis of Groundwater Samples

As described in the FSP, Groundwater Investigation, groundwater samples must be collected from HydroPunch borings to locate the edge of the contaminated groundwater. Each sample must be analyzed for the VOCs plus EDB, DBCP and carbon tetrachloride as listed in Tables 1-4 and 1-5. The analytical program for site investigation groundwater analysis is described below.

The EPA onsite FASP laboratory must analyze all groundwater samples, as indicated in Table 1-4, for VOCs plus EDB plus DBCP, and carbon tetrachloride. Analyses must be performed by FASP using a modified EPA Method 504.

2.3.1.4 Analysis of DNAPL Confirmation and Plume Characterization Samples

As described in the FSP, DNAPL Confirmation and Plume Characterization, well sump sediment samples must be collected from wells to confirm the presence of DNAPLs in the subsurface. Each well sediment sample must be field tested for a non-aqueous phase liquids. If DNAPL is confirmed, the samples must be analyzed for VOCs plus EDB, plus DBCP as listed in Table 1-10a. If no DNAPL is detected by field testing the well sump sediment samples, DMLS groundwater samples must be collected. One sample must be collected from each one-foot interval over a 10-foot length of screen. Each DMLS groundwater sample must be analyzed for VOCs plus EDB DBCP as listed in Table 1-5.

To characterize the pesticide plume in groundwater, wells in clusters OW-5 and OW-6 must be installed and sampled. Samples must be analyzed for CLPAS VOCs plus EDB and DBCP as in Table 1-4 and 1-5. Then, clusters OW-7, OW-8 and OW-9 must be installed and sampled. If EDB and carbon tetrachloride are detected at or above their MCLs in the samples from cluster wells OW-5 and OW-6, then cluster wells OW-10 and OW-11 will be installed and sampled. All groundwater analyses must be CLPAS VOCs plus EDB and DBCP using a 25 ml purge volume and by Method 504.

2.3.1.5 Analysis of Soil Gas and Flux Chamber Samples

As described in the FSP, Soil Gas and Flux Chamber Sampling, soil gas samples must be collected from 10 locations in the disposal basin area to measure average soil gas concentrations in the contaminated area. Then, soil gas samples must be collected every 50 feet along a north-trending transect of the disposal basin area to determine the soil gas concentration gradient. To measure the actual contaminant flux in soil gas to the ground surface, flux chamber samples will be collected at each of the 10 disposal basin area locations as well as at any transect location where VOCs are measured at or above 100 times the PRG concentrations. Each soil gas and flux chamber sample must be analyzed by Method TO-14 for the target compounds listed in

Table 1-10b. This target compound list represents groundwater contaminants of concern identified by the screen risk assessment presented in Bechtel's draft focus feasibility study, groundwater containment options. The ketones identified as chemicals of concern have been removed from the analyte list because they do not contribute significatnly to risk and they cannot be determined by Method TO-14.

2.3.2 Calibration and Preventative Maintenance

Laboratory analytical instruments and calibration and maintenance procedures must be provided in the FASP laboratory and EPA Region 9 designated laboratory SOPs applicable to the analyses being provided for this program. Field instrument calibrations must be performed as prescribed in procedures listed below:

2.3.2.1 Water Levels

Check electric probe against steel tape prior to first use and at least weekly during the field program.

2.3.2.2 pH

Check digital pH meter calibration daily in the field. Use laboratory-supplied buffer solutions (pH 4, 7, and 10) renewed daily in field to perform a two-point calibration check. Temperature corrections are applied during measurement.

2.3.2.3 Electrical Conductivity

Calibrate the electronic conductivity meter before and after each field use. Temperature correction must be applied automatically by instrument during measurement. Calibrate daily against potassium chloride standard corresponding to 1413 micro μohos/cm^2.

2.3.2.4 Temperature

The mercury thermometer must be factory-calibrated against National Institute of Standards and Technology standards and checked at least annually.

Check temperature meter calibration weekly against mercury thermometer.

2.3.3 Internal Quality Control Checks

The following sections describe requirements for collection of quality control samples for use in the review and validation of analytical data, and the assessment of the precision, accuracy, and completeness goals.

2.3.3.1 Equipment Rinsate Samples

Equipment rinsate samples must be prepared to evaluate field decontamination and sample handling procedures. The equipment rinsate samples must be prepared as described in the FSPs. The equipment rinsate samples may be analyzed for CLPAS TCL VOCs plus EDB and DBCP, organochlorine, organophosphorus, and carbamate/urea pesticides, and TPH as gasoline and diesel. Specific analyses requested for rinsate samples must be commensurate with the analyses being requested for routine samples associated with the rinsates. One equipment rinsate sample must be collected for each type of sampling equipment being used for each day that sampling equipment is decontaminated in the field, or one equipment rinsate sample must be collected per 20 samples collected, whichever is most frequent.

2.3.3.2 Background Samples

Background samples must be collected in an area which is unlikely to have received contaminants as described in the FSP. Background samples are intended to be representative of conditions that exist in the site vicinity. Background samples must be taken in similar geological strata to the other sample locations and at similar depths. The following monitoring wells have been designated as background wells: MW-6A, MW-6B, and MW-6C. Background groundwater water samples must be analyzed for VOCs plus EDB and DBCP. Background soil samples (see FSP, Soil Investigation) must be analyzed for VOCs plus EDB and DBCP, and organochlorine, organophosphorus, and carbamate/urea pesticides. No soil gas or soil flux background samples will be collected.

2.3.3.3 Field Duplicate Samples

Field duplicate samples must be collected simultaneously with a routine sample from the same source under identical conditions into separate sample containers. A field duplicate sample must be treated independently of its counterpart to assess laboratory performance through comparison of the results. At least 10 percent of samples collected per quarterly groundwater monitoring event must be duplicates and 10 percent of samples collected during the remedial investigation must be duplicates. Field duplicate samples and routine samples must be analyzed using the same analytical method. Field duplicate samples should be collected from areas of known or

suspected contamination. For the purposes of quarterly groundwater monitoring, the following monitoring wells have been designated as field duplicate sampling locations: MW-4C, MW-7C, MW-11A, and MW-12B. Field duplicate samples of well sump sediment and DMLS groundwater will not be collected since these samples wil be collected and analyzed as screening samples. Field duplicate samples of soil gas and flux must be collected.

2.3.3.4 Laboratory Quality Control Samples

Laboratory QC samples must be analyzed to evaluate laboratory analytical precision and accuracy. The laboratory must monitor the precision and accuracy of the results of their analytical procedures through analysis of laboratory quality control samples. Laboratory QC samples must be an aliquot of a field sample. For groundwater samples, double volumes of samples must be supplied to the laboratory for its use as described in the FSP. No extra volume is required for soil samples. At a minimum, one laboratory QC sample is required per week, or one per 20 samples (including blanks and duplicates), whichever is greater. Field rinsates must not be designated for laboratory QC samples.

2.3.3.5 Field Spike/Performance Evaluation Samples

Total accuracy must be evaluated for soil analyzed by the FASP laboratory through the use of soil samples spiked with site specific analytes of concern at or near the CRQL. These samples may be independently prepared performance evaluation samples or spiked site soils. At a minimum, one spiked QC sample must be analyzed per week. If the sample event lasts longer than 1 week, additional spiked QC samples must be designated.

2.3.4 Data Reduction

As stated in Section 1.2.2, each zone of the site will be statistically evaluated to ensure that surface contamination attributed to site-related constituents does not pose an undue risk to human health. The PRGs for industrial use must be used when evaluating risk associated with soil contamination at Frontier Fertilizer. Each analyte contributes to the risk presented. To evaluate the multi-contaminant risk, a risk index has been established. Each soil contaminant of concern's decision criteria is based upon a risk of 1×10^{-6}. The actual contamination present in each sample must be evaluated against the PRG as a ratio or portion of the cleanup limit, the RI, as follows:

$$RI_i = \frac{c_i}{PRG_i}$$

Where:

c_i = *measured concentration of chemical compound i*
PRG_i = PRG of chemical compound *i*
RI_i = Risk Index of chemical compound *i*

The RI is the ratio of the measured concentration of chemical compound *i* present to the Region 9 PRG for chemical compound *i*. If the RI is ² 1.0, the chemical compound has been reduced to a level at which it contributes less than or equal to a risk of 1×10^{-6}. To evaluate soil at Frontier Fertilizer, where there are multiple contaminants, the RI for each contaminant must be added to determine a CRI representing all the contaminants present.

$$CRI = \sum_{i=1}^{k} RI_i = \sum_{i=1}^{k} \frac{c_i}{PRG_i}$$

A sufficient number of samples must be collected to make this evaluation and subsequent decisions at the ≥90 percent confidence level. If the mean of the CRI for each zone of Frontier is ≤1.0, the procedures outlined in Chapter 6, *Determining Whether the Mean Concentration of the Site is Statistically Less than a Cleanup Level*, of *Methods for Evaluating the Attainment of Cleanup Standards*, EPA 230/02-89-042, EPA, 1989, will be used to evaluate if the CRI is ≤1.0 at the 90 percent confidence level. If the mean is ≤1 but the confidence level is not ≥90 percent, additional samples may have to be taken to raise the confidence level. If the mean of the CRI for each Zone is >1 but <3, then the evaluation must be repeated using only those analytes that are carcinogenic.

2.3.5 Documentation and Deliverables

For the quarterly groundwater monitoring program and all offsite analyses performed for the soil and groundwater investigations, the EPA Region 9 designated laboratory must perform the required analyses. Required documentation must include all documents appropriate to the analyses as required by the CLP SOW (or equivalent, if not CLP SOW analysis). This includes analytical reports (Form 1s), QC Summary sheets, and raw data. All necessary documentation must be supplied to the EPA Region 9 identified data validation contractor with preliminary Forms 1s marked "Unvalidated" supplied to Bechtel for use. Upon completion of validation, final Forms 1s and validation reports must be supplied to Bechtel.

FASP laboratory data must be provided to Bechtel in both hard copy and electronic copy. Forms 1s and electronic diskettes must be provided to Bechtel for use in field decisions immediately after analyses are completed. Forms 1s and diskettes must be marked "Unreviewed" or other such explanatory label to indicate the data's status. Complete documentation packages must be

provided after data review and finalization. Documentation of FASP and onsite (subcontracted) soil gas laboratory analyses must consist of analytical reports in the form of CLP SOW Forms 1s, CLP SOW QC summary sheets as appropriate for the methods being performed, and data review reports. The electronic copy of the data must be provided in DOS or Macintosh formatted diskettes in either dBase or Foxpro readable database format. Table 2-1 provides the recommended electronic deliverable format. The final format and content of the electronic deliverable must be agreed to by both Bechtel and the FASP and onsite (subcontracted) soil gas laboratory.

In all cases, actual results must be reported when the results are above instrument detection limit (appropriately flagged). All Forms 1s must indicate the instrument detection limits for each compound reported. Documentation must include definitions of all qualification flags assigned by the laboratory during data review.

Table 2-1
Proposed Electronic Data Deliverable Format

FieldNo.	Field Name	Type
Sample Results File		
1	Proj_No/SDG	N
2	Client_Samp	A12
3	Sample_No	N
4	Compound	A32
5	LRL	N
6	Units	A6
7	Results	N
8	Lab_Qual	A3
9	QC_Method	A11
10	Date_Coll	D
11	Date_Rcvd	D
12	Matrix	A7
13	Date_Anal	D
14	Cas_No.	A12
15	QC_Batch	N
16	Dilution	N
17	Footnotes	N
Sample QC File		
1	Proj_No/SDG	N
2	QC_Batch	N
3	Sample_Type	A12
4	QC_Sample_No.	N
5	Compound	A32
6	Units	A6
7	LRL	N
8	Results	N
9	Lab_Qal	A3
10	Orig_Samp_Result	N
11	Orig_Samp_No	N
12	Spike_Conc	N
13	Pct_Recov	N
14	Dup_Samp_No	N
15	Dup_Result	N
16	Dup_Pct_Recov	N
17	RPD_Pct_Recov	N

LRL = Lowest Reporting Limit.

N = Numeric field

A, # = alpha field, maximum number of allowable alpha characters.

Section 3

Quality Assurance Management

The following sections describe Bechtel's approach to data quality management and quality assurance oversight. The Data Quality Management section describes the flow of project data from the point of data generation to the final data use. It also addresses data validation requirements and identifies procedures to assess the precision, accuracy, and completeness of project data. The Quality Assurance (QA) Oversight section addresses project audits, corrective action, and quality assurance reports to management.

3.1 DATA QUALITY MANAGEMENT

Data quality management consists of data management, analytical data quality assessment, overall assessment of data quality, and data usability procedures.

3.1.1 Data Management

Figure 3-1 illustrates the flow of sampling and analytical data from the point of data generation to the final data uses. Field measurements must be initially recorded in bound field logbooks. The results must then be transcribed into a dBase compatible database for analysis and incorporation into quarterly groundwater monitoring reports and the remedial investigation report. The quarterly groundwater monitoring reports must ultimately be compiled and incorporated in the Frontier Fertilizer Remedial Investigation Report.

Laboratory analytical data must be recorded and reported as specified by the EPA CLP SOW and applicable Client Request Forms. Upon receipt of a summary of unvalidated data, the EPA must provide Bechtel with the unvalidated data. These data must be reviewed to determine Bechtel's approach to the next step in investigation sampling, or if the next round of sampling should be revised.

3.1.2 Analytical Data Quality Assessment

Analytical data quality assessment consists of FASP laboratory and Region 9 laboratory data quality assessment.

3.1.2.1 FASP Laboratory Data Quality Assessment

All analytical data produced by the FASP laboratory in support of the remedial investigation must undergo a limited data validation and review. The review must include the following aspects:

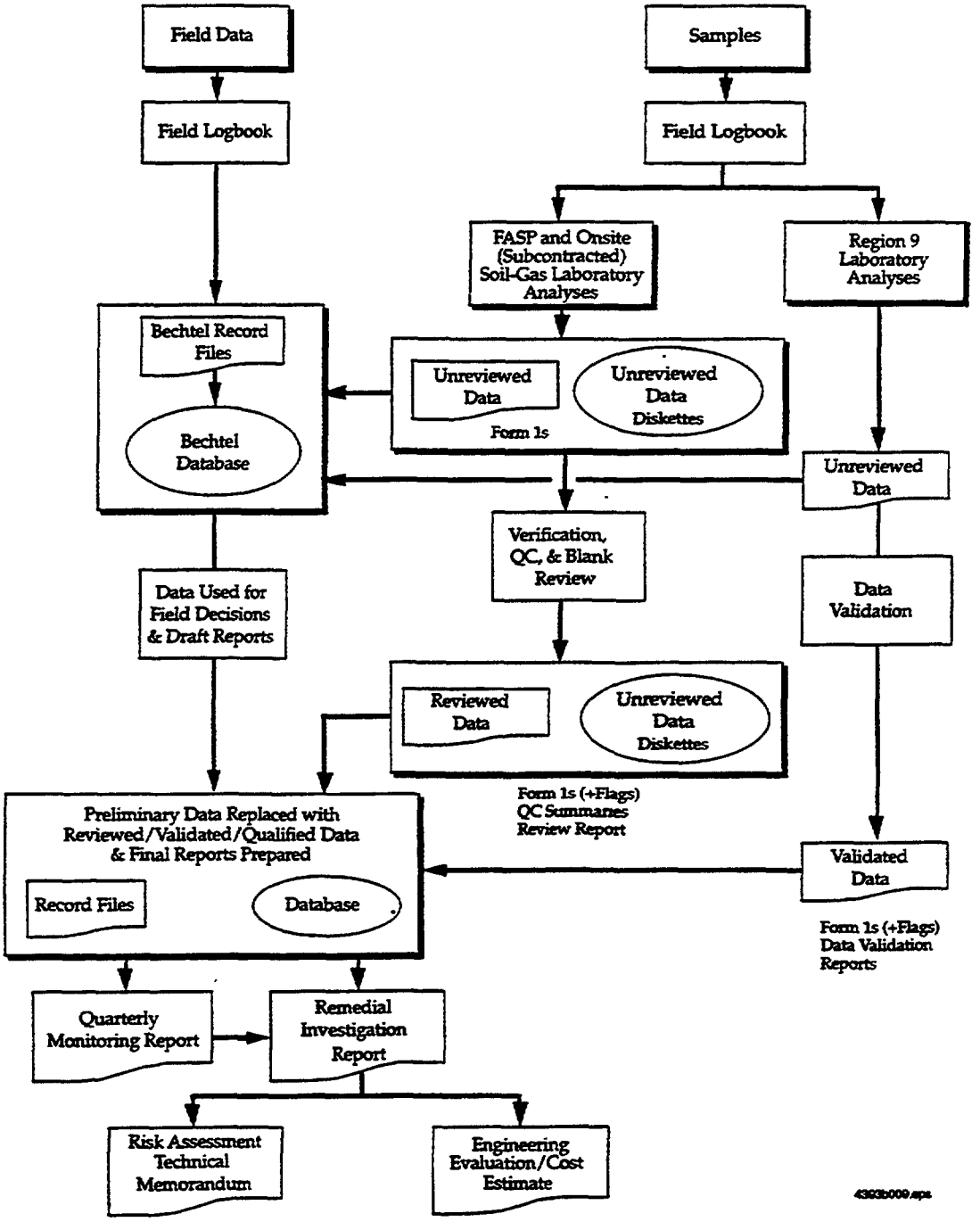

Figure 3-1 Flow of Remedial Investigation Data

Verification. *A non-technical check for the following types of attributes:*

- Were requested analyses performed?
- Was documentation supplied and completed as requested?
- Have there been transposition or other similar data transfer errors?

QC and Blank Check. A more extensive review of the data set. It includes a review of the QC data and blank data. QC data is reviewed against the same criteria used during full validation, in accordance with *EPA National Functional Guidelines for Organic Data Review, Revised June 1991*; however, qualification and acceptance/rejection of data is based on QC summaries only, and no raw data is included in the review. Data from analyses of blanks are included in this review to verify that there have been no sampling, sample handling, or analytical method problems resulting in contamination of samples.

Since FASP laboratory data will not receive complete validation, but will be used to make decisions regarding site remediation, additional assurance of data quality is required. Ten percent of the samples from the soil hot spot search and surface soil evaluations will be split and sent to the EPA Region 9 designated laboratory for analysis and comparison to FASP results. Organochlorine pesticides will be analyzed by the Region 9 designated laboratory and compared to FASP results by Bechtel.

Additionally, spiked/performance evaluation soil samples must be submitted blindly to the FASP laboratory to evaluate FASP laboratory accuracy and performance.

3.1.2.2 Region 9 Designated and Bechtel Subcontract Laboratory Data Quality Assessment

All analytical data produced by the EPA Region 9 designated laboratory in support of the soil and groundwater investigations must be validated by the EPA QAMS data validation subcontractor in accordance with the *EPA National Functional Guidelines for Organic Data Review, Revised June 1991*. Ten percent of the analytical data produced by the EPA Region 9 designated laboratory in support of quarterly groundwater monitoring must also be validated. When validated data are available, EPA must provide those results to Bechtel. The validated data must then be transcribed into tables for incorporation into quarterly groundwater monitoring reports and the Frontier Fertilizer Remedial Investigation Report, as appropriate.

3.1.3 Overall Assessment of Data Quality and Usability Procedures

Bechtel must evaluate the overall quality and usability of the data produced by the FASP, the subcontracted soil-gas laboratory and Region 9 laboratories to support the objectives of the soil

and groundwater investigations and quarterly groundwater monitoring program. This evaluation must include a review against the original data quality objectives (DQOs) and a review of the data in the context of the Frontier Fertilizer site.

3.1.3.1 DQO Review

The DQO review assesses if sufficient type, quality, and quantity of data have been obtained to make necessary decisions. The DQOs must be revisited based on actual data. The following questions may be addressed:

- Is the variability of the data set small enough to provide the adequate confidence in the results?
- Were there sufficient numbers of valid data points based on the error rates and variability?

3.1.3.2 Contextual Review

The contextual data review is an evaluation of the data set in the context of the type of data and decisions made based on the data. The contextual review also includes an assessment of the data considering the larger data set to which it belongs.

Field quality control (QC) samples must be reviewed and included in the overall assessment of data quality by Bechtel in a manner consistent with review and validation of laboratory analytical data. The following procedures must be used to assess the overall precision, accuracy, and completeness of project data as represented by field QC samples. While DQO goals are established for total measurement precision, accuracy, and completeness, professional judgment will be used and data will not necessarily be qualified based solely on field QC results.

Precision. Using the results of field duplicate analyses precision must be expressed as relative percent difference. Relative percent difference must be calculated as follows:

$$\text{Relative Percent Difference} = \frac{X_1 - X_2}{(X_1 + X_2)/2} \times 100\%$$

Where:

X_1 = Concentration observed in duplicate sample 1

X_2 = Concentration observed in duplicate sample 2

Analytical precision, used during data validation by the EPA Region 9 data validation subcontractor and the FASP and onsite (subcontracted) soil-gas laboratory data review, must be calculated by the laboratory with the results of matrix spike duplicate analyses and verified by data validation. Analytical precision must be reported with the analytical data.

In addition, the results of split sample pairs must be statistically compared to evaluate whether there are significant differences between the FASP laboratory analytes, and the Region 9 analyses of samples for organochlorine pesticides. A paired-sample t-test or similar statistical test will be used to evaluate if a significant difference exists between the split sample results.

Accuracy. Accuracy must be expressed as percent recovery. Percent recovery will be used by Bechtel to evaluate FASP laboratory performance using splits/performance evaluation samples. Percent recovery must also be calculated by the laboratory with the results of matrix spike analysis and used in data validation. Percent recovery for matrix spikes must be reported with the analytical data.

$$\text{Percent Recovery} = \frac{T}{A} \times 100\%$$

Where:

T = Measured concentration in the spiked sample

A = Actual spiked concentration added to the sample

Completeness. Completeness must be expressed as a percentage of the total number of planned measurements. This percentage must be calculated as follows:

$$\text{Completeness} = \frac{N_A}{N_P} \times 100\%$$

Where:

N_A = the number of valid samples

N_P = the number of planned samples

3.2 QUALITY ASSURANCE OVERSIGHT

The following sections describe requirements for project performance audits, system audits, corrective action, and reports to management.

3.2.1 Performance and System Audits

The EPA must periodically conduct laboratory performance and system audits in accordance with the EPA CLP SOW and applicable Client Request Forms. The EPA must also perform periodic audits of Bechtel's onsite activities. The first onsite audit was conducted during the first round of quarterly groundwater monitoring. Subsequent audits of Bechtel's onsite activities must be conducted at a frequency determined by the EPA work assignment manager.

Bechtel must also conduct internal audits of onsite activities. These internal audits must be conducted in accordance with requirements specified in Bechtel's ARCSWEST Quality Assurance Program Plan.

Bechtel will evaluate the performance of the laboratory providing Method TO-14 analytical services based on the performance evaluation requirements specified in Section 12, Performance Criteria and Quality Assurance, of Method TO-14 and as specified in Section 8, of the EPA, Region IX Regional Analytical Program Client Request Form for Method TO-14, (attached as Appendix A). In addition Bechtel will prepare and submit blind to the analytical laboratory, two identical performance evaluation samples containing analytes of concern at concentrations near the ambient air PRGs specified on Table 1–10b.

3.2.2 Corrective Action

When items or circumstances are identified that require corrective action, they must be immediately corrected by the individual noting the problem. The actions taken must be documented in the appropriate field logbook. When a situation is identified that cannot be resolved immediately, or if the condition observed may result in data or samples previously taken being questioned, a formal corrective action request (CAR) must be prepared and submitted to the Bechtel project manager for approval. A copy of the CAR must also be forwarded to the Bechtel QA manager and to the EPA work assignment manager. Upon approval and implementation of the CAR, the Bechtel project manager must provide the Bechtel QA manager and EPA work assignment manager with a completion notice.

3.2.3 Quality Assurance Reports to Management

A discussion of overall data quality and usability must be included in the remedial investigation report. Also a discussion of significant QA problems encountered in the field or reported by the laboratory, and their solutions, must be included in Bechtel's quarterly groundwater monitoring report and remedial investigation report, as appropriate.

Appendix A

Performance Evaluation Procedures for

Bechtel Subcontract Laboratory

[1]

U. S. ENVIRONMENTAL PROTECTION AGENCY REGION 9
Environmental Services Branch
75 Hawthorne Street, San Francisco, CA 94105
Phone: 415/744-1499

RAP Number

Modified? ___ YES ___ NO

REGIONAL ANALYTICAL PROGRAM

Client Request

_____ Regional Transmittal _____ Telephone Request

A. Region Contact: RSCC Coordinator, [redacted], (415) 744-1498

B. Date of Request:

C. Site Name:

D. City/State/ZIP Code:

E. 2 Digit Superfund Site Identifier:

F. CERCLIS #:

Please provide below a description of your request for the Regional Analytical Program. In order to most efficiently obtain laboratory capability for your request, please address all applicable questions. Incomplete or erroneous information may result in a delay in the processing of your request. If you need to provide additional information not addressed by the questions, please attach additional sheets of paper.

1. General description of analytical service requested:

a. Analysis

The analysis of low concentration ambient air (indoor and outdoor) collected into 6-liter SUMMA® passivated canisters for volatile organic compounds (VOCs) following EPA Method TO-14 and the Contract Laboratory Program (CLP) Statement of Work (SOW) Exhibit D, Section 1 (DRAFT): Analytical Method for the Determination of Volatile Organic Compounds (VOCs) in Air Collected in SUMMA® Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), December, 1991, Revision VCAA01.0.

Most of the air samples received by the laboratory will be at subatmospheric pressures (approximately 5 to 16 in Hg).

b. Laboratory Capacity

The laboratory must have the capacity to analyze ___ canisters per day.

c. Laboratory Supplied Equipment

The laboratory must provide the following equipment certified as clean and in proper working condition prior to commencement of [each round of] sample collection:

- ___ cleaned and evacuated 6-liter SUMMA® canisters. Each

[1]

canister must have the manufacturer's serial number, or a unique permanent i.d. number attached. The laboratory must evacuate the canisters to ___ in. Hg prior to shipment;

- ___ cleaned and preset ultra-low flow orifices (mechanical stainless steel/viton ultra-low flow controllers). The ultra-low flow controllers must be preset by the laboratory at a flow rate of 2.78 mL/min ±10%. The flow rate of each controller should be checked by the laboratory prior to shipment using a sacrificial canister and a mass flow meter or bubble meter; and

- ___ digital flow meters capable of accurate measurements in the 2.78 mL/min range.

This equipment must be received from the laboratory in good condition and with proper documentation indicating that they have been cleaned. (see Section 9 for the documentation requirements). Canisters must be cleaned and cerified prior to and between uses (see Section 7 for cleaning requirements).

The shipping address to which the laboratory must send the cleaned canisters and equipment will be provided prior to sampling.

The SUMMA® canisters and flow controllers will be returned to the laboratory by the samplers after the last round of sampling, or after the first round of sampling if the first and second rounds are separated by more than ___ weeks.

2. **Definition and number of work units involved (specify whether whole samples or fraction; and whether low, medium, or high concentration):**

3. **Purpose of analysis (specify whether Superfund [enforcement or remedial action], RCRA, NPDES, etc.):**

4. **Estimated date(s) of collection (provide a sampling schedule):**

   The first sampling round is expected to begin during the week of ___.

5. **Estimated date(s) and method of shipment:**

   Overnight carrier - shipped the same day or the day following sample pick-up (24-hour sample collection period) for next day delivery.

   Samples picked up on Thursdays will generally be shipped on Friday for Saturday delivery. Samples picked up on Fridays will generally be shipped on Saturdays for Monday delivery.

6. **Number of days analysis and data required after laboratory receipt of samples:**

   a. Technical Holding Times: The maximum technical holding time for analysis is 14 days from the date of sample collection.

   b. Contract Holding Times: The maximum contractual holding time for analysis is __ days from sample receipt by laboratory.

Analysis and a preliminary results report, consisting of analyte concentrations and laboratory receipt pressures versus EPA sample number, are required by facsimile transmission (FAX) within ___ days from receipt of each SDG by the laboratory.

Complete data package deliverables are required within __ days. [Clean canisters must be returned within ____ days of laboratory receipt of the sample.]

The shipping address to which the laboratory must send the cleaned canisters and equipment will be provided prior to sampling.

A Sample Delivery Group (SDG), is defined as one day's shipment of samples.

The maximum number of samples is not expected to exceed ____ samples.

REQUIRED TURNAROUND TIME:

Item	Estimated Dates
Ambient air samples	Analysis, faxed preliminary results and laboratory canister receipt pressures within ___ days of sample receipt.
	Complete data package within ___ days of sample receipt.
Canister cleaning	Analysis and complete data package and certification analysisto be submitted along with first complete data package for ambient air samples.

7. **Analytical protocol required (attach copy if other than a protocol currently used in this program):**

   a. The laboratories bidding on this project must already have the necessary instrumentation installed and operational. In addition to the required instrumentation, the analyses must be performed by chemists with recent experience of at least six (6) months in the analysis of low level air toxics in SUMMA® canisters.

   b. Measure the pressure of the samples upon receipt at the laboratory. Report the initial laboratory receipt pressure along with the analytical results, both in the preliminary faxed results and in the subsequent complete data package.

   c. Follow the procedures outlined in the EPA CLP SOW, Exhibit D, Section 1 (DRAFT): Analytical Method for the Determination of Volatile Organic Compounds (VOCs) in Air Collected in SUMMA® Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), December, 1991, Revision VCAA01.0. Analyze by gas chromatography/mass spectrometry operating in the SCAN mode.

      1. The analytical method to be used are based on modifications of the *EPA Contract Laboratory Program (CLP) Draft Statement of Work (SOW) Exhibit D, Section 1 (DRAFT): Analytical Method for the Determination of Volatile Organic Compounds (VOCs) in Air Collected in SUMMA® Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), December,*

1991, Revision VCAA01.0 (ATTACHMENT A). Where there are differences in requirements between the SAS CRF and the SOW, the SAS CRF shall take precedence.

d. Preheat the canister and heat all sample transfer lines to 50°C prior to sample introduction.

e. For the cleaning and certification of SUMMA® canisters follow the requirements specified in Sections 7.3 and 11.1 of EPA Method TO-14, The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA® Passivated Canister Sampling and Gas Chromatographic Analysis (ATTACHMENT B) and the following specifications:

1. All canisters must be cleaned and certified prior to initial sample collection and between uses.

2. Canisters are considered clean when target analytes are not detected at a concentration greater than the CRQLs.

3. Certify clean canisters according to the procedures in Sections 7.6 and 8 of this SAS CRF. If target analytes are detected at concentrations exceeding the CRQLs, reclean the canister until the target analytes are less than the CRQLs.

4. Any sample introduction procedure not utilizing an evacuation/pressure cycle must include heating of the canister to no greater than 160°C during evacuation.

5. Any sample introduction procedure not utilizing an evacuation/pressure cycle must maintain an evacuation of less than 0.05 mm Hg (50 m Torr) for no less than 12 hours.

6. All vacuum pumps utilized in this procedure must include a suitable trap for the prevention of backstreaming.

7. Submit canister cleaning and certification documentation according to Section ___ of this SAS CRF. Report certification results by canister serial number, or a unique permanent i.d. number attached to the canister.

8. Leak test all canisters prior to sample collection according to Section 11.1.2 of EPA Method TO-14.

9. System blanks must not contain the target analytes at concentrations above the CRQL.

8. **Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):**

a. **Calibration Procedure and Criteria:**

1. Follow the calibration procedure specified in Section 5.7 in Exhibit D of the *EPA CLP SOW for Analysis of Ambient Air in Canisters, December 1991* (DRAFT). The mass spectral tuning requirements for 4-bromofluorobenzene (BFB) analysis in Table D/VC-2 of the CLP SOW for Analysis of Ambient Air in Canisters, December 1991 (DRAFT) must be met prior to the analysis of standards for sample determinations. Every 12 hours, analyze 50 ng of BFB by direct injection or

introduction via sample loop valve injection system.

a. Prepare initial and continuing calibration standards according to Section 5.4 of the CLP SOW for Analysis of Ambient Air in Canisters, December 1991 (DRAFT). The low level standard for the initial calibration must be at concentrations equivalent to the CRQL. The sample concentrations are expected to range from nondetect at the CRQL up to 25 ppbv. Prepare continuing calibrations standards with target compounds at a concentration of 10 ppbv.

b. Analyze initial and continuing calibrations standards according to Sections 5.8 and 5.9 of the *EPA CLP SOW for Analysis of Ambient Air in Canisters, December 1991* (DRAFT). Perform continuing calibration daily and every 12 hours during sample analyses.

c. Humidify calibration standards when used, and obtain calibration standards by one or more of the following means:

1. Purchase from the National Institute for Standards and Technology (NIST).

2. Produce internally and certified by or directly traceable to NIST.

3. Purchase from a commercial supplier who has more than 5-years experience in the preparation and certification of volatile organic air standards.

3. Follow the calibration procedures specified in Section 8 of this SAS CRF when generating acceptable canister cleaning and certification results.

b. **Internal Quality Control Checks, Control Limits and Corrective Actions:**

1. Follow the QC requirements specified below and in Section 5 of the *EPA CLP SOW for Analysis of Ambient Air in Canisters, December 1991* (DRAFT). Where there are differences in requirements between the SAS CRF and the SOW, the SAS CRF shall take precedence.

a. Less than 30% relative standard deviation (%RSD) in relative response factors (RRF) for the initial calibration standards, and less than a ±30% difference (%D) between the RRF for the daily continuing calibration and the average RRF from the initial calibration, are required. The minimum RRF acceptance criteria of 0.05 for all analytes must be met in the initial and continuing calibrations.

b. Analyze laboratory method blanks, consisting of humidified zero-grade air from a known source, after every calibration and after any sample containing high concentrations of target analytes. Laboratory method blanks must contain no target compounds at concentrations exceeding the CRQL. If a laboratory

method blank exceeds this criterion, the analytical system should be considered to be out of control. Investigate the source of the contamination, and take and document appropriate corrective measures before proceeding with further sample analysis. Reanalyze all samples processed with a method blank that is out of control. All reanalyses must be performed at no additional cost to the Agency. The Laboratory Manager, or his/her designee, must address problems and solutions in the case narrative.

c. Spike the organic surrogate compounds, chlorobenzene-d5 or 1,4-difluorobenzene, into all calibration standards, method blanks, QC samples, laboratory duplicates and field samples at a (resulting) concentration of 10 ppbv. Surrogate recoveries of 80-120% are required. Reanalyze the samples if surrogate recoveries are outside of the QC limits. If reanalysis of the sample solves the problem, submit data only from the analysis in which surrogate recoveries are within QC limits. If reanalysis does not solve the problem, submit data from both analyses.

If another surrogate, such as octafluorotoluene, is used instead of those listed above, the laboratory must demonstrate that the surrogate does not interfere with any target analytes. The laboratory must also notify the Region in advance.

d. Spike the organic internal standard, bromochloromethane, into all calibration standards, method blanks, QC samples, laboratory duplicates and field samples immediately preceding analysis. Prepare internal standard spiking solutions at a (resulting) concentration of 10 ppbv. Internal standard areas for all samples, method blanks, and QC samples must be within ±40% of the internal standard areas in the most recent continuing calibration analysis; and internal standard retention times must be within ±0.50 minutes of the internal standard retention times in the most recent continuing calibration analysis.

If another internal standard, such as 1,4-difluorobenzene, is used instead of bromochloromethane, the laboratory must demonstrate that the internal standard does not interfere with any target analytes. The laboratory must also notify the Region in advance.

e. Analyze a CRQL standard, which is a low level QC check standard, every 12 hours during which low level samples are analyzed to demonstrate acceptable instrument sensitivity. Percent recoveries for the CRQL standard must be within 65-135%.

f. Performance Evaluation (PE) samples may be analyzed to measure analytical accuracy. PE samples may be analyzed periodically throughout the contract period. Laboratory results for low level PE samples must be within 20% of the nominal true value.

g. Analyze laboratory duplicates (DUPs) at a frequency of one per sample delivery group. The relative percent differences (RPD) between duplicate results must be less than 20% for resuults greater than 5 times the CRQL. For results less than 5 times the CRQL, the RPDs must be less than 30%. Reanalyze laboratory duplicates that fail to meet this criterion.

h. The following ananlyte identification criteria apply all standards, method blanks, QC samples, laboratory duplicates and field samples.

1. Analyte retention times must be within ±0.06 relative retention time (RRT) units of the RRT in the last continuing calibration standard according to Section 5.8.5.3 of the *EPA CLP SOW for Analysis of Ambient Air in Canisters, December 1991* (DRAFT).

2. Both the primary ions and the secondary ions must be present in the spectra.

3. The acceptance level for relative abundance of the appropriate ions in all standards, method blanks, QC samples, laboratory duplicates and field samples is determined to be ±20% of the expected abundance observed in the most recent continuing calibration standard.

4. All ions greater than 15% in the standard spectrum must be present in the sample spectrum. (Note that the standards themselves, both initial and continuing, must meet the QC criteria in the SAS CRF).

5. Account for all fragmentation ions that are greater than 15% in the sample spectrum but not in the standard spectra (background, coeluting peak, etc.) in order to prevent the reporting of false positive results.

i. Reanalyze samples containing target analytes at concentrations greater than the initial calibration range using the following methods in the order presented:

1. Analyze a smaller aliquot of sample from the SUMMA® canister.

2. If after analyzing a smaller aliquot the concentration is still greater than the initial calibration range, then dilute the sample and reanalyze according to procedures outlined in Sections 10.4.1.3 and 10.4.1.4 of EPA Method TO-14 or Section 5.12.6 of the *EPA CLP SOW for Analysis of Ambient Air in Canisters, December 1991* (DRAFT).

3. If sample dilution is necessary, the dilution must be adjusted so that the target analyte is quantitated at a level in the upper half of the

calibration range. Report the results and submit documentation for the analysis of both the diluted and undiluted sample.

2. For canister cleaning and certification, follow all QC requirements specified in Sections 11.1 of EPA Method TO-14. Refer to Section 7.3 of EPA Method TO-14 for specification of the canister cleaning system.

   a. All canisters must be free of any contaminants prior to sample collection. Canisters are considered clean when the criteria specified in Section 7.6 of this SAS CRF are met.

   b. Leak test all canisters prior to sample collection according to Section 11.1.2 of EPA Method TO-14.

   c. System blanks must not contain target analytes at concentrations exceeding the CRQL.

3. If the control limits listed in this SAS CRF are exceeded, take appropriate actions to correct the problem and reanalyze the affected samples.

4. The QC requirements listed in this CRF are the minimum required. It is impossible to address all analytical situations that might be experienced by a laboratory during the analysis of environmental samples. The laboratory is expected to adhere to good laboratory practices when analyzing samples. If the laboratory has questions concerning the analyses of samples not addressed in this document, the Region should be notified IMMEDIATELY (through the Sample Management Office).

9. **Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion.**

   a. **Data Calculations and Reporting Units:**

   Calculate and report the sample results as specified in the analytical methods. All records of analyses, dilutions and calculations must be legible and sufficient to recalculate all sample concentrations and QC results.

   Perform sample quantitation using the relative response factor (RRF) from the daily continuing calibration standard. Report results for all target analytes in concentration units of parts per billion by volume (ppbv).

   Note: Report all results less than the CRQL as "CRQL U" on CLP Form I, or equivalent form. The CRQL may be viewed as a reporting limit.

   b. **Documentation and Deliverables:**

   Submit all documentation and deliverables required in Exhibit B of the (DRAFT): Analytical Method for the Determination of Volatile Organic Compounds (VOCs) in Air Collected in SUMMA® Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), December 1991.

Appropriate CLP forms, or equivalent, must be modified to include the target analytes. Deliverables for each Sample Delivery Group should include, but are not limited to, the following:

For Preliminary Faxed Results:

1. Preliminary results report consisting of analyte concentrations and laboratory receipt pressures versus EPA sample numbers.

For Complete Sample Results Data Package:

1. All Sample Tracking Reports (i.e., signed SAS Packing Lists/Chain-of-Custody forms).

2. Complete SDG File (CSF) inventory on a modified CLP Form DC-2.

3. Sample log-in information on CLP Form DC-1.

4. A copy of the SAS CRF, as provided by SMO (so that any changes authorized by SMO will be known). Only the technical portion of the SAS CRF is required.

5. Any telephone logs referring to the samples.

6. An SDG Narrative which includes: a signature of the laboratory manager (or his or her designee), laboratory name, EPA laboratory I.D., contract number, SAS number, SDG number, a description of any problems encountered during the processing of the resolution of these problems, a list of correct EPA sample I.D. numbers, the corresponding laboratory sample I.D. numbers, a differentiation between the initial analyses and any reanalyses, a formula (including definitions) showing how the results were calculated, and an example of an actual calculation for a sample in the SDG.

7. Modified CLP Form 1 for all environmental and QC samples which lists the tabulated sample results for all target analytes. The header of the Form 1 should include: matrix, units, sample volume, dilution factor, and dates of receipt and analysis. Form 1s for any reanalyses, diluted analyses, or confirmation analyses must be included.

8. Modified CLP Form 2 which lists the %recovery (%R) values of the surrogate compounds for all samples, blanks, and QC samples.

9. Modified CLP Form 3 for laboratory duplicate (DUP) result summaries with relative percent difference (RPD) values.

10. Modified CLP Form 4 which summarizes the samples associated with each laboratory method blank.

11. Modified CLP Form 5A for BFB tune result summaries.

12. Modified CLP Form 8A which summarize areas and RTs of the internal standards for all samples, blanks, QC samples, and standards.

13. Raw sample data which include the following items:

    a. Reconstructed Ion Chromatogram (RIC)
    b. GC integration report/data system printout
    c. Manual worksheet

14. Instrument calibration data which include the following items:

    a. Initial Calibration

        (1) Modified CLP Form 6D which includes: retention times (RTs) for each concentration level, mean RT, and RT windows for all target and surrogate compounds.

        (2) Modified CLP Form 6 which includes: standard concentrations, relative response factors (RRFs) for each concentration level, average RRF, and percent relative standard deviations (%RSDs) for all target and surrogate compounds.

        (3) Header of the modified CLP Form 6 must include: date and time of calibration, instrument I.D., and gas chromatographic (GC) analytical column I.D. (i.e. liquid phase, length, diameter).

        (4) Raw data which include: RICs and integration reports/data system printouts. Peak areas or heights, concentrations, and RTs must be clearly indicated.

    b. Continuing Calibration

        (1) Modified CLP Form 7 which includes: retention times (RTs), standard concentrations, relative response factors (RRFs), and percent differences (%Ds) for all target and surrogate compounds.

        (2) Raw data which include: RICs and integration reports/data system printouts. Peak areas or heights, concentrations, and RTs must be clearly indicated.

15. Raw QC data which include the following items:

    a. Blank data, in chronological order:

        1. Tabulated results on a modified CLP Form 1
        2. GC integration report/data system printout
        3. Manual worksheet

    b. DUP data, in chronological order:

        1. Tabulated results on a modified CLP Form 1
        2. GC integration report/data system printout
        3. Manual worksheet

16. Analytical sequence on a modified CLP Form 8D. Modified CLP Form 8D must list instrument I.D., EPA sample I.D. numbers, laboratory sample I.D. numbers, date and time analyzed for

all standards, environmental samples, and QC samples, and retention times of the surrogates and internal standards.

17. Bench sheets for dilutions. Bench sheets for sample preparation which include spike solution and surrogate solution description (i.e. concentrations and volume added.)

18. Standards preparation logs, for all standards used for either calibration or spiking, which include source, traceable lot number, and concentrations of all compounds.

Canister Cleaning and Certification:

1. Full data package deliverables specified for complete data packages above in Section 9 of this SAS CRF.

2. Cleaning certification results reported by canister serial number or other permanent unique identification number attached to the canister on modified CLP Form I.

3. System blank showing target analytes to be less than the CRQL.

4. Canister handling report which will be attached to each canister indicating that it has been cleaned, verified and is acceptable for sample collection.

10. **Other (use additional sheets or attach supplementary information, as needed):**

Attached is a copy of the "U. S. EPA Region 9 Laboratory QC Summary Report" form. This form is to be completed by the Laboratory Manager or his/her designee and submitted with each data package. The form is to reflect the conditions contained within the data package with which it is submitted. Laboratories may make additional copies of this form as needed.

11. **Name of sampling/shipping contact:**

Phone: ( )

12. **Data Requirements:**

Parameter	Contract Required Quantitation Limit (CRQL)
VOCs	See Table 1

13. **QC Requirements:**

QC Required	Frequency of QC	Limits (% or Conc.)
Analysis		
Laboratory Method Blanks	Daily and every 12 hours	< CRQL
Laboratory Duplicates	1 per SDG	< 20% (results >5XCRQL) < 30% (results ≤5XCRQL)
Canister Certification		
all canisters		< CRQL

14. **Action required if limits are exceeded:**

If above control limits are exceeded, take appropriate actions to identify the problem by reanalyzing the affected samples. Corrective action should be taken before additional samples are analyzed.

Table 1

Target Compound List for EPA Method TO-14

Analyte	SAS CRQL (ppbv)
Acetone	5
Acetonitrile	5
Acrolein	5
Acrylonitrile	5
Benzene	2
Benzyl chloride	5
Bromodichloromethane	2
Bromomethane	5
1,3-Butadiene	5
2-Butanone	5
Carbon tetrachloride	2
Chlorobenzene	2
Chlorodifluoromethane	2
Chloroethane	2
Chloroform	2
Chloromethane	2
3-Chloro-1-propene	2
Cyclohexane	2
Dibromochloromethane	2
1,2-Dibromoethane	2
1,2-Dichlorobenzene	2
1,3-Dichlorobenzene	5
1,4-Dichlorobenzene	5
Dichlorodifluoromethane	2
1,1-Dichloroethane	2
1,2-Dichloroethane	2
1,1-Dichloroethene	5
cis-1,2-Dichloroethene	2
trans-1,2-Dichloroethene	2
1,2-Dichloropropane	2
trans-1,2-Dichloropropene	2
cis-1,2-Dichloropropene	5
1,2-Dichloro-1,1,2,2-tetra-fluoroethane	2
Ethylbenzene	2
Heptane	2
Hexachlorobutadiene	5
Hexane	2
Methanol	5
Methylene chloride	5
Methyl methacrylate	2
4-Methyl-2-pentanone	5

Table 1
(cont.)

Target Compound List for EPA Method TO-14

Analyte	SAS CRQL (ppbv)
alpha-Methyl styrene	5
Octane	5

n-Pentane	2
Propylene	5
Styrene	5
1,2,4-Trichlorobenzene	2
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
1,1,2,2-Tetrachloroethane	2
Tetrachloroethene	5
Toluene	5
Trichloroethene	2
Trichlorofluoromethane	2
1,1,2-Trichloro-1,2,2-trifluoroethane	2
1,2,4-Trimethylbenzene	2
1,3,5-Trimethylbenzene	2
Vinyl acetate	5
Vinyl chloride	2
Xylenes (m- and p-)	5
Xylene (o-)	5

U.S. Environmental Protection Agency Region IX
Hazardous Waste Management Division
Field Operations Branch

Field Sampling Plan

QUARTERLY MONITORING PROGRAM

Frontier Fertilizer
4303 and 4309 Second Street
Davis, California 95617

Site EPA ID Number CAD 071530380

Anticipated Sampling Dates: March 15, 1999 to March 24, 1999

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Table of Contents

Section		Page
1.0	OBJECTIVES OF SAMPLING EFFORT	1
2.0	BACKGROUND	1
	2.1 Location	1
	2.2 Site Description	2
	2.3 Operational History	2
	2.4 Previous Activities	5
3.0	SAMPLING AND ANALYSIS PROGRAM AND RATIONALE	9
	3.1 Sampling Recommendations	9
	3.2 Analysis Recommendations	10
4.0	REQUEST FOR ANALYSES	10
	4.1 Groundwater Sample Analyses	11
	4.2 Equipment Rinsate Sample Analyses	11
5.0	FIELD METHODS AND PROCEDURES	11
	5.1 Groundwater Samples	11
	5.2 Equipment Rinsate Samples	20
	5.3 Decontamination Procedures	20
6.0	DISPOSAL OF INVESTIGATION-DERIVED WASTES	21
7.0	SAMPLE DOCUMENTATION AND SHIPMENT	22
	7.1 Field Logbooks	22
	7.2 Bottles and Preservatives	23
	7.3 EPA Chain-of Custody Records and QA/QC Summary Forms	24
	7.4 Labeling, Packaging, and Shipment	25
8.0	QUALITY CONTROL	26
	8.1 Equipment Rinsate Samples	26
	8.2 Background (Reference) Samples	27
	8.3 Duplicate Samples	27
	8.4 Laboratory Quality Control Samples	28
	8:5 Field Variances	28

APPENDIX A: Regional Analytical Program Client Request Forms

Table of Contents (Cont'd)

List of Figures

Figure		
2-1	Site Location	3
2-2	Site Features Map	4

List of Tables

Table		Page
4-1	Request for Analyses: Matrix = Water	12
5-1	Well Construction Summary	16

1.0 OBJECTIVES OF SAMPLING EFFORT

Bechtel Environmental, Inc. (BEI) will conduct this field sampling effort to gather data as part of a Remedial Investigation and Feasibility Study (RI/FS) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). This field sampling plan has been prepared under contract with the U.S. Environmental Protection Agency (EPA), Contract Number 68–W9–0060 and specific authorization of EPA Region IX, Work Assignment Number 60–28–9L4R.

Field sampling will be conducted under protocol accepted by the EPA as specified in the *Preparation of a U.S. EPA Region IX Sample Plan for EPA–Lead Superfund Projects* guidance document (Quality Assurance Office, U.S. EPA, Region IX, August, 1993) and the Quality Assurance Project Plan (QAPjP) originally submitted by BEI on February 1, 1994, revised and resubmitted July 14, 1997. Laboratories participating in the EPA Contract Laboratory Program (CLP) will be utilized for analyses. Laboratory services will be obtained and coordinated through the EPA Quality Assurance Office (QA Office).

The site being investigated is the Frontier Fertilizer site (CAD 071530380) in Davis, Yolo County, California. From 1972 to 1983, the site was used as a fertilizer and pesticide distribution facility. Pesticides and fertilizers were stored and mixed on site and sold to farmers in 500 to 1,000–gallon tank trailers. When the trailers or other containers were returned, residual material was rinsed out and deposited into an unlined basin near the northwest corner of the site. Analytical results of soil and groundwater samples collected on or adjacent to the site indicated the presence of several pesticides compounds in onsite soils and in the groundwater beneath the site. The primary contaminants of concern in both soil and groundwater are 1,2–dibromoethane (EDB); 1,2–dichloropropane (DCP); 1,2–dibromo–3–chloropropane(DBCP); and carbon tetrachloride (CCl_4).

The objective of the sampling effort is to determine if contamination has continued to migrate in the groundwater beneath the site, particularly to the deeper A–1 aquifer. The analytical data will be used to measure the concentration of volatile organic compounds in the three groundwater zones beneath and hydraulically downgradient of the site. In addition, the analytical data will be compared with previous groundwater sampling data to determine the seasonal variations in contaminant concentrations in the three groundwater zones beneath and hydraulically downgradient of the site.

2.0 BACKGROUND

2.1 Location

The Frontier Fertilizer site is located at 4303 and 4309 Second St. in Davis, Yolo County, Calif. The geographic coordinates of the site are 38° 33' 9.5" N latitude and 121° 42' 7.0" W longitude

(Township 8 North, Range 2 East, Section 12, Mt. Diablo Baseline and Meridian, Davis, Calif., 7.5–minute quadrangle). The location of the site is shown in Figure 2–1.

2.2 Site Description

The Frontier Fertilizer site is located at the eastern edge of the city of Davis, California. The site consists of several warehouses, shops, a pole barn, labor camp complex, tomato grading station, several sumps and culverts, and a disposal basin area. The 18–acre site is bordered to the south by Second Street and Interstate I–80, and to the north, west, and east by agricultural fields. Construction of the Mace Ranch Park industrial and residential development is underway on most of the agricultural land surrounding the site. The nearest property zoned for residential use is just north of the drainage ditch which runs through the field north of the site. The site layout is shown in Figure 2–2.

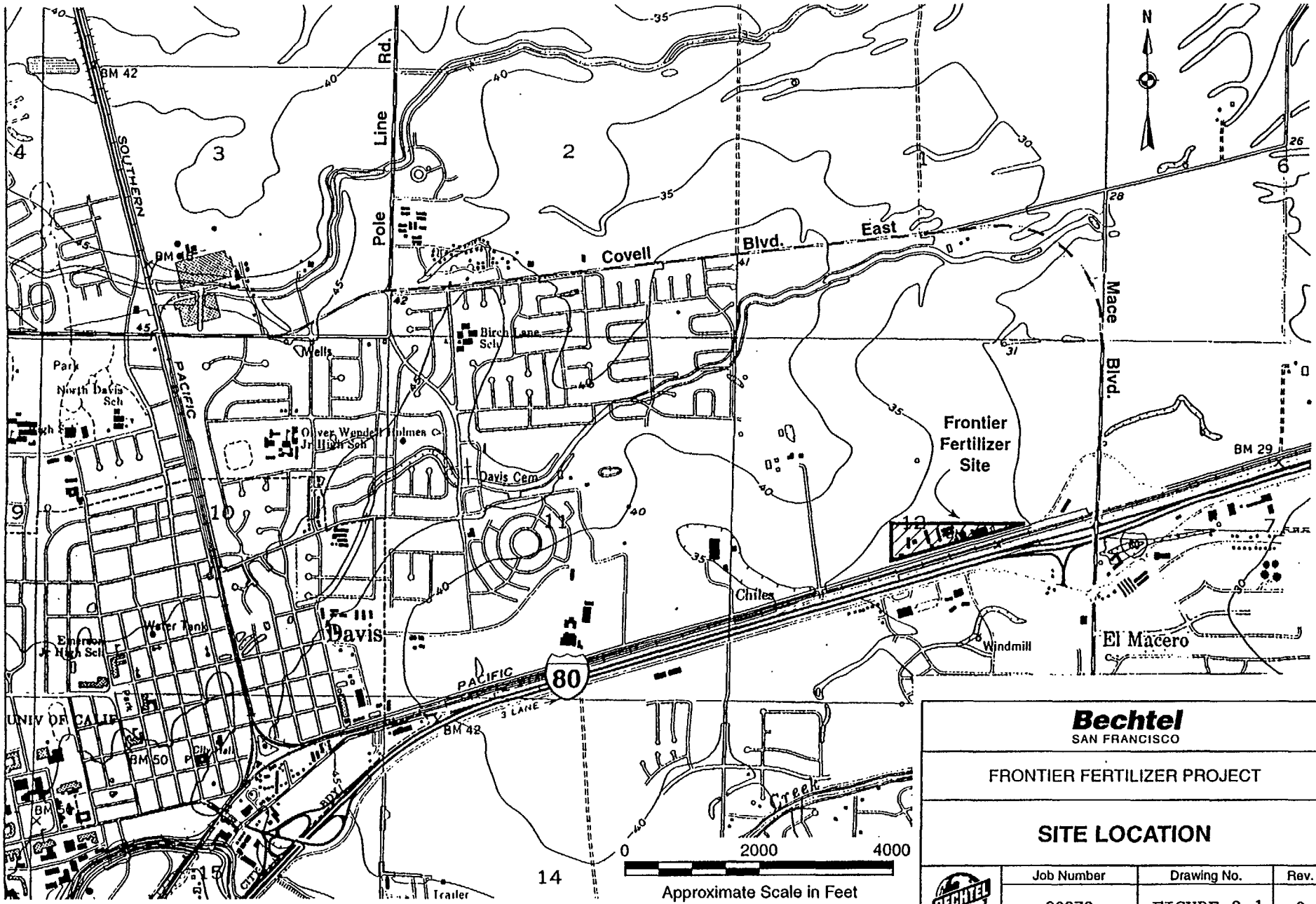
As shown in Figure 2–2, the site is triangular in shape. Several warehouse and shop buildings are located in the eastern part of the site. These buildings were used for equipment maintenance and grain and equipment storage. The labor camp complex, which is located in the central portion of the site, was used to house migrant farm laborers from 1950 to 1972. The labor camp complex consists of three housing buildings and a concrete sump. The tomato grading station, which is in the southwestern portion of the site consists of a grading facility, a sump, scales and a scale house. The pole barn and a warehouse is located in the western section of the site. The pole barn was used for machinery and pesticide storage. The warehouse was used for pesticide and fertilizer storage. In the northwest corner of the site is the disposal basin area. An unlined disposal basin received pesticide rinsewater generated by the washing of pesticide tank trailers on site. In 1985, the disposal basin was excavated and the area was backfilled. Approximately 30,000 cubic yards of soil in this area are contaminated with EDB, DCP, and DBCP. This area of soil contamination may be a continuing source of groundwater contamination.

2.3 Operational History

The site was first operated as farm headquarters of the C. Bruce Mace Ranch Company in 1950. Grain warehouses and barns for machinery storage were the first buildings erected. A labor camp for Mexican nationals was constructed between 1952 and 1954. Site development continued from east to west, with the site finally occupying 14 acres in 1970. In 1970, the 14–acre site was sold to Anderson Farms, Inc. The next major improvement of the site and its operations occurred in 1972, when a tomato grading station and a wash rack to rinse off tomato trucks were installed in the south–central area. In addition, Barber–Rowland Company (Barber–Rowland) moved onto the 4 acres to the west of the original 14 acres, completing the expansion of the site to 18 acres.

The arrival of Barber–Rowland in 1972 marked the beginning of fertilizer and pesticide operations on the site. In 1982, Frontier Fertilizer took over the fertilizer and pesticide operations from Barber–Rowland. Frontier's operations were terminated in 1987. During site operations by Barber–Rowland and Frontier Fertilizer, fertilizers and pesticides were stored in

SFQ19/BEI_DESIGN/DRAFT_2/FRONTIER/lfsitegw.ai
12/13/96da



Source: U.S.G.S. Davis, CA 7-1/2 minute series topographic quadrangle 1952, photorevised 1981.

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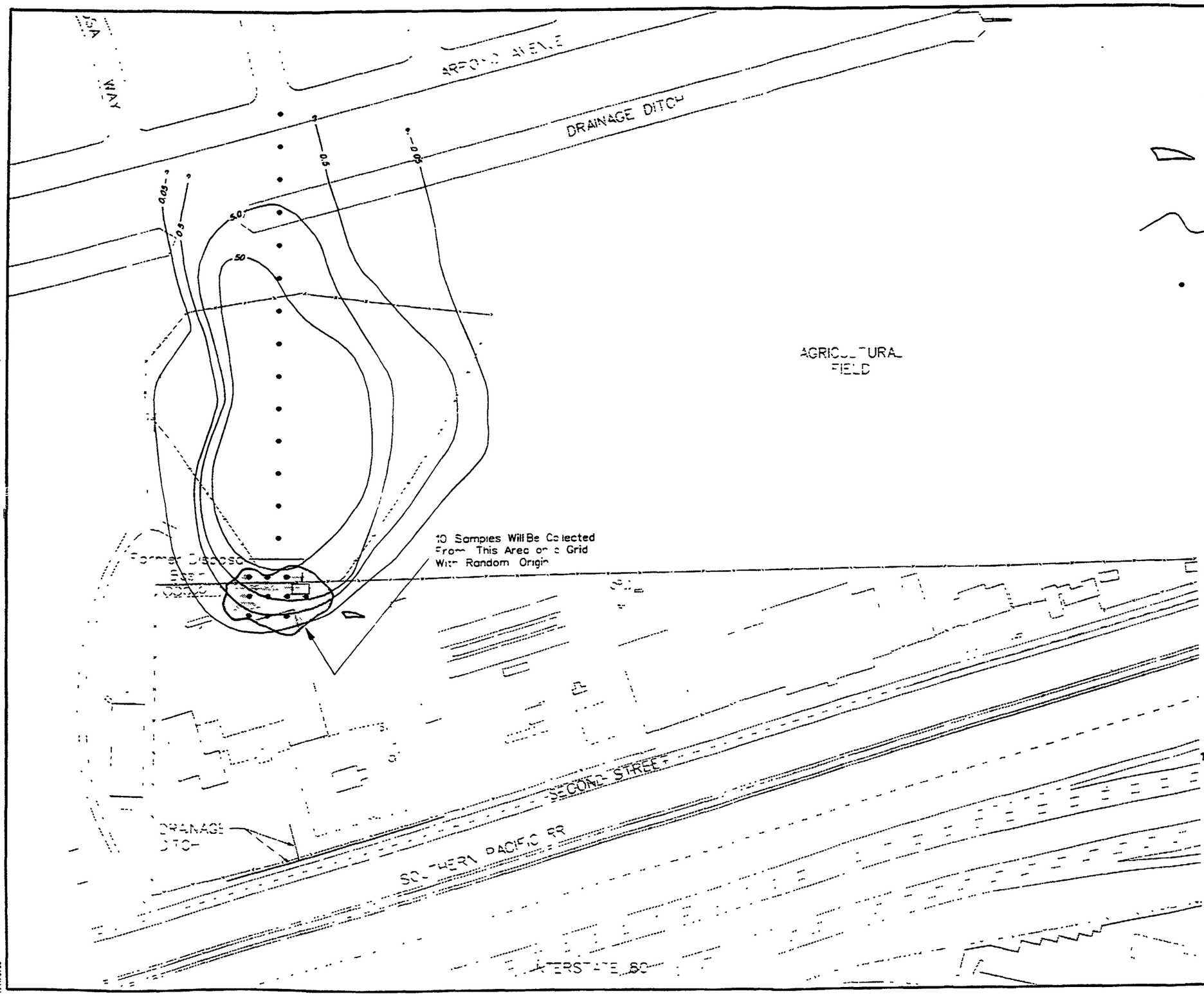
FRONTIER FERTILIZER PROJECT

SITE LOCATION

Job Number	Drawing No.	Rev.
20376	FIGURE 2-1	0



EXPLANATION

Approximate Extent of EDB in Soil at concentrations ≥ 5 ug/kg (based on samples from 7-8 feet deep), July 1995

Approximate Extent of EDB in S-1 Zone Groundwater, May 1996 (ug/L)

• Planned Soil-Gas Sample Location

NOTES:

1) Locations of samples in the disposal basin area will be selected in the field.

2) Flux-chamber samples will be collected at all disposal basin area sampling locations and at north-south transect locations as determined by the soil-gas concentrations

- N -

150 75 0 150 300

APPROXIMATE SCALE IN FEET

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DAVIS, CALIFORNIA

SOIL-GAS AND FLUX-CHAMBER SAMPLING LOCATIONS

Job Number	Drawing No	Rev
20376	FIGURE 1-5b	0

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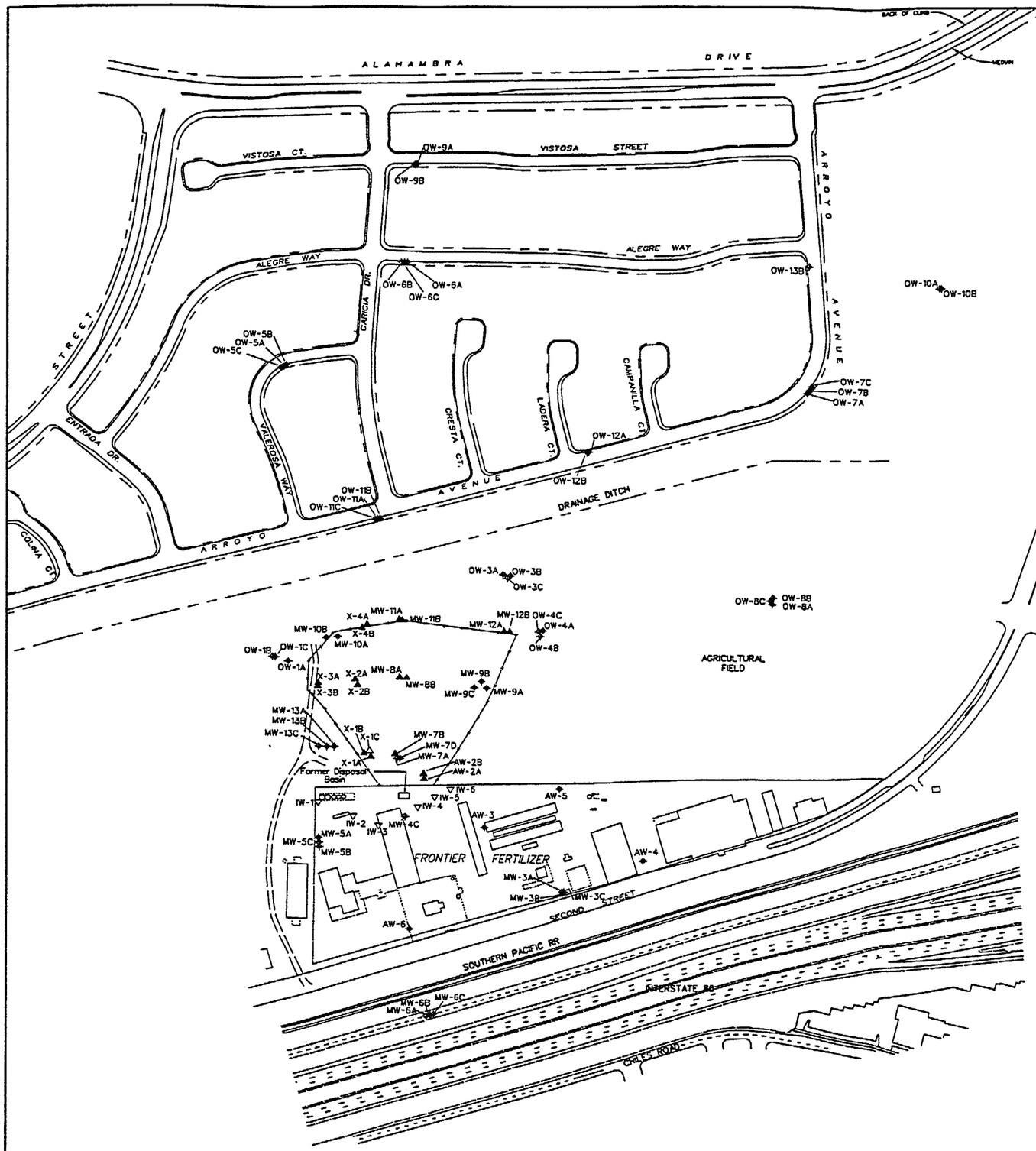

EXPLANATION

MW-10A ⊕	Monitoring Well
IW-6 ▽	Inactive Injection Well
X-2A ▲	Active Extraction Well
X-1C △	Inactive Extraction Well

N

100 0 100 200 400

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FRONTIER FERTILIZER
DAVIS, CALIFORNIA

SITE FEATURES MAP

Job Number	Drawing No.	Rev
20376	FIGURE 2-2	0

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07/19/90

Table 5-1 (Cont'd)
Well Construction Summary

Well ID	Northing	Easting	Installation Date	Installer	Ground Elevation (ft)	Top of Casing Elevation (ft)	Depth of Screen (ft)	Depth of Filter pack (ft)	Total Depth of Well (ft)	Total Depth Explored (ft)	Well Type	Zone
OW-12B	323845.86	2085755.00	7/7/98	B	30.3	30.09	69-79	67-80	80	80	Monitoring	S-2
OW-13B	324326.67	2086332.57	7/8/98	B	30.2	29.95	70-75	67-82.5	83.5	83.5	Monitoring	S-2
X-1A	232052.76	2085194.26	4/22/95	EE	31.11	31.1	31 to 51	30 to 52	53	53.5	Extraction	S-1
X-1B	323061.14	2085176.87	4/25/95	EE	31.13	34.2	66 to 85	64 to 86	88	90	Extraction	S-2
X-1C	323066.87	2085192.22	5/3/95	EE	31.4	30.8	111 to 131	109 to 134	133	134	Extraction	A-1
X-2A	323253.40	2085153.84	4/26/95	EE	31.41	31.23	30 to 50	29 to 54	54	54	Extraction	S-1
X-2B	323239.28	2085160.04	4/28/95	EE	31.46	31.61	71 to 91	70 to 94	94	94	Extraction	S-2
X-3A	323243.00	2085057.24	5/6/95	EE	32.17	32.02	30 to 50	28 to 53	53	53	Extraction	S-1
X-3B	323235.94	2085057.13	5/11/95	EE	32.36	31.79	65 to 90	62 to 93	93	93	Extraction	S-2
X-4A	323397.19	2085184.59	4/29/95	EE	31.65	31.37	28 to 48	26 to 48	53	53	Extraction	S-1
X-4B	323387.25	2085171.22	5/5/95	EE	31.38	31.28	68 to 88	67 to 91	91	91	Extraction	S-2

Acronyms/Abbreviations:

B – Bechtel
EE – Ecology and Environment
GTI – Groundwater Technology, Inc.
ID – identifier
LS – Luhdorff and Scalmanini

When collecting duplicate groundwater samples, bottles with the two different sample designations will alternate in the filling sequence. Section 7.5 gives detailed procedures for sample packaging, labeling, and shipping. All groundwater sampling equipment will be decontaminated before and after each sample is collected using procedures outlined in Section 5.3. Field notes will be kept in accordance with procedures outlined in Section 7.1.

5.2 Equipment Rinsate Samples

Equipment rinsate samples will be collected to evaluate field sampling and decontamination procedures by pouring laboratory–grade, certified organic–free water over the decontaminated sampling equipment. One equipment rinsate sample will be collected each day at the locations described in Section 4.0. Equipment rinsate samples will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate samples that are collected will be analyzed using the attached RAP for CRF for volatile organic compounds plus EDB and DBCP using the 25 ml purge method and by Method 504.

The equipment rinsate samples will be preserved, packaged, and sealed in the manner described in Section 7.0 of this sample plan. A separate CLP sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

5.3 Decontamination Procedures

The decontamination procedures that will be followed are in accordance with approved QAPjP procedures. Decontamination of sampling equipment must be conducted consistently to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated water will be decontaminated. Disposable equipment intended for one time use will not be decontaminated but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling devices used, including trowels and augers, will be steam–cleaned or decontaminated according to EPA Region IX recommended procedures.

The following, to be carried out in sequence, is an EPA Region IX recommended procedure for the decontamination of sampling equipment:

1. Wash with non–phosphate detergent and tap water, using a brush if necessary
2. Tap–water rinse
3. Deionized/distilled water rinse
4. Pesticide grade solvent (hexane) rinse (when semi-volatile and non–volatile organic contamination may be present) in a decontamination bucket
5. Deionized/distilled water rinse (twice)
6. Organic free water rinse [high performance liquid chromatography (HPLC) grade]

Equipment will be decontaminated in a pre-designed area on pallets or plastic sheeting, and clean equipment will be stored on plastic sheeting in uncontaminated areas. Materials to be stored more than a few hours will also be covered.

6.0 DISPOSAL OF INVESTIGATION–DERIVED WASTES

In the process of collecting environmental samples at the Frontier Fertilizer site during this field sampling event, the BEI site team will generate different types of potentially contaminated investigation–derived wastes (IDW) that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Purged groundwater

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during RI/FS field investigations comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the Office of Emergency and Remedial Response (OERR) Directive 9345.3–02 (May 1991) which provides the guidance for the management of IDW during RI/FS field investigations. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

Listed below are the procedures that will be followed for handling the IDW. The procedures have enough flexibility to allow the site investigation team to use its professional judgment on the proper method for the disposal of each type of IDW generated at each sampling location.

- Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.
- Decontamination fluids that will be generated during this field sampling event will consist of pesticide grade solvent, deionized water, residual contaminants, and water with non–phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site. The water (and water with detergent) will be poured onto the ground or into a storm drain. Pesticide grade solvents will allowed to evaporate from the decontamination bucket.
- Groundwater purge water will be treated on site using the groundwater remediation system.

7.0 SAMPLE DOCUMENTATION AND SHIPMENT

7.1 Field Logbooks

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. At a minimum, the following sampling information will be recorded:

- Site sketch
- Sample location and description
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sampling equipment used
- Onsite measurement data (e.g. temperature, pH, conductivity, etc.)
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Type of preservation used
- Instrument reading (e.g., OVM, HNU, etc.)
- Lot numbers of the sample containers, sample tag numbers, chain–of–custody form numbers, and chain–of–custody seal numbers
- Shipping arrangements (Federal Express air bill number)
- Recipient laboratory(ies).

Logbooks are bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology which might prove inappropriate. In addition to the sampling information, the following specifics will also be recorded in the field logbook:

- Team members and their responsibilities
- Time of site arrival/entry on site and time of site departure
- Other personnel on site

- A summary of any meetings or discussions with any potentially responsible parties (PRPs), representatives of PRPs, or federal, state, or other regulatory agencies
- Any deviations from sampling plans, site safety plans, and QAPjP procedures
- Any changes in personnel and responsibilities as well as reasons for the changes
- Levels of safety protection
- Equipment calibration and equipment model and serial number.

7.2 Bottles and Preservatives

The number of sample containers, volumes, and materials are listed in the Section 4.0, Request for Analyses tables. The containers are pre–cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by BEI to the containers prior to shipment of the sample containers to the laboratory.

7.2.1 Groundwater Samples

Low concentration groundwater samples to be analyzed using the attached RAP for CRFs volatile organic compounds plus EDB and DBCP, RAS volatile organic compounds plus EDB and DBCP using the 25 ml purge method, and EPA Method 504 for EDB and DBCP will be collected in 40–ml amber glass vials provided by the EPA Equipment Management Facility (EMFAC II). The 40-ml glass vials will be pre-acidified with two drops of 1:1 hydrochloric acid (HCl) except for vials designated for Method 504 analysis. During purging, the pH will be measured using a pH meter on at least one vial at each sample location to ensure the pH is less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCl will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be filled so that no headspace occurs. The samples will be placed on ice to chill to 4°C immediately upon collection. As shown in Table 4–1, three vials of each groundwater sample are required for each analysis.

7.2.2 Equipment Rinsate Samples

Low concentration equipment rinsate samples to be analyzed using the attached RAF for CRFs for volatile organic compounds plus EDB and DBCP using the 25 ml purge method and using Method 504 will be collected in 40–ml amber glass vials provided by the EPA Equipment Management Facility (EMFAC II). The 40-ml glass vials will be pre-acidified with two drops of 1:1 hydrochloric acid (HCl) except for vials designated for Method 504 analysis. The pH will be measured using a pH meter on at least one vial to ensure the pH is less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCl will be added to the sample vials.

Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be filled so that no headspace occurs. The samples will be placed on ice to chill to 4°C immediately upon collection. Two vials of each equipment rinsate sample is required for each laboratory.

7.3 EPA Chain-of-Custody Records And QA/QC Summary Forms

The EPA Chain-of-Custody Records are used to document sample collection and shipment to offsite laboratories. All sample shipments will be accompanied by a chain-of-custody record. One form will be completed and sent with the samples for each laboratory and each shipment (i.e., each day). If multiple coolers are sent to a single lab on a single day, one form per cooler will be completed and sent with the samples.

The chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of BEI. The field engineer will sign the chain-of-custody record. The field engineer will sign the "relinquished by" box and note date, time, and air bill number.

In addition to maintaining the custodial integrity of the samples, the chain-of-custody records will include the following information:

- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (i.e., matrix)
- Type of analysis to be performed
- Type of preservation used
- Shipping arrangements (Federal Express air bill number)

The white (original) copy of the Chain-of-Custody Record will accompany the samples to the EPA Region IX Laboratory and the pink (second) copy will be sent to the EPA Region IX Quality Assurance Office (QA Office). A copy of the original will be made for the BEI file.

A quality assurance/quality control (QA/QC) summary form will be completed for each laboratory and each matrix of the sampling event. The sample numbers for all rinsate samples, reference samples, laboratory QC samples, and duplicates will be documented on this form (see Section 8.0). The original form will be sent to the QA Office; a photocopy will be made for the BEI file. This form is not sent to the laboratory.

A self–adhesive custody seal will be placed across the lid of each sample. For VOC samples, the seal will be wrapped around the cap. The shipping containers in which samples are stored (a steel–belted cooler) will be sealed with self–adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

The CLP Paperwork Instructions, Appendix G to the guidelines on *Preparation of a U.S. EPA Region 9 Sample Plan for EPA–Lead Superfund Projects,* will be taken to the field as a reference. Corrections on sample paperwork will be made by placing a single line through the mistake and initialing and dating the change. The correct information will be entered above, below, or after the mistake.

7.4 Labeling, Packaging, and Shipment

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The CLP samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: CLP SAS Number, station location, date of collection, analytical parameter, sampler's initials, and method of preservation. Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

All sample containers will be placed in a strong–outside shipping container (a steel–belted cooler). The following outlines the packaging procedures that will be followed for low concentration samples.

1. When ice is used, the samples shall be surrounded by the ice and triple bagged with heavy duty plastic bags. Also, the drain plug of the cooler shall be secured with fiberglass tape to prevent melting ice from leaking out of the cooler.
2. Line the bottom of the cooler with bubble wrap to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
4. Secure bottle/container tops with strapping tape and custody seal all container tops.
5. Affix sample labels onto the containers with clear tape.
6. Wrap all glass sample containers in bubble wrap to prevent breakage.
7. Seal all sample containers in heavy duty plastic bags. Write the sample numbers on the outside of the plastic bags with indelible ink.

All samples will be placed in coolers with the appropriate EPA Chain-of-Custody Record. All forms will be enclosed in a large plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and

breakage during shipment. Vermiculite will also be placed in the cooler to absorb spills if they occur. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature. Each ice chest will be securely taped shut with nylon strapping tape, and custody seals will be affixed to the front, right and back of each cooler.

The Region IX Regional Sample Control Center (RSCC) will be notified daily (phone 415–882–1180) of the sample shipment schedule (Friday shipments must be reported no later than noon) and will be provided with the following information:

- Sampling contractor's name
- The name and location of the site
- Chain-of-Custody Record Number
- Sample identification number
- Total number(s) by concentration and matrix of samples shipped to each laboratory
- Carrier, air bill number(s), method of shipment (priority next day)
- Sample date and time it was sampled
- Shipment date and when it should be received by lab
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be shipped or if this is the last shipment.

8.0 QUALITY CONTROL

8.1 Equipment Rinsate Samples

Equipment rinsate samples will be prepared to evaluate field sampling and decontamination procedures. The equipment rinsate samples will be prepared as described in Section 5.2. The equipment rinsate samples that are collected will be analyzed using the attached RAF for CRFs for volatile organic compounds plus EDB and DBCP using the 25 ml purge method and using Method 504.

A minimum of one equipment rinsate sample will be collected each day that sampling equipment is decontaminated in the field. Equipment rinsate samples will be obtained by passing water through or over the decontaminated sampling device.

The equipment rinsate samples will be preserved, packaged, and sealed as appropriate for water samples. A separate CLP sample number and station number will be assigned to each rinsate sample, and it will be submitted blind to the laboratory.

8.2 Background (Reference) Samples

The background (reference) samples will be collected in an area which is unlikely to have received contaminants. Background samples are intended to be representative of conditions that exist in the site vicinity. Background/upgradient samples will be taken in similar geological strata to the other sample locations and at similar depth. The background samples that are collected will be analyzed using the attached RAF for CRFs for volatile organic compounds plus EDB and DBCP using the 25 ml purge method. In addition, if EDB or DBCP are not found in the sample at a level of 1 µg/L or higher for any background sample analyzed using the above analysis, then that sample must be analyzed for EDB and DBCP using EPA Method 504.

Background/upgradient groundwater samples will be collected from sample locations MW–3A, MW–3B, MW-3C, MW–6A, MW–6B, and MW–6C. Each of these wells are screened in one of the three shallow groundwater zones beneath the site. Monitoring wells MW-3A, MW–6A and MW–6B are designated as the background sample locations for groundwater zone S–1. Monitoring wells MW–3B and MW–6C are designated as the background sample locations for groundwater zone S–2. Monitoring well MW–3C is designated as the background sample location for the A–1 aquifer.

Background samples will be preserved, packaged, and sealed in the same manner as other soil or water samples. A separate CLP sample number and station number will be assigned to each background sample, and it will be submitted blind to the laboratory.

8.3 Duplicate Samples

Duplicate samples are collected simultaneously with a standard sample from the same source under identical conditions into separate sample containers. A duplicate sample is treated independently of its counterpart in order to assess laboratory performance through comparison of the results. At least 10 percent of samples collected per event will be duplicates. At least one duplicate will be collected for each sample matrix. Every analytical group for which a standard sample is analyzed will also be tested for in one or more duplicate samples. Duplicate samples should be collected from areas of known or suspected contamination.

Duplicate groundwater samples will be collected at sample locations MW–13A, OW–3A, MW–9A, OW-6A, X-1A, and X-2A. Duplicate groundwater samples will be extracted from these wells because analytical results of past sampling events indicate the presence of pesticides. In addition, these wells provide duplicate samples from each of the three shallow groundwater zones beneath the site.

Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. A separate CLP sample number and station number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

8.4 Laboratory Quality Control Samples

Laboratory quality control (QC) samples are analyzed by the EPA contract as part of the CLP standard laboratory quality control protocols. The laboratory monitors the precision and accuracy of the results of their analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike samples and matrix spike duplicate samples. The term "matrix" refers to use of the actual media collected in the field (i.e., routine soil and water samples). Laboratory QC samples are an aliquot (subset) of the field sample. They are not a separate sample but a special designation of an existing sample. A routinely collected water sample (three 40–ml glass vials) does not contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. For water samples, double volumes of samples are supplied to the laboratory for its use. Two sets of water sample containers are filled and all containers are labeled with a single sample number. The laboratory is alerted as to which sample is to be used for QC analysis by notation on the sample container label and the traffic report and chain–of–custody record. Laboratory QC samples should be collected from areas of known or suspected contamination.

At a minimum, one laboratory QC sample is required per week or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 1 week or involves collection of more than 20 samples per matrix, additional QC samples will be designated. For this sampling event, groundwater samples collected at the following locations will be the designated laboratory QC samples: sample locations OW–3A, MW–7B, OW-10B, and MW–8A.

8.5 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, QA Office will be notified of the modifications and a verbal approval will be obtained before implementing the modifications. Modifications to the approved plan will be documented in the RI/FS Report.

containers, sold in bulk, or mixed and placed in 500– to 1,000–gallon trailers that were attached to a purchaser's truck for transport to the farm. If a pesticide container or trailer was returned with residual material inside, the excess pesticide and container rinsate were poured onto the ground or into at least one unlined disposal basin located near the northwest corner of the site (Figure 2–2). In addition, used pesticide, insecticide, and herbicide containers were stored, crushed, and disposed of on site and at other locations off site. Frontier Fertilizer operations were confined to the western end of the property. Currently, the site is fenced and secure, and there are no activities other than those associated with the remediation.

According to California Department of Health Services (DHS) records, on July 27, 1983, an employee's dog came in contact with liquid in the disposal basin. The dog died of pesticide poisoning while being examined by a veterinarian. Yolo County Department of Public Health (YCDPH) personnel visited the site on August 2, 1983, and observed the 20–foot by 15–foot by 4–foot deep basin, with approximately 1,500 gallons of fluid ("dark, oily liquids") in it. YCDPH personnel returned 2 days later to collect fluid samples, but the pit had been pumped out. Soil samples collected from the base of the pit had very high concentrations of disyston and EDB. In September 1983, YCDPH, under the guidance of DHS, stipulated that corrective action be taken at the site. Soil samples taken by YCDPH on March 2, 1984 indicated that soil contamination by EDB, DCP, DBCP, and other pesticide– and herbicide–related compounds existed at the site.

EDB was employed as a soil fumigant to kill nematodes and was normally purchased from manufacturers as a powder, or in a 5 percent solution in water. Its use in California was discontinued in 1982. DBCP was employed as a nematicide and was normally purchased from manufacturers in powder form or in 7.5 percent solutions in water. Its use was discontinued in California in 1977. DCP is still used in California as a nematicide and for weed control.

2.4 Previous Activities

2.4.1 Previous Remedial Actions

Soil Removal Conducted by Frontier Fertilizer

Soil sampling activities took place between August 1983 and November 1984. Following a pilot treatment study, the RWQCB and DHS approved Frontier Fertilizer's plans to proceed with preliminary remedial action at the site. The remedial action consisted in the removal of soil from the pesticide disposal basin northeast of the pole barn, and land farming of the excavated soil. On April 11 to April 15, 1985, the pesticide disposal basin was excavated to a depth of 20 feet, and approximately 1,100 yd^3 of soil was excavated. The excavated soil was hauled to the treatment site, where it was unloaded in windrows approximately 75 feet apart, graded until smooth, and laser–leveled to an applied soil thickness of 1.5 inches. After the soil had been spread, the field was disked. The soil was disked again the following week and disked a third time after about a month.

Groundwater Extraction and Treatment Conducted by the State

The DTSC began a removal action in early 1993 by installing pumps in monitoring wells MW–7B and MW–7C and a construction treatment system on site. This system was designed to draw down the water levels in the two wells by several feet at a flow rate of 0.25 gpm in each well. Wells MW–7B and MW–7C were selected for use as extraction wells because the concentrations of pesticides were highest in them and they are approximately 100 feet downgradient from the former pesticide disposal basin. This system operated until May 1995, when it was replaced by a larger system, installed by EPA.

Groundwater Extraction and Treatment Conducted by EPA

In July 1995, EPA installed a groundwater extraction and activated carbon treatment system at Frontier Fertilizer. Pumps were installed in 17 wells, and 8 wells were plumbed as injection wells. Ecology and Environment (E&E) has been monitoring the treatment system for EPA. Initially, the 17 wells were pumping approximately 28 gpm. Flows have increased gradually since July 1995 to about 50 gpm as of April 1996. BEI assumed responsibility for operating and maintaining the system for EPA in April 1997.

The injection system uses wells IW–1 through IW–6, MW–4A, and MW–4B. All the injection wells use the head buildup within the casing as the injection head pressure. Approximately 30 to 40 percent of the system effluent (or treated groundwater) is discharged to the injection system, with the remainder discharged to the sanitary sewer.

2.4.2 Previous Investigations

Three groundwater investigations were carried out prior to EPA's direct oversight of the Frontier Fertilizer Site. These were conducted by Luhdorff and Scalmanini Consulting Engineers (LSCE) for Frontier Fertilizer, Groundwater Technology, Inc. (GTI) for RAMCO Enterprises, and Metcalf and Eddy, Inc. (M&E) for California EPA. LSCE's groundwater investigation focused on characterizing the nature and extent of contaminants in groundwater and site hydrogeologic characterization. GTI's investigation added several wells to the monitoring network and provided additional data to characterize the nature and extent of pesticide contamination. M&E's investigation was directed toward initial containment of the pesticide plume. M&E installed one additional monitoring well cluster, sampled the monitoring wells, and conducted aquifer pumping tests to support the design of a groundwater pump and treat system. The two investigations conducted for EPA are discussed below.

Preliminary Assessment Conducted by Ecology and Environment for EPA

In 1993, the EPA Emergency Response Section contracted with E&E to investigate pesticide soil and groundwater contamination at Frontier Fertilizer. The purpose of this investigation was to collect soil samples to determine levels of pesticide contamination remaining in the soil and to

attempt to locate a source for the carbon tetrachloride contamination. Analytical data were used to determine if a removal action was warranted for any source area on site. Removal options considered included soil vapor extraction and soil excavation. EPA determined that soil containing concentrations of 1,2–dibromoethane (EDB), 1,2–dibromo–3–chloropropane (DBCP), and 1,2–dichloropropane (DCP) above 1,000 parts per billion (ppb) would be considered for removal action.

Groundwater sampling and analysis were also conducted as part of the EPA preliminary assessment. Between August 24 and September 1, 1993, 25 of the 39 wells associated with the site were sampled. Wells were selected from all areas of the contaminated groundwater and all three water–bearing zones. The objective of the sampling event was to determine whether contaminant concentrations had changed since the previous sampling. Of particular concern was whether contamination was entering the A–1 aquifer. (Figure 2–2 shows well locations.)

Remedial Investigation Conducted by BEI for EPA

Upon review of the previous investigation results, it was determined that additional soil and groundwater sampling was required. Soil sampling was conducted as a hot spot search to determine if all sources of contamination had been identified. The entire Frontier Fertilizer property was sampled on a grid, and samples were analyzed for volatile organic compounds (VOCs), organophosphorus pesticides, carbonate/urea pesticides, and organochlorine pesticides.

Additional soil samples were collected to determine if site soil had been dispersed off site by wind and/or rain, to calibrate a VLEACH model of contaminant transport in the disposal basin area, to characterize the disposal basin soil for removal and disposal, and to determine background soil concentrations of chemicals of concern (COCs).

The results from analysis of these samples are presented in the February 1997 Draft Interim Final Remedial Investigation (RI) Report, which concludes for soil that:

- Contaminated soil has not been transported off site by wind or surface water runoff.
- Soils in the immediate vicinity of the former disposal basin contain levels of contaminants that may not be above RCRA hazardous levels.
- Soils beneath and adjacent to the former disposal basin are contaminated with pesticides to depths corresponding, at a minimum, to the water table at a depth of 32 feet below ground surface (bgs).
- The lateral extent of these contaminated soils has been delineated.
- Other possible sources of contaminants were investigated but none were found.
- Background soils contain detectable concentrations of several pesticides.

- Contaminant levels in soils are indicative of a dense non–aqueous phase liquid (DNAPL) release. The highest levels of EDB and DCP were detected in soils near the former disposal basin.
- DNAPL migration probably extends beyond the water table, and into the S–2 water–bearing zone.
- Site surface soils are not generally contaminated with pesticides at concentrations above PRGs.

Groundwater sampling was conducted as a HydroPunch™ survey to determine the leading edge of the pesticide plume in the S–1 and S–2 water–bearing zones and in the A–1 aquifer. This survey included preparation of geologic logs and water level measurements. In addition, groundwater samples were collected and water level measurements were made at site monitoring wells during the RI. The results from analysis of these data are also presented in the RI Report, which concludes for groundwater that:

- Groundwater occurs in three water–bearing zones. From shallowest to deepest, they are the S–1 zone, the S–2 zone, and the A–1 aquifer. The S–1 and S–2 zones are silty sand lenses surrounded by a clay and silt material. The A–1 aquifer is a more regionally extensive gravel and sand aquifer with one to two orders of magnitude greater transmissivity than that of the shallower sand zones. The site hydrogeology is a three–dimensional flow system. The flow system exhibits a horizontal or lateral anisotropy; therefore, S–1 and S–2 sands and the A–1 aquifer are valid representations of site conditions. However, there are significant vertical flow components that are recognized and integrated into the conceptual model.
- There is an areally extensive clay aquitard between the S–1 and S–2 zones. Although this clay appears to be extensive, there may be localized regions of interconnection between the S–1 and S–2 zones. The aquitard separating the S–2 zone and the A–1 aquifer pinches out to the north. There is evidence from the seasonal water level changes and the geologic data that the S–2 zone and A–1 aquifer are hydraulically interconnected in this area.
- Groundwater contamination was detected at high levels locally in the S–1 and S–2 zones and at much lower levels in the A–1 aquifer.
- The highest concentrations of EDB, DBCP, and DCP were detected in the S–1 and S–2 zone wells located immediately downgradient from the former disposal basin.
- Contaminant levels in the S–1 and S–2 zones indicate a localized presence of DNAPL. Although the DNAPL may no longer be mobile, it does

appear to have migrated into the S–2 zone around wells MW–7C and MW–13B.

- Dissolved phase contaminants enter the A–1 aquifer where the intervening aquitard pinches out, and the downward gradients between the A–1 aquifer and S–2 zone induce migration of groundwater from the S–2 into the A–1 aquifer. Because of the low concentrations of DCP, EDB, and DBCP and the limited areal extent of these compounds in the A–1 aquifer, there was no indication of a DNAPL in the A–1 aquifer.

- Carbon tetrachloride was detected at concentrations above the maximum contaminant level (MCL) in the S–1, S–2, and A–1 zones. The plume configuration is markedly different from the pesticide plume configuration, indicating the carbon tetrachloride source is not the former disposal basin. Soil and groundwater data do not indicate the source for the carbon tetrachloride.

- Background wells, located across I–80 and hydraulically upgradient from the site, contained tetrachloroethene (PCE) and other organic compounds at detectable concentrations. During one sampling event, PCE concentrations were above the MCL (5.0 μg/L) in two upgradient wells.

3.0 SAMPLING AND ANALYSIS PROGRAM AND RATIONALE

3.1 Sampling Recommendations

Groundwater sampling may be conducted at any of the monitoring wells on or adjacent to the site (see Figure 2–2). Monitoring wells MW–3A, MW–3B, MW–3C, MW–6A, MW–6B, and MW–6C were chosen as background/upgradient locations. These wells are screened in each of the three shallow groundwater zones beneath the site. Monitoring wells MW–3A, MW–6A and MW–6B are designated as the background sample locations for groundwater zone S–1. Monitoring wells MW–3B and MW–6C are designated as the background sample locations for groundwater zone S–2. Monitoring well MW–3C is designated as the background sample location for the A–1 aquifer. Analytical results of groundwater samples collected from monitoring wells MW–3B and MW–3C indicate the presence of EDB, DCP, and carbon tetrachloride in these wells. However, with the exception of DCP in MW–3B, these compounds have not been consistently detected. MW–6A, MW–6B, and MW–6C do not contain measurable concentrations of site related contaminants.

Generally, routine monitoring will focus on perimeter wells and down gradient wells to assure that closed concentration contours can be completed when presenting the monitoring results. A minimal number of plume core area wells will be sampled, since these wells have a long history of high levels of contamination and no observable concentration versus time trends. During the upcoming phase two of the remedial investigation, more intensive monitoring will be conducted for one round of sampling to obtain as high a spatial resolution as possible picture of the

distribution of contaminants in the S–1 and S–2 zones. These data will be used to interpret planned soil gas and flux chamber sampling which will be conducted to evaluate the impact contaminated groundwater has on the flux of volatile organic compounds from the soil surface.

Upon completion of the phase two remedial investigation, new wells installed during the investigation will be added to the monitoring program. This FSP will be amended each quarter that monitoring is conducted to specify the monitoring wells recommended for sampling.

3.2 Analysis Recommendations

Groundwater samples collected from monitoring wells that have consistently contained high levels of EDB and DBCP will be analyzed using the attached Regional Analytical Program Client Request Form (RAP CRF) for volatile organic compounds plus EDB and DBCP using a 5 ml purge volume. Groundwater samples collected from all other wells will be analyzed using the attached RAP CRF for volatile organic compounds plus EDB and DBCP by using a 25 milliliter (ml) purge volume to achieve a contract required quantitation limit (CRQL) of 1 microgram per liter (µg/L). In addition, if EDB or DBCP are not found in the sample at a level of 1 µg/L or higher for any groundwater sample analyzed using the above analysis, then that sample will be analyzed for EDB and DBCP using the attached RAP CRF for the EPA Method 504.

EPA Method 504 has CRQLs for EDB and DBCP of 0.05 µg/L. These low CRQLs are required by risk assessors to properly assess the risks posed by the site to the surrounding environment.

4.0 REQUEST FOR ANALYSES

The Frontier Fertilizer site was identified as a potential hazardous waste site and entered into the CERCLIS database on August 1, 1985 (CAD 071530380). BEI will conduct this field sampling effort to gather data as part of an RI/FS under CERCLA. The anticipated sampling dates for the next sampling effort are March 15 to March 24, 1999. The following samples (including duplicate, QA/QC, and equipment rinsate samples) will be collected and analyzed as part of this effort:

- Four (4) low concentration water samples using the attached RAP CRF for volatile organic compounds plus EDB and DBCP.
- Seventy-one (71) low concentration water samples using the attached RAP CRF for volatile organic compounds plus EDB and DBCP using a 25 ml purge volume to achieve a CRQL of 1 µg/L.
- Seventy-one (71) low concentration water samples using the attached RAP CRF for EDB and DBCP via EPA Method 504. If EDB or DBCP are not found in the sample at a level of 1 µg/L or higher for any groundwater sample analyzed using the 25 ml purge method, then that sample will be analyzed for EDB and DBCP using EPA Method 504.

4.1 Groundwater Sample Analyses

As described in Table 4–1, groundwater samples will be collected from 58 locations. A double volume sample collected at sample locations OW-3A, MW–7B, OW-10B, X-1A and MW–8A will be identified to the laboratory for use in laboratory QA/QC. Duplicate groundwater samples will be collected at sample locations MW–13A, OW–3A. MW–9A, OW-6A, X–1A, and X–2A. Duplicate groundwater samples will be extracted from these wells because analytical results of past sampling events indicate the presence of pesticides. In addition, these wells provide duplicate samples from each of the groundwater zones beneath the site.

4.2 Equipment Rinsate Sample Analyses

Equipment rinsate samples will be prepared as described in Section 5.2. Equipment rinsate samples will be analyzed using the attached RAP CRFs for volatile organic compounds plus EDB and DBCP using the 25 ml purge method and using Method 504. The equipment rinsate samples will be prepared following the decontamination of groundwater sampling equipment used to collect samples from sample locations most likely to be contaminated. A minimum of one equipment rinsate sample will be collected each day that sampling equipment is decontaminated in the field. Table 4–1 shows the tentative locations for equipment rinsate samples.

5.0 FIELD METHODS AND PROCEDURES

This section describes the procedures to be used to collect groundwater samples. All samples will be handled in accordance with approved QAPjP procedures and the chain–of–custody guidelines specified in Section 7.3 and transferred into pre–cleaned containers. The containers will be labeled as described in Section 7.5, sealed with tape, and placed in coolers for transport to the laboratory. Samples will be collected in containers, preserved as appropriate, and analyzed within holding times specified in Section 7.2 and on Table 4–1. Samplers will don clean, disposable latex gloves at each sampling site. Prior to each sampling event, plastic sheeting shall be placed on the ground, over the sampling area, such that it prevents the extracted groundwater (either purged or sampled) from being re-introduced into the area.

5.1 Groundwater Samples

5.1.1 Water–Level Measurements

If well heads are accessible, wells will be sounded for depth to water from top of casing and total well depth prior to purging. An electronic sounder, accurate to the nearest +/– 0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column, the graduated markings on the probe wire

Table 4-1
Request for Analysis
Matrix = Water

CLP Analytical Services Requested				Special Analytical Services		
Chemistry Type				Organic		
Specific Analyses Requested				VOCs plus EDB and DBCP	VOCs plus EDB and DBCP by using the 25 ml purge method	EPA Method 504 for EDB and DBCP
Preservatives				Add 1:1 HCl to pH<2 Chill to 4°C	Add 1:1 HCl to pH<2 Chill to 4°C	Chill to 4°C
Analytical Holding Times				Hold <14 days	Hold <14 days	Hold <14 days
Contract Holding Times				Hold <10 days	Hold <10 days	Hold <10 days
Sample Number	Sample Location	Sample Date	Special Designation	Number and type of container	Number of 40 ml glass vials	Number of 40 ml glass vials
MW-6A	MW-6A	Day 1	Background		3	3
MW-6B	MW-6B	Day 1	Background		3	3
MW-6C	MW-6C	Day 1	Background		3	3
MW-3A	MW-3A	Day 1	Background		3	3
MW-3B	MW-3B	Day 1	Background		3	3
MW-3C	MW-3C	Day 1	Background		3	3
AW-5	AW-5	Day 1			3	3
AW-4	AW-4	Day 1			3	3
MW-4C	MW-4C	Day 2			3	3
MW-5A	MW-5A	Day 2			3	3
MW-5B	MW-5B	Day 2			3	3
MW-5C	MW-5C	Day 2			3	3
OW-1A	OW-1A	Day 2			3	3
OW-1B	OW-1B	Day 2			3	3
MW-13A	MW-13A	Day 2			3	3
MW-13B	MW-13B	Day 2			3	3
MW-13C	MW-13C	Day 2			3	3
OW-1C	OW-1C	Day 2			3	3
OW-3A	OW-3A	Day 3	LAB QA/QC		6	6
OW-3B	OW-3B	Day 3			3	3
OW-3C	OW-3C	Day 3			3	3
OW-4A	OW-4A	Day 3			3	3
OW-4B	OW-4B	Day 3			3	3
OW-4C	OW-4C	Day 3			3	3
MW-9A	MW-9A	Day 3			3	3
MW-9B	MW-9B	Day 3			3	3
MW-9C	MW-9C	Day 3			3	3
MW-7D	MW-7D	Day 4			3	3
MW-10A	MW-10A	Day 4			3	3
MW-8A	MW-8A	Day 4	LAB QA/QC		6	6
MW-8B	MW-8B	Day 4			3	3
AW-2A	AW-2A	Day 4			3	3
AW-2B	AW-2B	Day 4			3	3
MW-7B	MW-7B	Day 4	LAB QA/QC	6	0	0
X-1A	X-1A	Day 4		3	0	0
MW-11A	MW-11A	Day 5			3	3
MW-11B	MW-11B	Day 5			3	3
MW-12A	MW-12A	Day 5			3	3
X-2A	X-2A	Day 5			3	3

Table 4-1
Request for Analysis
Matrix = Water

CLP Analytical Services Requested				Special Analytical Services		
Chemistry Type				Organic		
Specific Analyses Requested				VOCs plus EDB and DBCP	VOCs plus EDB and DBCP by using the 25 ml purge method	EPA Method 504 for EDB and DBCP
Preservatives				Add 1:1 HCl to pH<2 Chill to 4°C	Add 1:1 HCl to pH<2 Chill to 4°C	Chill to 4°C
Analytical Holding Times				Hold <14 days	Hold <14 days	Hold <14 days
Contract Holding Times				Hold <10 days	Hold <10 days	Hold <10 days
Sample Number	Sample Location	Sample Date	Special Designation	Number and type of container	Number of 40 ml glass vials	Number of 40 ml glass vials
X-1B	X-1B	Day 5		3	0	0
OW-5A	OW-5A	Day 5			3	3
OW-5B	OW-5B	Day 5			3	3
OW-5C	OW-5C	Day 5			3	3
OW-6A	OW-6A	Day 6			3	3
OW-6B	OW-6B	Day 6			3	3
OW-6C	OW-6C	Day 6			3	3
OW-7A	OW-7A	Day 6			3	3
OW-7B	OW-7B	Day 6			3	3
OW-7C	OW-7C	Day 6			3	3
OW-8A	OW-8A	Day 6			3	3
OW-8B	OW-8B	Day 6			3	3
OW-8C	OW-8C	Day 6			3	3
OW-9A	OW-9A	Day 7			3	3
OW-9B	OW-9B	Day 7			3	3
OW-10A	OW-10A	Day 7			3	3
OW-10B	OW-10B	Day 7	LAB QA/QC		6	6
OW-11A	OW-11A	Day 7			3	3
OW-11B	OW-11B	Day 7			3	3
OW-11C	OW-11C	Day 7			3	3
OW-12A	OW-12A	Day 7			3	3
OW-12B	OW-12B	Day 7			3	3
OW-13B	OW-13B	Day 7			3	3
MW-15A	MW-13C	Day 2	Duplicate		3	3
MW-15C	OW-3A	Day 3	Duplicate		3	3
MW-16B	MW-9A	Day 3	Duplicate		3	3
MW-17B	X-1A	Day 4	Duplicate	3	0	0
MW-18A	X-2A	Day 5	Duplicate		3	3
MW-18B	OW-6A	Day 6	Duplicate		3	3
MW-14A	MW-3B	Day 1	Rinsate		3	3
MW-14B	MW-4C	Day 2	Rinsate		3	3
MW-14C	OW-3A	Day 3	Rinsate		3	3
MW-15D	MW-8B	Day 4	Rinsate		3	3
MW-16A	MW-11A	Day 5	Rinsate		3	3
MW-16C	OW-6A	Day 6	Rinsate		3	3
MW-17A	OW-11A	Day 7	Rinsate		3	3

are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level sounders have a visual indicator consisting of small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. Because the weighted probe will sink into silt at the bottom of well screens, total well depths will be measured and recorded to the nearest 0.1 feet. Water level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells which have the least amount of known contamination first. Water levels in extraction wells will be determined by electronically accessing the dedicated pressure transducer in each well.

5.1.2 Well Purging

All wells will be purged prior to sampling. Three to five casing volumes of water will be purged using an electric submersible pump, a hand bailer or a hand pump depending on the diameter and capacity of the well. In cases where hand bailers are used to purge the well, clean disposable bailers shall be used; a new disposable bailer will be used for each well. When pumps are used for purging, clean flexible plastic or Teflon tubes will be used for groundwater extraction. All tubes will be decontaminated before and after use in each well. Pumps will be placed 2 to 3 feet from the bottom of the well to permit reasonable drawdown but to prevent cascading conditions. If necessary, purge water will be collected into a measured bucket to record the purge volume.

Prior to the start of purging, the water level of the well will be measured as described in Section 5.1.1. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter based on the results of previous sampling. Monitoring well construction details are specified in Table 5–1 along with water elevations determined in Summer 1995.

One casing volume will be calculated as: $\mathbf{V = \pi d^2 h / 77.01}$

where:

V is the volume of one well casing of water (in gallons, 1 gallon = 7.48 ft^3);

d is the inner diameter of the well casing (in inches); and

h is the total depth of water in the well (in feet).

Prior to the start of sampling and after each well casing volume is purged, water temperature, pH, and specific conductance will be measured using field test meters and the measurements will be recorded. Samples will be collected after these parameters have stabilized; indicating representative formation water is entering the well. Three consecutive measurements which display consistent values of all parameters will be taken prior to sampling. Samples will be collected after three well casing volumes if parameters have stabilized. Typically, the temperature should not vary by more than +/– 1°C, pH by more than 0.2 pH units, and specific conductance by more than 10 percent from reading to reading. No water that has been tested with a field meter probe will be collected for chemical analysis. If these parameters have not stabilized after five

casing volumes have been purged, purging will cease, a notation will be recorded in the field logbook and samples will be collected. In accordance with Section 7.1, depth to water measurements, field measurements of parameters, and purge volumes will be recorded in the field logbook.

Extraction wells connected to the onsite remediation system will be purged directly into the groundwater treatment system and samples will be taken directly from the sampling tap on the well head. Water temperature, pH, and specific conductance will not be measured, since these wells are continuously pumped for treatment. Therefore, groundwater in these wells represents formation water.

If a monitoring well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80 percent of static water column, and dewatered once more. After water levels have recharged to 80 percent of the static water column, groundwater samples will be collected.

All field meters will be calibrated according to manufacturers guidelines and specifications prior to beginning field work every day. Field meter probes will be decontaminated before and after use at each well.

5.1.3 Groundwater Monitoring Well Samples

Groundwater samples will be collected from monitoring wells located on or adjacent to the site. A physical description of monitoring wells to be sampled is given in Table 5–1. Prior to sampling, the water level in the well will be measured as described in Section 5.1.1 and wells will be purged as described in Section 5.1.2. All wells will be sampled within 24 hours after purging. Clean nitrile gloves will be worn while collecting samples. Groundwater samples will be collected using a Teflon bailer or tap. Groundwater will be transferred from the Teflon bailer to the appropriate sample container using a bottom emptying device to reduce agitation of the water samples during transfer.

Extraction wells connected to the onsite remediation system will be sampled directly from the sampling tap closest to the well head. All aerators, strainers, or hoses will be removed from the tap prior to sample collection. The flow will be adjusted so that a gentle stream is obtained. A flow rate of less than 100 milliliters per minute is recommended for samples to be analyzed for RAS volatile organic compounds to minimize volatilization. Groundwater samples will be transferred from the bailer or tap directly into the appropriate sample containers, preserved as described in Section 7.2.1, chilled and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the discharge device (bailer) or tap to the sample container. The sample container (40–ml glass vial) will be inverted and checked for air bubbles to insure zero headspace. If bubbles are present, the vial will be opened and topped off. If air bubbles still exist, the vial will be discarded and a new sample will be collected.

Table 5-1
Well Construction Summary

Well ID	Northing	Easting	Installation Date	Installer	Ground Elevation (ft)	Top of Casing Elevation (ft)	Depth of Screen (ft)	Depth of Filter pack (ft)	Total Depth of Well (ft)	Total Depth Explored (ft)	Well Type	Zone
AW-2A											Extraction	
AW-2B	322997.00	2085330.00	6/1/85	LS	32.00	32.57	73 to 93	71 to 98	96	98	Extraction	S-2
AW-3	322869.95	2085487.12	6/1/85	LS	31.46	32.92	13 to 53	9 to 55	53	55	Monitoring	S-1
AW-4	322782.99	2085900.24	6/1/85	LS	31.47	32.88	15 to 32.5	12.5 to 99	32.5	39	Monitoring	S-1
AW-5	322970.79	2085685.24	6/1/85	LS	31.26	32.18	14 to 24	9 to 33	24	33	Monitoring	S-1
AW-6	322606.79	2085293.16	6/1/85	LS	31.96	31.70	13 to 23, 33 to 53	9 to 55	53	55	Monitoring	S-1
IW-1	322934.14	2085059.43	5/18/95	EE	32.39	32.64	25 to 90	23 to 93	93	93	Injection	S-1/2
IW-2	322898.74	2085148.83	5/19/95	EE	31.95	32.07	25 to 90	23 to 93	93	93	Injection	S-1/2
IW-3	322874.85	2085215.10	5/21/95	EE	31.91	32.19	25 to 90	23 to 93	93	93	Injection	S-1/2
IW-4	322922.29	2085314.81	5/22/95	EE	31.34	31.37	25 to 90	23 to 93	93	93	Injection	S-1/2
IW-5	322948.45	2085358.02	5/23/95	EE	31.52	31.75	25 to 90	23 to 93	93	93	Injection	S-1/2
IW-6	322969.07	2085397.89	5/24/95	EE	31.27	31.65	25 to 90	23 to 93	93	93	Injection	S-1/2
MW-3A	322705.96	2085692.00	3/7/86	LS	27.7	27.52	34 to 44	30 to 46	44	46	Monitoring	S-1
MW-3B	322701.49	2085694.44	3/7/86	LS	27.72	27.32	66 to 76	61 to 78	76	78	Monitoring	S-2
MW-3C	322705.84	2085697.05	3/7/86	LS	27.7	27.32	116 to 126	112 to 135	126	140	Monitoring	A-1
MW-4C	322897.67	2085281.65	3/7/86	LS	31.45	31.29	114 to 124	110 to 140	124	145	Monitoring	A-1
MW-5A	322842.18	2085060.19	7/1/87	LS	31.91	33.05	10 to 30	7 to 32	40	42	Monitoring	S-1
MW-5B	322818.94	2085061.50	7/1/87	LS	31.76	33.15	34 to 44	32 to 48	54	56	Monitoring	S-1
MW-5C	322830.48	2085060.56	7/1/87	LS	31.81	33.15	70 to 80	65 to 80	90	94	Monitoring	S-2
MW-6A	322382.75	2085335.91	10/7/87	LS	32.17	34.11	12.5 to 30	10 to 34	40	42	Monitoring	S-1
MW-6B	322385.00	2085345.97	10/7/87	LS	32.18	34.06	40 to 50	36 to 54	60	62	Monitoring	S-1
MW-6C	322388.52	2085354.78	10/7/87	LS	32.26	34.08	70 to 80	70 to 80	90	93.5	Monitoring	S-2

Table 5-1 (Cont'd)
Well Construction Summary

Well ID	Northing	Easting	Installation Date	Installer	Ground Elevation (ft)	Top of Casing Elevation (ft)	Depth of Screen (ft)	Depth of Filter pack (ft)	Total Depth of Well (ft)	Total Depth Explored (ft)	Well Type	Zone
MW-7A	323047.76	2085261.99	7/27/87	LS	31.37	33.94	12.5 to 30	9 to 33	40	42	Monitoring	S-1
MW-7B	323059.65	2085256.80	7/27/87	LS	31.27	29.81	36 to 46	34 to 49	56	58	Extraction	S-1
MW-7D	323048.18	2085269.04	12/11/89	GTI	31	33.88	114 to 124	111 to 130	129	130	Monitoring	A-1
MW-8A	323259.17	2085268.08	12/12/89	GTI	31.6	34.52	25 to 45	24 to 46	50	50	Extraction	S-1
MW-8B	323257.05	2085285.66	12/21/89	GTI	31.36	34.57	80 to 90	78 to 90	90	90	Extraction	S-2
MW-9A	323230.82	2085492.48	12/13/89	GTI	30.79	33.92	25 to 45	23 to 46	45	46	Monitoring	S-1
MW-9B	323247.90	2085479.24	12/21/89	GTI	30.69	33.76	71 to 81	69 to 82	87	88	Monitoring	S-2
MW-9C	323232.23	2085460.27	12/12/89	GTI	30.84	33.45	115 to 125	110 to 128	125	128	Monitoring	A-1
MW-10A	323363.89	2085108.47	12/15/89	GTI	32.05	35.05	25 to 45	23 to 46	50	50	Monitoring	S-1
MW-10B	323361.00	2085079.22	12/14/89	GTI	32.05	35.12	67 to 77	64 to 90	77	90	Monitoring	S-2
MW-11A	323410.05	2085266.93	12/14/89	GTI	31.53	34.23	25 to 45	23 to 46	45	45	Extraction	S-1
MW-11B	323407.70	2085274.82	12/28/89	GTI	31.51	34.65	67 to 77	63 to 79	77	90	Extraction	S-2
MW-12A	323379.77	2085538.9	12/14/89	GTI	30.79	34.05	25 to 45	24 to 46	45	46	Extraction	S-1
MW-12B	323379.03	2085553.92	12/27/89	GTI	30.74	33.87	67 to 77	67 to 90	77	90	Extraction	S-2
MW-13A	323078.01	2085100.26	12/9/91	GTI	31.98	31.55	37 to 51	35 to 53	52	53	Monitoring	S-1
MW-13B	323078.06	2085080.60	12/4/91	GTI	31.98	31.54	75 to 85	72 to 86	85.5	86	Monitoring	S-2
MW-13C	323078.94	2085060.37	11/18/91	GTI	31.98	33.92	115 to 125	113 to 127	125	126	Monitoring	A-1
OW-1A	323298.84	2084941.15	7/19/95	B	32.62	34.82	42 to 57	39 to 59	59	59	Monitoring	S-1
OW-1B	323310.53	2084941.29	7/17/95	B	32.41	34.62	68 to 88	66 to 89	88	90	Monitoring	S-2
OW-1C	323309.40	2084948.07	7/73/95	B	32.29	34.58	112 to 137	110 to 138	138	138	Monitoring	A-1
OW-3A	323527.40	2085536.45	7/31/95	B	30.95	33.20	39 to 49	38 to 50	51	51	Monitoring	S-1
OW-3B	323523.87	2085555.89	7/28/95	B	31.04	33.10	64 to 84	62 to 86	86	86	Monitoring	S-2
OW-3C	323517.63	2085547.71	7/26/95	B	31.09	33.44	103 to 133	100 to 139	139	139	Monitoring	A-1

Table 5-1 (Cont'd)
Well Construction Summary

Well ID	Northing	Easting	Installation Date	Installer	Ground Elevation (ft)	Top of Casing Elevation (ft)	Depth of Screen (ft)	Depth of Filter pack (ft)	Total Depth of Well (ft)	Total Depth Explored (ft)	Well Type	Zone
OW-4A	323381.97	2085640.82	8/4/95	B	30.71	32.99	37 to 47	35 to 49	49	49	Monitoring	S-1
OW-4B	323366.94	2085634.32	8/3/95	B	30.76	33.02	65 to 85	62 to 87	87	87	Monitoring	S-2
OW-4C	323379.66	2085629.75	8/2/95	B	30.7	32.94	113 to 145	110 to 147	147	147	Monitoring	A-1
OW-5A	324066.75	2084968.74	11/3/97	B	32.06	31.69	39 to 49	38 to 49	50	50	Monitoring	S-1
OW-5B	324069.97	2084974.72	11/4/97	B	32.08	31.85	69 to 79	69 to 79	80	80	Monitoring	S-2
OW-5C	324063.01	2084962.28	11/4/97	B	32.13	31.75	93 to 103	94 to 104	104	104	Monitoring	A-1
OW-6A	324336.77	2085287.63	11/4/97	B	30.87	30.51	37.5 to 42.5	38 to 44	43.5	43.5	Monitoring	S-1
OW-6B	324337.43	2085272.15	11/4/97	B	30.78	30.30	92 to 97	90 to 110	98	98	Monitoring	S-2
OW-6C	324337.22	2085279.36	11/4/97	B	30.83	30.31	124 to 134	115.5 to 135	135	135	Monitoring	A-1
OW-7A	324000.26	2086329.02	11/4/97	B	29.81	29.41	40 to 45	35.5 to 44	46	46	Monitoring	S-1
OW-7B	324008.55	2086335.19	11/5/97	B	29.76	29.29	68 to 73	67 to 72.5	74	74	Monitoring	S-2
OW-7C	324017.09	2086340.98	11/4/97	B	29.71	29.19	112.5 to 122.5	110 to 123.5	123.5	123.5	Monitoring	A-1
OW-8A	323449.71	2086237.99	11/5/97	B	30.21	31.35	40 to 45	36 to 48	46	46	Monitoring	S-1
OW-8B	323466.53	2086239.53	11/5/97	B	30.17	30.69	65.5 to 70.5	64.5 to 71.5	71.5	71.5	Monitoring	S-2
OW-8C	323458.05	2086223.36	11/5/97	B	30.22	31.86	109 to 119	108 to 120	120	120	Monitoring	A-1
OW-9A	324588.92	2085311.78	7/2/98	B	31.10	31.03	40 to 45	37 to 48.5	48.5	48.5	Monitoring	S-1
OW-9B	324588.67	2085306.65	7/1/98	B	31.1	31.02	65 to 75	62 to 77.5	78.5	78.5	Monitoring	S-2
OW-10A	324271.63	2086668.43	7/9/98	B	27.5	29.99	32-42	29-44	46	46	Monitoring	S-1
OW-10B	324271.02	2086672.90	7/9/98	B	27.6	29.99	63-68	60-77.5	78.5	78.5	Monitoring	S-2
OW-11A	323671.15	2085210.54	11/7/97	B	31.73	31.19	40 to 45	40 to 53	46	46	Monitoring	S-1
OW-11B	323672.63	2085217.34	11/7/97	B	31.68	31.51	68 to 73	66 to 73.5	74	74	Monitoring	S-2
OW-11C	323669.19	2085204.52	11/7/97	B	31.86	31.64	116 to 126	114.5 to 127	127	127	Monitoring	A-1
OW-12A	323847.27	2085759.45	7/10/98	B	30.4	30.21	43-53	41-56	56	56	Monitoring	S-1

Appendix A

Regional Analytical Program

Client Request Forms

U. S. ENVIRONMENTAL PROTECTION AGENCY
CLP Sample Management Office
P. O. Box 818 - Alexandria, Virginia 22313
Phone: 703/557-2490; FTS/557-2490

SAS Number

Modified? X YES ___ NO

SPECIAL ANALYTICAL SERVICES

Client Request

_____ Regional Transmittal _____ Telephone Request

A. EPA Region/Client: Region 9

B. Region Contact: RSCC Coordinator, [redacted]

C. Date of Request: March 10, 1998

D. Site Name: Frontier Fertilizer

E. City/State/ZIP Code: Davis, CA 95616

F. 2 Digit Superfund Site Identifier: 4R

G. CERCLIS #: CAD 0715 30380

Please provide below a description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address all applicable questions. Incomplete or erroneous information may result in a delay in the processing of your request. If you need to provide additional information not addressed by the questions, please attach additional sheets of paper.

1. General description of analytical service requested:

The analysis of low concentration soil and water samples for purgeable halocarbons and aromatics plus 1,2-dibromoethane (EDB) and 1,2-dibromo-3-chloropropane (DBCP) following SW-846 Methods 8010A and 8020A protocols.

2. Definition and number of work units involved (specify whether whole samples or fraction; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):

4 low water samples, these samples may contain levels of EDB and 1,2-dichloropropane in the ppm range and should be screened prior to analysis.

3. Purpose of analysis (specify whether Superfund [enforcement or remedial action], RCRA, NPDES, etc.):

SF RI/FS

4. **Estimated date(s) of collection (provide a sampling schedule):**

March 15 through March 24, 1999

5. **Estimated date(s) and method of shipment:**

Overnight carrier - samples are to be shipped on the day of collection for next day delivery.

6. **Number of days analysis and data required after laboratory receipt of samples:**

   a. The contract required holding time for analysis is ten (10) days from the date of sample receipt by the laboratory. The holding time requirement applies to any reanalyses, diluted analyses, and confirmation analyses.

   b. The technical holding time for analysis is fourteen (14) days from the date of sample collection. Please note that, for water samples that have not been preserved to a pH of 2 or below, the technical holding time for Method 8020A analysis is seven (7) days from the date of sample collection.

   c. Data packages and all other deliverables are required within 35 days from receipt of the last sample in each Sample Delivery Group (SDG). A SDG is defined as all samples received within a 14 day period or 20 samples, whichever is reached first.

7. **Analytical protocol required (attach copy if other than a protocol currently used in this program):**

   a. Determine the initial pH of all water samples.

   b. Follow the procedures outlined in Section 7.0 of SW-846 Method 5030A for sample introduction by purge-and-trap. Analyze a 5 milliliter volume for water samples or a 5 gram aliquot for soil samples. Sample introduction by direct injection is *not* an option unless prior approval has been obtained from the Region.

   c. Follow SW-846 Method 8010A procedures using gas chromatography/ electrolytic conductivity detection (GC/ELCD) for the analysis of halogenated volatile organic compounds (VOCs). A list of the required SW-846 Method 8010A target compounds with corresponding contract required quantitation limits (CRQL) is provided in Table 1 of this SAS Client Request Form (CRF).

d. Follow SW-846 Method 8020A procedures using gas chromatography/ photoionization detection (GC/PID) for the analysis of aromatic volatile organic compounds. A list of the required SW-846 Method 8020A target compounds with corresponding CRQLs is provided in Table 2 of this SAS CRF.

e. Second column confirmation analysis is *required* for all samples with positive results. Perform confirmation analyses on a column with a liquid phase different from that used for primary analysis. Follow the procedures outlined in Section 4.1.2 of SW-846 Methods 8010A and 8020A for column selection.

Evaluation of PID data to substantiate a positive result from the original analysis for the 8010A compounds which can be detected by the PID (e.g. bromobenzene and benzyl chloride) is not allowed. Evaluation of ELCD data to substantiate a positive result from the original analysis for the 8020A compounds which can be detected by the ELCD (e.g. chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene) is not allowed. Second *column* confirmation analysis is required.

Evaluation of PID data to show that the result from the original analysis is a false positive for the 8010A compounds which can be detected by the PID (e.g. bromobenzene and benzyl chloride) is acceptable. Evaluation of ELCD data to show that the result from the original analysis is a false positive for the 8020A compounds which can be detected by the ELCD (e.g. chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene) is acceptable.

Confirmation analyses must meet *all* instrument calibration criteria and blank acceptance criteria specified in Section 8 of this SAS CRF.

f. The following two modifications are acceptable to the Region if all other requirements specified in the SAS CRF are met:

(1) Use of a capillary column.

(a) Rtx-502.2®, Rtx-Volatiles®, Supelco VOCOL®, or DB™-624, or equivalent for primary analysis.

(b) Rtx-1® or DB™-1, or equivalent for confirmation analysis.

(2) Detection achieved by an electrolytic conductivity detector (ELCD) and a photoionization detector (PID) in series.

8. Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):

a. Calibration Procedure and Criteria:

1. Follow the protocols outlined in Section 7.4.2 of SW-846 Method 8000A for external standard calibration.

2. Alternatively, follow the protocols outlined in Section 7.4.3 of SW-846 Method 8000A, Section 5.7 of SW-846 Method 8010A, and Section 5.6 of SW-846 Method 8020A for internal standard calibration. If internal standard calibration is used, select one or more of the following compounds as internal standards: 1-chloro-2-fluorobenzene, 4-bromofluorobenzene, fluorobenzene, or 1,4-difluorobenzene.

3. Perform an initial calibration with at least five levels of standards. The standards must include all target and surrogate compounds. A 5-mL purge volume is required. The analytical working range must include a low standard at 5 nanograms (ng) and a midpoint standard at 50 ng. EDB and DBCP must be included in the initial calibration standard.

4. The %relative standard deviation (%RSD) between calibration factors (CFs) or relative response factors (RRFs) for all analytes in the initial calibration must not exceed 30%.

   a. Alternatively, use linear regression to verify calibration curve linearity. Prepare calibration curves following the protocols outlined in Method 8000A Section 7.4.2.2 or Method 8000A Section 7.4.3.3. A linear fit is required. The correlation coefficient for all target analytes in the initial calibration must be greater than or equal to 0.99.

   If calibration curves are used, documentation must be sufficient to recalculate all sample concentrations and QC results, as specified in Section 9.a.4 of this SAS CRF. Provide the equation for the line (i.e., $y = mx + b$) generated by the data system.

5. Determine a retention time (RT) window for each target and surrogate compound. Calculate the mean and standard deviation (σ_{n-1}) of the 5 retention times for each compound from the 5 concentration levels in the initial calibration. Calculate the window as the mean RT ±3 times the standard deviation.

6. Analyze a 50 ng continuing calibration standard at the beginning of each 12-hour time period during which samples are analyzed, after each group of 10 samples, and at the end of the analytical sequence. EDB and DBCP must be included in the continuing calibration standard.

7. The percent differences (%D) between CFs/RRFs from the continuing calibration and average CFs/RRFs from the initial calibration must not exceed ±25% for all analytes, except for the gases and methylene chloride. The %Ds for bromomethane, chloromethane, chloroethane, dichlorodifluoromethane, trichlorofluoromethane, vinyl chloride, 2-chloroethylvinylether, and methylene chloride must not exceed ±30%.

   a. If calibration curves were prepared from the initial calibration, calculate the concentration of each analyte in the continuing calibration from the curves using linear regression. The found value of each analyte in the continuing calibration must be 75-125% of the true value for all analytes, except the gases and methylene chloride. The found value of the gases and methylene chloride must be 70-130% of the true value.

8. The retention times of the target compounds in the continuing calibration must be within the RT windows established by the initial calibration.

9. All VOCs in the 5 ng standard must have a signal-to-noise ratio of 5:1 or greater. If this requirement cannot be met, submit a method detection limit (MDL) study as part of the data package, in order to validate the ability to achieve the contract required quantitation limits. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero.

b. <u>Internal Quality Control (QC) Checks, Control Limits and Corrective Actions</u>:

1. When calibration standard measurements exceed the QC requirements for the initial calibration or the continuing calibration, terminate analysis, correct the problem, and recalibrate the instrument.

   The continuing calibration standard reflects the conditions under which the analysis of all associated samples was performed. Associated samples are considered to be both the samples following the continuing calibration and the preceding samples up to the previous continuing calibration. Reanalyze all samples associated with an out-of-control continuing calibration standard

2. If internal standard calibration is used, internal standard area counts must not vary by more than a factor of 2 (-50% to +100%) from the area counts of the associated 50 ng calibration standard. Internal standard retention times (RT) must not vary by more than ±30 seconds from the RT of the associated 50 ng calibration standard.

   If these control limits are exceeded, take appropriate action to identify the problem by reanalyzing the affected sample. If reanalysis solves the problem, then the problem was within the laboratory's control. In this case, submit only data from the analysis with internal standard area counts or retention times within QC limits. If reanalysis of the sample does *not* solve the problem, then submit data from both the initial analysis and the reanalysis.

3. Analyze a method blank in each 12-hour time period in which samples are analyzed. The concentration of any target compound in the method blank must be less than the CRQL.

   If a method blank exceeds these acceptance criteria, the analytical system should be considered to be out-of-control. Investigate the source of the contamination. Take and document appropriate corrective measures before proceeding with further sample analysis. Reanalyze all samples processed with a method blank that is out-of-control. Reanalyses at no additional cost to the Agency are mandatory.

4. Analyze an instrument blank immediately after any sample which contains a target compound at a concentration greater than 50 ppb. The concentration of any target compound in the instrument blank must be less than the CRQL. These acceptance criteria must be met, before proceeding with further sample analysis, in order to demonstrate that there is no analyte carryover from the contaminated sample.

5. Spike all samples, method blanks, and QC samples with 50 ng of at least one of the following three halogenated surrogate compounds: bromochloromethane, 2-bromo-1-chloropropane, and 1,4-dichlorobutane. Follow the procedures outlined in Section 5.8 and Section 8.3 of SW-846 Method 8010A.

   Spike all samples, method blanks, and QC samples with 50 ng of at least one of the following two aromatic surrogate compounds: 1,1,1-trifluorotoluene and 4-bromofluorobenzene (BFB). Follow the procedures outlined in Section 5.7 and Section 8.3 of SW-846 Method 8020A. (BFB may not be used as a surrogate when internal standard calibration is performed and BFB has been selected as an internal standard.)

Surrogate recoveries of 75-125% for water samples and 65-135% for soil samples are required. If these control limits are exceeded, take appropriate action to identify the problem by reanalyzing the affected sample. If reanalysis solves the problem, then the problem was within the laboratory's control. In this case, submit only data from the analysis with surrogate recoveries within QC limits. If reanalysis of the sample does *not* solve the problem, then submit data from both the initial analysis and the reanalysis.

6. Analyze matrix spike and matrix spike duplicate (MS/MSD) samples at the frequency of one per sample delivery group. Spike 10 ppb of the following halogenated and aromatic VOCs: 1,1-dichloroethene, trichloroethene, chlorobenzene, toluene, and benzene.

   Recoveries of 75-125% for water samples and 65-135% for soil samples are required. RPDs must not exceed 30%. Flag MS/MSD results that exceed these criteria and note noncompliant MS/MSD results in the SDG narrative. No corrective action measures are required due to noncompliant MS/MSD results.

7. Dilute and reanalyze samples which contain one or more target analytes at concentrations above the initial calibration range. If dilution is necessary, adjust the dilution so that the most highly concentrated analyte is determined at a concentration in the upper half of the calibration range. Report the results and submit documentation for both the diluted and undiluted analyses.

8. The QC requirements listed above are the minimum required. It is impossible to address all analytical situations that might be experienced by a laboratory during the analysis of environmental samples. The laboratory is expected to adhere to good laboratory practices when analyzing samples. If the laboratory has questions concerning the analyses of samples not addressed in this document, the Region should be notified IMMEDIATELY (through the Sample Management Office).

C. Additional Compounds and CAS numbers:
1,2-dibromoethane (EDB) CAS No.: 106-93-4
1,2-dibromo-3-chloropropane (DBCP) CAS No.: 96-12-8

9. **Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion.**

a. <u>Data Calculations and Reporting Units</u>:

1. Use the CFs/RRFs from the 50 ng continuing calibration standard, analyzed at the beginning of the 12-hour time period, to calculate the concentrations of target and

surrogate compounds in the samples. For samples analyzed during the same 12-hour time period as the initial calibration standards, use the CFs/RRFs from the 50 ng calibration standard.

a. If calibration curves are prepared from the initial calibration, calculate the concentrations of target and surrogate compounds in the samples from the curves using linear regression.

2. Report results for water samples in concentration units of micrograms per liter (µg/L). Report results for soil samples, on a dry-weight basis, in concentration units of micrograms per kilogram (µg/kg).

3. Report analyte concentrations that are less than or equal to 10 µg/L or 10 µg/kg to 1 significant figure, and analyte concentrations that are greater than 10 µg/L or 10 µg/kg to 2 significant figures.

4. All records of analysis, dilutions, and calculations must be legible and sufficient to recalculate all sample concentrations and QC results. Include an example of an *actual* calculation for a sample in the data package.

b. <u>Documentation and Deliverables</u>:

Deliverables (in the form of a purge file - i.e., original documents) for each Group shall include all deliverables required by the IFB, including:

1. All Sample Tracking Reports (i.e., signed SAS Packing Lists/Chain-of-Custody forms).

2. Complete SDG File (CSF) inventory on a modified CLP Form DC-2.

3. Sample log-in information on a modified CLP Form DC-1.

4. A copy of the SAS CRF, as provided by SMO (so that any revisions or additions authorized by SMO will be known). Only the technical portion of the SAS CRF is required.

5. Any telephone logs referring to the samples.

6. An SDG Narrative which includes: a signature of the laboratory manager (or his or her designee), laboratory name, EPA laboratory I.D., contract number, SAS number, SDG number, a description of any problems encountered during the processing of the samples, a description of the

resolution of these problems, a list of correct EPA sample I.D. numbers, the corresponding laboratory sample I.D. numbers, a differentiation between the initial analyses and any reanalyses, the pH of all water samples, a formula (including definitions) showing how the results were calculated, and an example of an *actual* calculation for a sample in the SDG.

7. Modified CLP Form 1 for all environmental and QC samples which lists the tabulated sample results for all target analytes. The header of the Form 1 should include: matrix, units, sample weight or volume, purge volume, %moisture, dilution factor, and dates of receipt and analysis. Form 1s for any reanalyses, diluted analyses, or confirmation analyses must be included.

8. Modified CLP Form 2 which lists the %recovery (%R) values of the surrogate compounds for all samples, blanks, and QC samples.

9. Modified CLP Form 3, a matrix spike/matrix spike duplicate (MS/MSD) results summary, which reports the %recovery and relative percent difference (RPD) values for the spiked compounds.

10. Modified CLP Form 4 which summarizes the samples associated with each laboratory method blank.

11. If internal standard calibration is used, modified CLP Form 8A which summarize areas and RTs of the internal standards for all samples, blanks, QC samples, and standards.

12. Raw sample data which include the following items for both primary and confirmation analyses:

    a. Chromatogram
    b. GC integration report/data system printout
    c. Manual worksheet

13. Instrument calibration data which include the following items for both primary and confirmation analyses:

    a. Initial Calibration

        (1) Modified CLP Form 6D which includes: retention times (RTs) for each concentration level, mean RT, and RT windows for all target and surrogate compounds.

(2) Modified CLP Form 6 which includes: standard concentrations, calibration factors (CFs) or relative response factors (RRFs) for each concentration level, average CF or RRF, and percent relative standard deviations (%RSDs) for all target and surrogate compounds.

(3) Header of the modified CLP Form 6 must include: date and time of calibration, instrument I.D., and gas chromatographic (GC) analytical column I.D. (i.e. liquid phase, length, diameter).

(4) Raw data which include: chromatograms and integration reports/data system printouts. Peak areas or heights, concentrations, and RTs must be clearly indicated.

(5) Include, if calibration curves are used: graph, correlation coefficient, and equation of the line for each target and surrogate compound.

b. Continuing Calibration

(1) Modified CLP Form 7 which includes: retention times (RTs), standard concentrations, calibration factors (CFs) or relative response factors (RRFs), and percent differences (%Ds) for all target and surrogate compounds.

(2) Modified CLP Form 2A (Inorganic), if calibration curves are used, which includes: RTs, true values, found values, and percent recoveries (%R) for all target and surrogate compounds.

(3) Header of the modified CLP Form 7/2A must include: date and time of calibration, instrument I.D., and GC analytical column I.D.

(4) Raw data which include: chromatograms and integration reports/data system printouts. Peak areas or heights, concentrations, and RTs must be clearly indicated.

14. Raw QC data which include the following items for both primary and confirmation analyses:

a. Blank data, in chronological order:

1. Tabulated results on a modified CLP Form 1
2. Chromatogram
3. GC integration report/data system printout

4. Manual worksheet

b. MS/MSD data, in chronological order:

1. Tabulated results on a modified CLP Form 1
2. Chromatogram
3. GC integration report/data system printout
4. Manual worksheet

15. Analytical sequence on a modified CLP Form 8D. Modified CLP Form 8D must list instrument I.D., EPA sample I.D. numbers, laboratory sample I.D. numbers, date and time analyzed for all standards, environmental samples, and QC samples, and retention times of the surrogates and internal standards.

16. Analyte concentration and identification summary on a modified CLP Form 10A. Modified Form 10A must be included for each sample in which target analytes were detected and should list RTs and concentrations of the analyte from both the primary and confirmation GC columns and the RPD between the two quantitative results.

17. Bench sheets for pH determination, %solids determination, and dilutions. Bench sheets for sample preparation which include spike solution and surrogate solution description (i.e. concentrations and volume added.)

18. Standards preparation logs, for all standards used for either calibration or spiking, which include source, traceable lot number, and concentrations of all compounds.

10. **Other (use additional sheets or attach supplementary information, as needed):**

Attached is a copy of the "U. S. EPA Region 9 Laboratory QC Summary Report" form. This form is to be completed by the Laboratory Manager or his/her designee and submitted with each data package. The form is to reflect the conditions contained within the data package with which it is submitted. Laboratories may make additional copies of this form as needed.

11. **Name of sampling/shipping contact:** Bart Draper, Bechtel Environmental Inc

Phone: 415-768-3282

12. **Data Requirements:**

Parameter	Contract Required Quantitation Limit (CRQL)
SW-846 Method 8010A	See Table 1
SW-846 Method 8020A	See Table 2

13. **QC Requirements:**

QC Required	Frequency of QC	Limits (% or Conc.)
Method blank	Every 12-hour time period in which samples are analyzed	<CRQL for all target analytes
Matrix Spike/ Matrix Spike Duplicate	1 per SDG	75-125% (water) 65-135% (soil) ≤30 RPD

14. **Action required if limits are exceeded:**

If surrogate control limits are exceeded, take appropriate action to identify the problem by reanalyzing the affected sample. If reanalysis solves the problem, then the problem was within the laboratory's control. In this case, submit only data from the analysis with surrogate recoveries within QC limits. If reanalysis of the sample does not solve the problem, then submit data from both the initial analysis and the reanalysis.

TABLE 1

Target Compound List for SW-846 Method 8010A

Compound	CAS Number	CRQL (µg/L or µg/kg)
Benzyl chloride	100-44-7	1
Bromobenzene	108-86-1	1
Bromodichloromethane	75-27-4	1
Bromoform	75-25-2	1
Bromomethane	74-83-9	1
Carbon tetrachloride	56-23-5	1
Chloroethane	75-00-3	1
2-Chloroethylvinylether	110-75-8	1
Chloroform	67-66-3	1
Chloromethane	74-87-3	1
Dibromochloromethane	124-48-1	1
Dibromomethane	74-95-3	1
Dichlorodifluoromethane	75-71-8	1
1,1-Dichloroethane	75-34-3	1
1,2-Dichloroethane	107-06-2	1
1,1-Dichloroethene	75-35-4	1
trans-1,2-Dichloroethene	156-60-5	1
1,2-Dichloropropane	78-87-5	1
cis-1,3-Dichloropropene	10061-01-5	1
trans-1,3-Dichloropropene	10061-02-6	1
Methylene chloride	75-09-2	5
1,1,2,2-Tetrachloroethane	79-34-5	1
1,1,1,2-Tetrachloroethane	630-20-6	1
Tetrachloroethene	127-18-4	1
1,1,1-Trichloroethane	71-55-6	1
1,1,2-Trichloroethane	79-00-5	1
Trichloroethene	79-01-6	1
Trichlorofluoromethane	75-69-4	1
1,2,3-Trichloropropane	96-18-4	1
Vinyl chloride	75-01-4	1

TABLE 2

Target Compound List for SW-846 Method 8020A

Compound	CAS Number	CRQL (µg/L or µg/kg)
Benzene	71-43-2	1
Chlorobenzene	108-90-7	1
1,2-Dichlorobenzene	95-50-1	1
1,3-Dichlorobenzene	541-73-1	1
1,4-Dichlorobenzene	106-46-7	1
Ethylbenzene	100-41-4	1
Toluene	108-88-3	1
Xylenes (Total)	1330-20-7	1

U. S. EPA REGION 9
LABORATORY QC SUMMARY REPORT
INSTRUCTIONS

1. A separate form is to be completed and attached to the Regional copy (original) of each data package submitted. This form is to be placed directly behind the case narrative.

2. The Laboratory QC Summary Report form is to be completed by the Laboratory Manager, or his/her designee.

3. This form will be used to identify areas of noncompliance with the required QC limits that may result in resampling or reduction in payment.

4. Answers to questions are designed so that a YES answer indicates compliance and requires no further explanation. A NO answer indicates non-compliance and requires a short explanation. If a lengthy explanation is required (or desired), write <u>See Case Narrative</u> in the blank space and include the explanation in the case narrative.

U. S. EPA REGION 9
LABORATORY QC SUMMARY REPORT

LABORATORY: _____ SAS #: _____

SUBMITTED BY: _____ # SAMPLES: _____

TITLE: _____ MATRIX: _____

ANALYSIS: PURGEABLE HALOCARBONS AND AROMATICS IN WATER AND SOIL BY SW-846 METHOD 8010A AND METHOD 8020A

DATE: _____

QC SUMMARY TABLE

QC PARAMETER	QC LIMITS	FREQUENCY
Laboratory method blank	<CRQL for all target analytes	every 12-hour time period in which samples are analyzed
Initial calibration (%RSD)	≤30% for all target analytes	as needed
Initial calibration (correlation coefficient)	≥0.99 for all target analytes	as needed
Continuing calibration (%D)	±25% for all analytes, except gases and methylene chloride ±30% for gases and methylene chloride	at beginning of each 12-hour time period in which samples are analyzed, after every 10 samples, and at end of analytical sequence
Continuing calibration (found value)	75-125% of true value for all analytes, except gases and methylene chloride 70-130% for gases and methylene chloride	at beginning of each 12-hour time period in which samples are analyzed, after every 10 samples, and at end of analytical sequence
Continuing calibration (retention times)	within retention time windows established in initial calibration	at beginning of each 12-hour time period in which samples are analyzed, after every 10 samples, and at end of analytical sequence

QC SUMMARY TABLE
(continued)

QC PARAMETER	QC LIMITS	FREQUENCY
MS/MSD (%R)	75-125% (water) 65-135% (soil)	1 per SDG
MS/MSD (RPD)	≤30%	1 per SDG
Surrogates (%R)	75-125% (water) 65-135% (soil)	all blanks, samples, and QC samples
Internal standards (areas counts)	±0.50 minutes	all blanks, samples, and QC samples
Internal standards (retention times)	-50% to +100%	all blanks, samples, and QC samples

1. Were all water and/or soil samples analyzed within the contract required holding time of 10 days from the date of receipt by the laboratory? YES NO

   a. If no, list the samples that were analyzed outside of the holding time.

   _____

   b. How many days outside of the holding time were these samples analyzed?

   _____

2. Were all water samples analyzed within the technical holding time of 14 days (for preserved samples) or 7 days (for unpreserved samples) from the date of collection? Were all soil samples analyzed within the technical holding time of 14 days from the date of collection? YES NO

   a. If no, list the samples that were analyzed outside of the holding time?

   _____

   b. How many days outside of the holding time were these samples analyzed?

   _____

3. Were all samples received intact and in good condition? YES NO

a. If no, list the samples and describe the condition.

_____

4. Was the data package sent within 35 days from the receipt of the last samples in the SDG? YES NO

a. If no, how many days late was the data package sent?

_____

5. Were SW-846 Methods 5030A, 8010A, and 8020A protocols followed for the analysis of these samples? YES NO

a. If no, specify which method was followed.

_____

b. If no, why was this method followed? Who authorized use of this method?

_____

6. Was external standard calibration used? YES NO

7. Was internal standard calibration used? YES NO

a. If yes, list the compound(s) used.

_____

b. If yes, were the area counts of all internal standards within -50% to +100% of the area counts for each respective internal standard in the associated calibration standard? YES NO

If no, why not?

_____

c. If yes, were the retention times of all internal standards within ±0.50 minutes of the retention time for each respective internal standard in the associated calibration standard? YES NO

If no, why not?

_____

8. Was a 5-point initial calibration curve (including a 5 ng low standard) analyzed prior to sample analyses? YES NO

a. If yes, when? _____

b. If no, why not? _____

9. Was linear regression used? YES NO

10. Did the initial calibration curve meet the QC requirement of ≤30% RSD for all target compounds? correlation coefficients of ≥0.99? YES NO

a. If no, specify the analyte(s) and %RSD(s) or correlation coefficient(s) that were outside of the QC limits.

_____

_____

_____

11. Were continuing calibration standards analyzed at the beginning of each 12-hour time period in which samples were analyzed? YES NO

After every 10 samples? YES NO

At the end of the analytical sequence? YES NO

a. If no, why not? _____

12. Were percent differences (%D) for target compounds in the continuing calibration standards within the QC requirement of ±25%? ±30% for the gases and methylene chloride? or 75-125% of true value? 70-130% of true value for the gases and methylene chloride? YES NO

a. If no, specify the analyte(s) and %D(s) or %R(s) that were outside of the QC limits.

_____

_____

13. Were the retention times of target analytes in the continuing calibration within the retention time windows established in the initial calibration? YES NO

a. If no, specify the analyte(s) with retention times that were outside of the retention time windows.

_____

14. Was the signal-to-noise ratio requirement of 5:1 met for all analytes in the 5 ng standard in the initial calibration? YES NO

a. If no, why not? _____

15. Were laboratory method blanks analyzed in each 12-hour time period in which samples were analyzed? YES NO

a. If no, at what frequency were laboratory method blanks analyzed?

_____

16. Were laboratory method blanks free of contamination? YES NO

a. If no, list the target analyte(s) and level(s) present.

_____

_____

17. Were instrument blanks analyzed after unusually concentrated samples? YES NO

a. If no, why not?

_____

18. Were instrument blanks free of contamination? YES NO

a. If no, list the target analyte(s) and level(s) present.

_____

19. Were surrogate recoveries within the QC requirements for all samples? YES NO

a. If no, list the recoveries that were above this range.

_____

b. If no, list the recoveries that were below this range.

_____

c. How many non-compliant recoveries were caused by dilutions?

_____

d. How many non-compliant recoveries were caused by matrix interferences?

_____

e. Were samples with noncompliant recoveries reanalyzed? YES NO

If no, why not? _____

20. Were MS/MSD analyses performed at a minimum frequency of 1 per SDG? YES NO

a. If no, why not? _____

21. Were MS/MSD recoveries within the QC requirements for all spike compounds? YES NO

a. If no, specify the %R(s) that were outside of the QC limits.

_____

22. Were RPDs between MS/MSD results within the QC requirement of ≤30% for all spike compounds? YES NO

a. If no, specify the RPD(s) that were outside of this QC limit.

_____

23. Were the CRQLs met for all target analytes? YES NO

a. If no, why not? _____

24. Were second column confirmation analyses performed on all samples with positive results? YES NO

a. If no, why not? _____

b. If yes, specify the two columns that were used.

Primary _____

Confirmation _____

25. Was it possible to analyze all target analytes within the range of the initial calibration curve? YES NO

a. If no, were these samples diluted according to the instructions in Section 8.b.7 of the SAS Client Request Form? YES NO

b. List these samples, the analytes above range, and the analyte concentration.

_____

_____

c. If no, explain why not and list the samples.

_____

_____

U. S. ENVIRONMENTAL PROTECTION AGENCY REGION 9
Environmental Services Branch
75 Hawthorne Street
San Francisco, CA 94105
Phone: 415/744-1498

Site Name: Frontier Fertilizer
Case/RAP No.:

REGIONAL ANALYTICAL PROGRAM CLIENT REQUEST FORM

The analysis of low concentration water samples for the target compound list (TCL) volatile organic compounds (VOCs) (plus 1,2-dibromoethane and 1,2-dibromo-3-chloropropane) following protocols outlined in the U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics Analysis (OLM03.1) and the Superfund Analytical Methods for Low Concentration Water for Organics Analysis (SAMLCO, 10/92 or more recent version). Where the procedures in this Client Request Form (CRF) differ from the above referenced methods, the procedures listed here are to take precedence.

A 25-mL purge volume is used for sample analysis to achieve low quantitation limits. The CRQLs listed in item 9, page 11 of this CRF must be met.

1. **Definition and number of work units involved (specify whether whole samples or fraction; specify sample matrices; and specify concentration):** 71 low level groundwater samples

2. **Estimated date(s) of collection (provide a sampling schedule):**

   March 15 to March 24, 1999

3. **Estimated date(s) and method of shipment:**

   Overnight courier - samples are to be shipped on the day of collection for next day delivery including Saturday deliveries. Laboratory must be capable of accepting Saturday deliveries.

4. **Number of days analysis and data required after laboratory receipt of samples:**

   a. The contract required analysis holding time is ten (10) days from the date of sample receipt by the laboratory.

   b. The technical analysis holding time is fourteen (14) days from the date of sample collection for preserved samples and seven (7) days from the date of sample collection for unpreserved samples.

   c. Data packages and all other deliverables are required within 35 days from receipt of last sample in each sample delivery group (SDG). A SDG is defined as the following, whichever is most frequent:

      - Each case of field samples received; or
      - Each 20 field samples within a case; or
      - Each 14 calendar day period during which field samples in a case are received.

5. **Analytical protocol required (attach copy if other than a protocol currently used in this program):**

   a. Follow the procedures outlined in Exhibit D of the CLP SOW (OLM03.1) for the analysis of VOCs in water by gas chromatography/mass spectrometry (GC/MS) with sample introduction by purge-and-trap instrumentation.

   b. A list of the VOC target compounds with corresponding contract required quantitation limits (CRQL) is provided in Section 9 of this Regional Analytical Program (RAP) Client Request Form (CRF).

   c. Analyze a 25-mL sample aliquot for all samples which do not exceed the calibration range when run without dilution.

   d. Determine the pH of all samples to verify preservation to pH <2 according to Exhibit D, Section 10.2 of OLM03.1.

6. **Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):**

   a. <u>Calibration Procedure and Criteria</u>:

      1. Perform a GC/MS tuning according to the procedure outlined in Exhibit D, Section 9.2 of the CLP SOW (OLM03.1). A GC/MS instrument performance check with 4-bromofluorobenzene (BFB) is required at the beginning of each 12 hour period during which standards and samples are analyzed. Instrument performance checks must meet the ion abundance criteria specified in Table 1 of Exhibit D, Section 17.0, of the CLP SOW (OLM03.1). The MS tune criteria must be met before any instrument calibration standards, environmental samples, laboratory method blanks, or quality control (QC) samples are analyzed.

      2. Perform initial instrument calibration according to the procedure outlined in Exhibit D, Section III, Part C, Item 14 of the Superfund Analytical Methods for Low Concentration Water for Organics Analysis (SAMLCO, 10/92 or more recent version). Prepare initial calibration standards, containing all of the target analytes listed in Table 1 of this RAP CRF and system monitoring compounds, according the requirements of Table D-1 of Exhibit D, Section II, Part B, Item 7.5 of the SAMLCO (10/92) to the following specifications:

Include 1,2-dibromoethane and 1,2-dibromo-3-chloropropane in initial and continuing calibration standard solution. See No. 8, page 1 for criteria

Volume of Working Standard (µL added to 25 mL)	Final Concentration of Aqueous Standard for Non-Ketones (µg/L)	Final Concentration of Aqueous Standard for Ketones (µg/L)
5	1	5
10	2	10
25	5	25
50	10	50
125	25	125

The minimum relative response factors (RRFs) for all analytes in the initial calibration must meet the acceptance criteria specified in Table D-3 of Exhibit D, Section V and Section III, Item 14.5.4 of SAMLCO (10/92). The percent relative standard deviation (%RSD) of analyte RRFs across the initial calibration curve must not exceed 30% except as noted in Section III, Item 14.5.4.

3. Analyze a sixth initial calibration standard containing carbon tetrachloride, 1,2-dichloroethane, *cis*-1,3-dichloropropene, *trans*-1,3-dichloropropene, and vinyl chloride at a concentration of 0.5 µg/L to verify that the requested CRQLs can be achieved. The minimum RRF requirement for these analytes is 0.05. This low level standard need not be included with the other five initial calibration standards in calculating the %RSD for the standard curve.

4. Perform continuing instrument calibration according to the procedure outlined in Exhibit D, Section III, Part C, Item 15 of the SAMLCO (10/92) once per each 12 hour period of instrument operation. Prepare a continuing calibration standard, containing all of the target analytes listed in Section 9 of this RAP CRF, at concentrations equivalent to the midpoint of the initial calibration curve. The minimum RRFs for all analytes in the continuing calibration must meet the acceptance criteria specified in Table D-3 of Exhibit D, Section V and Section III, Item 15.5.4 of SAMLCO (10/92). The percent difference (%D) between the RRFs from the continuing calibration and average RRFs from the initial calibration must not exceed ±30% except as noted in Section III, Item 15.5.4.

b. <u>Internal Quality Control Checks, Control Limits and Corrective Actions</u>:

1. When calibration standard measurements exceed the QC requirements for the initial calibration or the continuing calibration, take corrective action as specified in Exhibit D, Section III, Part C, Items 14.6 (for initial calibration) and 15.6 (for continuing calibration) of SAMLCO (10/92).

   The continuing calibration standard reflects the conditions under which the analysis of all associated samples was performed. Reanalyze all samples associated with an out-of-control continuing calibration standard.

2. Analyze a laboratory method blank in each 12-hour time period in which samples are analyzed according to the procedure described in Exhibit D, Section 12.1 of the CLP SOW (OLM03.1). The concentration of target compounds in the laboratory method blanks must meet the requirements specified in Exhibit D, Section 12.1.4.5 of OLM03.1.

   If a method blank exceeds these acceptance criteria, the analytical system should be considered to be out-of-control. Follow the corrective action procedures outlined in Exhibit D, Section 12.1.5 of the CLP SOW (OLM03.1). Investigate the source of contamination and document appropriate corrective measures taken before proceeding with further sample analysis. Reanalyze all samples processed with a method

blank that is out-of-control. Reanalyses must be performed at no additional cost to the Region.

3. Analyze instrument blanks after the analysis of a sample containing target analytes at concentrations exceeding the initial calibration range and storage blanks per Exhibit D, Section V, Item 26 of SAMLCO (10/92). The concentration of target compounds in the instrument and storage blanks must meet the requirements specified in Exhibit D, Section V, Item 26.4 of SAMLCO (10/92).

   If an instrument blank exceeds these acceptance criteria, the analytical system should be considered to be out-of-control. Follow the corrective action procedures outlined in Exhibit D, Section V, Item 26.5 of SAMLCO (10/95). Investigate the source of the contamination and document the appropriate corrective measures taken before proceeding with further sample analysis. Reanalyze all samples processed with an instrument blank that is out-of-control. Reanalyses must be performed at no additional cost to the Region. Document storage blank contamination in the SDG narrative and retain all storage blank data at the laboratory.

4. Spike all environmental samples, laboratory method blanks, and QC samples with the system monitoring compounds (SMCs), toluene-d_8, 4-bromofluorobenzene (BFB), and 1,2-dichloroethane-d_4, according to the procedure outlined in Exhibit D, Section 10.1.3.7 of the CLP SOW (OLM03.1). Prepare the system monitoring compound spiking solution according to Exhibit D, Section 7.2.4.1 of the CLP SOW (OLM03.1).

   System monitoring compound recoveries within the limits for water specified in Table 7 of Exhibit D, Section 17 are required. If these control limits are exceeded, take appropriate action to identify the problem by reanalyzing the affected sample. If reanalysis solves the problem, then the problem was within the laboratory's control. In this case, submit only data from the analysis with system monitoring compound recoveries within QC limits. If reanalysis of the sample does *not* solve the problem, then submit data from both the initial analysis and the reanalysis.

5. Add the internal standard compounds bromochloromethane, chlorobenzene-d_5, and 1,4-difluorobenzene to all calibration standards, method blanks, and QC samples prior to analysis according to the procedure outlined in Exhibit D, Sections 9.3.3.3 (for initial calibration standards), 9.4.3.2 (for continuing calibration standards), and 10.1.3.7 (for samples and blanks) of the CLP SOW (OLM03.1). Prepare the internal standard compound spiking solution according to Exhibit D, Section 7.2.4.3 of the CLP SOW (OLM03.1).

   Internal standard area counts must not vary by more than a factor of 2 (-50% to +100%) from the area counts of the associated continuing calibration standard. Internal standard retention times (RT) must not vary by more than ±30 seconds from the (RT) of the associated continuing calibration standard. Refer to Exhibit D, Sections 11.3.5 and 11.3.6 of the CLP SOW (OLM03.1) for internal standard acceptance criteria. If these control limits are exceeded,

reanalyze the affected sample. If reanalysis solves the problem, then the problem was within the laboratory's control. In this case, submit only data from the analysis with internal standard areas within QC limits. If reanalysis of the sample does *not* solve the problem, then submit data from both the initial analysis and the reanalysis.

6. Analyze matrix spike and matrix spike duplicate (MS/MSD) samples at the frequency of one per sample delivery group according to the procedure outlined in Exhibit D, Section 12.2 of the CLP SOW (OLM03.1). Prepare the matrix spiking solution according to Exhibit D, Section 7.2.4.2 of the CLP SOW (OLM03.1); prepare MS/MSD samples according to the procedure outlined in Exhibit D, Section 12.2.3 of the CLP SOW (OLM03.1).

Include 1,2-dibromoethane and 1,2-dibromo-3-chloropropane in matrix spiking solution. 75% to 125% recoveries are required for these compounds.

MS/MSD recoveries, and relative percent differences (RPDs) between MS/MSD recoveries, within the limits specified for water in Table 8 of Exhibit D, Section 17.0 are required. Flag MS/MSD results that exceed these criteria and note noncompliant MS/MSD results in the SDG narrative. No corrective action measures are required due to noncompliant MS/MSD results.

7. Dilute and reanalyze samples which contain one or more target analytes at concentrations above the initial calibration range. If dilution is necessary, adjust the dilution so that the most highly concentrated analyte is determined at a concentration in the upper half of the calibration range. Report the results and submit documentation for both the diluted and undiluted analyses.

8. The QC requirements listed above are the minimum required. It is impossible to address all analytical situations that might be experienced by a laboratory during the analysis of environmental samples. The laboratory is expected to adhere to good laboratory practices when analyzing samples. If the laboratory has questions concerning the analyses of samples not addressed in this document, the Region should be notified IMMEDIATELY. The Laboratory Manager, or designee, must address any problems and its resolution in the SDG narrative.

7. **Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion.**

a. **<u>Data Calculations and Reporting Units</u>:**

1. **Calculate the relative response factor (RRF) and the concentration of individual analytes according to the equations specified in Exhibit D, Sections 9.3.4.1 and 11.2.1 of the CLP SOW (OLM03.1).**

2. **Report sample results in concentration units of micrograms per liter (µg/L). Report results less than 10 µg/L to 1 significant figure and results greater than or equal to 10 µg/L to 2 significant figures.**

3. For rounding results, adhere to the following rules:

   a) If the digit following those to be retained is less than 5, round down;
   b) If the digit following those to be retained is greater than 5, round up; or
   c) If the digit following the last digit to be retained is 5, round down if the digit is even, and round up if the digit is odd.

4. Ensure that all records of analysis, dilutions and calculations are legible and sufficient to recalculate all sample concentrations and QC results. Include an example of an *actual* sample calculation in the data package.

b. <u>Documentation and Deliverables</u>:

All documentation and deliverables as required in Exhibit B of the CLP SOW (OLM03.1) must be submitted. The required deliverables for each SDG must include the following:

1. All original shipping documents and sample tracking reports including signed RAP chain-of-custody forms, airbills, and traffic reports.

2. A completed and signed document inventory on a modified Organics Complete SDG File (CSF) Inventory Sheet (CLP Form DC-2).

3. All original sample receipt documents including sample log-in information on a modified CLP Form DC-1, an SDG cover sheet, and any other receipt forms such as copies of receipt logbooks.

4. A copy of the RAP CRF, as provided by the Region (so that any additions or revisions authorized by the Region will be known). Only the technical portion of the CRF is required.

5. Any telephone logs referring to the samples.

6. An SDG narrative signed by the laboratory manager, or designee, certifying the accuracy and validity of all data reported. The SDG narrative must contain: laboratory name; laboratory code; contract number; RAP number; SDG number; a list of correct EPA sample numbers and the corresponding laboratory sample identification (ID) numbers, differentiating between the initial analyses and any reanalyses; and the pH of all water samples. The SDG narrative must provide a description of all GC columns used for analysis, including brand name, the internal diameter in millimeters (mm), the length in meters, coating material, and film thickness. The SDG narrative must describe any administrative or technical problems encountered during the processing of the samples and a description of the resolution of these problems. The SDG narrative must include an explanation for any manual integrations or manual edits. The SDG narrative must provide a formula (including definitions) showing how the results were calculated, and an example of an *actual* calculation for a sample in the SDG.

7. The following header information is required for each data reporting form: laboratory name; contract number; laboratory code; RAP number; and SDG number.

8. Tabulated analysis results for all environmental and QC sample results on a modified CLP Form 1. Include the compound name and Chemical Abstract Service (CAS) registry number. Clearly specify concentration units and laboratory qualifiers. Include the following additional information in the header: laboratory sample ID, laboratory file ID, sample volume, purge volume, dilution factor, the validated time of sample receipt (VTSR), analysis date, and pH. Form 1s for any reanalyses or diluted analyses must be included.

9. Modified CLP Form 1E for all environmental samples which lists tentatively identified compounds. The modified CLP Form 1E must report the CAS number, compound name, RT, the estimated concentration, and the laboratory qualifier for each TIC reported. The header information should be the same as that provided in CLP Form 1, listed above.

10. Raw sample data must include the following items:

    a) Reconstructed ion chromatograms (RICs) labeled with the following information: EPA sample number, date and time of analysis, GC/MS instrument identifier, laboratory file ID, and analyst ID. Each internal standard and surrogate compound must be labeled on the RIC by name.

    b) Copies of raw mass spectra and background-subtracted mass spectra of detected target compounds labeled with the compound name, EPA sample number, laboratory file ID, analysis date and time, and instrument ID. For TICs, copies of mass spectra with associated 3 best-match spectra must be provided and labelled as above.

    c) GC/MS quantitation report/data system printouts containing the following information: EPA sample number, date and time of analysis, RT or scan numbers of identified target compounds, ion used for quantitation, copy of area table from data system, GC/MS instrument ID, laboratory file ID, and analyst ID.

    d) Extracted ion current profile (EICPs) displaying any manual integrations

11. Modified CLP Form 2A which lists the percent recovery (%R) values, rounded to the nearest whole number, and the QC limits for each system monitoring compound in all samples and laboratory method blanks. Flag all recoveries outside the QC limits with an asterisk.

12. Modified CLP Form 3A, a matrix spike/matrix spike duplicate (MS/MSD) results summary, which reports percent recoveries and RPD values to the nearest whole number for the spike compounds. List the QC limits for percent recovery and RPD for each spike compound and flag all values outside of the QC limits with an asterisk. Tabulate the concentration of analytes added to the sample, the sample concentration, and the MS and MSD concentrations for each analyte spiked. Include the EPA sample number in the header.

13. Modified CLP Form 4A which summarizes the samples that were analyzed with each laboratory method blank. The EPA sample

number, the laboratory sample ID, and analysis time must be reported for each sample associated with the referenced blank. Include the following additional information in the header: the laboratory method blank EPA sample number, laboratory file ID, laboratory sample ID, method blank analysis date and time, the GC column ID (i.e. liquid phase, length, diameter), and instrument ID.

14. CLP Form 5A which summarizes the data for BFB instrument performance checks. The ion, the abundance criteria, and the percent relative abundance for each ion must be reported. The modified CLP Form 5A must include the EPA sample number, laboratory sample ID, laboratory file ID, and date and time of analysis for each sample associated with the referenced BFB instrument performance check. Include the following additional information in the header: laboratory file ID, BFB injection date and time, instrument ID, and GC column ID.

15. Instrument calibration data which include the following items:

    a) Initial Calibration

        1) Modified CLP Form 6A which includes: RRFs for each analyte and surrogate for each concentration level, and average RRFs and %RSDs for each target and surrogate compound

        2) Include the following additional information in the form header: date and time of calibration, instrument ID, and GC analytical column ID

        3) Raw data which include: RICs and quantitation reports/data system printouts. RICs must contain the following information: EPA sample number, date and time of analysis, GC/MS instrument identifier, laboratory file ID, and analyst ID. Each internal standard and surrogate compound must be labeled on the RIC by name. Quantitation reports/data system printouts must contain the following information: EPA sample number, date and time of analysis, RT or scan numbers of identified target compounds, ion used for quantitation, copy of area table from data system, GC/MS instrument ID, laboratory file ID, and analyst ID.

        4) Extracted ion current profile (EICPs) displaying any manual edits and integrations.

    b) Continuing Calibration

        1) Modified CLP Form 7A which includes: average RRFs (from the initial calibration), RRFs (for the continuing calibration standard), and %D values for each target and surrogate compound.

        2) Include the following additional information in the header: laboratory file ID, date and time of the continuing calibration, instrument ID, GC

analytical column ID, and the date and time of the referenced initial calibration

3) Raw data which include: RICs must contain the following information: EPA sample number, date and time of analysis, GC/MS instrument identifier, laboratory file ID, and analyst ID. Each internal standard and surrogate compound must be labeled on the RIC by name. Quantitation reports/data system printouts must contain the following information: EPA sample number, date and time of analysis, RT or scan numbers of identified target compounds, ion used for quantitation, copy of area table from data system, GC/MS instrument ID, laboratory file ID, and analyst ID.

4) Extracted ion current profile (EICPs) displaying any manual edits and integrations.

16. Modified CLP Form 8A which summarizes areas and RTs of the internal standards for all samples, blanks, QC samples associated with the referenced continuing calibration standard. Clearly specify the QC limits for the internal standard response and RT and flag all results outside the QC limits. Include the following information in the header: laboratory file ID for the standard, date and time of analysis, instrument ID, and GC column ID.

17. Raw QC data which include the following items:

a) Blank data, in chronological order:

1) Tabulated results on a modified CLP Form 1A and 1E

2) RIC, mass spectra, and best-match spectra labeled as specified above

3) GC/MS quantitation report/data system printout labeled as specified above

4) EICPs displaying any manual integrations or edits

b) MS/MSD data, in chronological order:

1) Tabulated results on a modified CLP Form 1A

2) RIC labeled as specified above

3) GC/MS quantitation report/data system printout labeled as specified above

4) EICPs displaying any manual integrations or edits

c) BFB Instrument Performance Check data, in chronological order:

1) Bar graph spectrum labelled with EPA sample number, date and time of analysis, GC/MS

instrument identifier, laboratory file ID, and analyst ID.

2) Mass listing labeled with EPA sample number, date and time of analysis, GC/MS instrument identifier, laboratory file ID, and analyst ID

3) RICs labeled with EPA sample number, date and time of analysis, GC/MS instrument identifier, laboratory file ID, and analyst ID.

18. Bench sheets for pH determination and dilutions

19. Bench sheets for sample analysis including instrument ID and analysis date and time

20. Bench sheets for sample preparation which include spike solution and SMC solution description (i.e. concentrations and volume added)

21. Standards preparation logs, for all standards used for either calibration or spiking, which include source, traceable lot number, and concentrations of all compounds

22. Any internal laboratory sample or sample extract transfer records and tracking sheets

8. **Other (use additional sheets or attach supplementary information, as needed):**

If a copy of the "U.S. EPA Region 9 Laboratory QC Summary Report" form is attached, complete the form by following the directions on the first page of the form.

Initial and continuing calibration criteria for 1,2-dibromoethane and 1,2-dibromo-3-chloropropane are as follows:

	min. RRF	max % RSD	max %D (continuing calibration)
1,2-dibromoethane	0.100	30.0	± 30.0
1,2-dibromo-3-chloropropane	0.010	30.0	± 30.0

1,2-dibromoethane criteria are from SAMLCO. 1,2-dibromo-3-chloropropane criteria are specific for this project. Four point initial calibration of 1,2-dibromo-3-chloropropane is acceptable if five point calibration fails to meet the above criteria due to poor response at the 1 ug/L level.

9. **Data Requirements:**

The required target compounds with corresponding contract required quantitation limits (CRQLs) are provided below.

Analyte	CAS Number	(CRQL) µg/L
Chloromethane	74-87-3	1
Bromomethane	74-83-9	1
Vinyl chloride	75-01-4	0.5
Chloroethane	75-00-3	1
Methylene chloride	75-09-2	1
Acetone	67-64-1	10
Carbon disulfide	75-15-0	1
1,1-Dichloroethene	75-35-4	1
1,1-Dichloroethane	75-34-3	1
1,2-Dichloroethene (total)	540-59-0	1
Chloroform	67-66-3	1
1,2-Dichloroethane	107-06-2	0.5
2-Butanone	78-87-5	10
1,1,1-Trichloroethane	71-55-6	1
Carbon tetrachloride	56-23-5	0.5
Bromodichloromethane	75-27-4	1
1,2-Dichloropropane	78-87-5	1
cis-1,3-Dichloropropene	10061-01-5	0.5
Trichloroethene	79-01-6	1
Dibromochloromethane	124-48-1	1
1,1,2-Trichloroethane	79-00-5	1
Benzene	71-43-2	1
trans-1,3-Dichloropropene	10061-02-6	0.5
Bromoform	75-25-2	1
4-Methyl-2-pentanone	108-10-1	10
2-Hexanone	591-78-6	10
Tetrachloroethene	127-18-4	1
1,1,2,2-Tetrachloroethane	79-34-5	1
Toluene	108-88-3	1
Chlorobenzene	108-90-7	1
Ethylbenzene	100-41-4	1
Styrene	100-42-5	1
Xylenes (total)	1330-20-7	1

U. S. EPA REGION 9
LABORATORY QC SUMMARY REPORT

LABORATORY: _____ SAS #:

SUBMITTED BY: _____ # SAMPLES:

TITLE: _____ MATRIX:

ANALYSIS: VOLATILE ORGANIC COMPOUNDS IN WATER FOLLOWING CONTRACT LABORATORY PROGRAM (CLP) STATEMENT OF WORK (SOW) FOR ORGANICS ANALYSIS (OLM02.1) PROTOCOLS USING A 25 ML PURGE VOLUME

DATE:

QC SUMMARY TABLE

QC PARAMETER	QC LIMITS	FREQUENCY
Laboratory method blank (concentration of target analytes)	<CRQL	each 12 hour period during sample analysis
Initial and continuing calibration (4-bromofluorobenzene tuning)	as per requirements listed in Table 1 of Exhibit D, Section 17 of CLP SOW (OLM02.1)	beginning of each 12 hour period during sample analysis
Initial calibration (%RSD)	<30% for all analytes (in 5 point calibration)	as needed
Initial calibration (minimum relative response factor [RRF])	as per requirements listed in Table D-3 of Exhibit D, Section V of SAMLCO (10/92) or on page 9 of SAS CRF for EDB and DBCP	as needed
Initial calibration (minimum relative response factor [RRF])	_ 0.05 (criterion applies to sixth initial calibration standard containing analytes with 0.5 g/L CRQLs)	with every initial calibration performed
Continuing calibration (%D)	_30% for all analytes	every 12 hours during sample analysis

QC SUMMARY TABLE (Continued)

QC PARAMETER	QC LIMITS	FREQUENCY
Continuing calibration (minimum RRF)	as per requirements listed in Table D-3 of Exhibit D, Section V of SAMLCO (10/92) or as listed on page 9 for EDB and DBCP	every 12 hours during sample analysis of SWS CRF
System monitoring compounds (%R)	as per requirements listed in Table 7 of Exhibit D, Section 17 of SOW (OLM02.1)	all standards, blanks, environmental samples, and QC samples
Internal standards (areas, retention times)	as per requirements listed in Exhibit D, Sections 11.3.5 and 11.3.6 of SOW (OLM02.1)	all blanks, environmental samples, and QC samples
MS/MSD (%R)	as per requirements listed in Table 8 of Exhibit D, Section 17 of SOW (OLM02.1)	1 per SDG
MS/MSD (RPD)	as per requirements listed in Table 8 of Exhibit D, Section 17 of SOW (OLM02.1)	1 per SDG

1. Were all samples analyzed within the contract required holding time of 10 days from the date of sample receipt? YES NO

   a. If no, list the samples that were analyzed outside of the holding time.

   b. How many days outside of the holding time were these samples analyzed?

2. Were all samples analyzed within the technical holding time of 14 days (for preserved samples) or 7 days (for unpreserved samples) from the date of collection? YES NO

   a. If no, list the samples that were analyzed outside of the holding time

   b. How many days outside of the holding time were these samples analyzed?

3. Were all samples received intact and in good condition? YES NO

4. Was the data package sent within 35 days from the receipt of the last samples in the SDG? YES NO

   a. If no, how many days late was the data package sent?

5. Were the protocols outlined in the Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics Analysis (OLM02.1 or more recent version) followed for the analysis of these samples? YES NO

   a. If no, specify which method was used.

   b. If no, why was this method used and who authorized its use?

   c. Was the approved method followed without modifications or deviations? YES NO

   d. If no, specify what the modification or deviations were and who approved them.

6. Was a BFB tune performed every 12 hours during sample analysis? YES NO

   a. If no, why not?

7. Were the ion abundance criteria specified in Table 1 of Exhibit D, Section 17 of the SOW (OLM02.1) met for all BFB tunes that were performed? YES NO

   a. If no, why not?

8. Was a 5-point initial calibration curve analyzed prior to sample analyses? YES NO

a. If yes, when?

b. If no, why not?

9. Did the initial calibration standards contain all target analytes at the concentrations specified in Table D-1 of Exhibit D, Section II, Part B, Item 7.5 of the Superfund Analytical Methods for Low Concentration Water for Organics Analysis (SAMLCO, 10/92)? YES NO

a. If no, why not?

10. Did the initial calibration curve meet the QC requirement of <30% RSD for all target compounds? YES NO

a. If no, specify the analyte(s) and %RSD(s) that were outside of the QC limits.

11. Was a sixth initial calibration standard containing carbon tetrachloride, 1,2-dichloroethane, *cis* and *trans*-1,3-dichloropropene, and vinyl chloride at a concentration of 0.5 _g/L analyzed as part of the initial calibration? YES NO

a. If no, why not?

12. Was a minimum RRF of 0.05 achieved for all analytes in the sixth initial calibration standard? YES NO

a. If no, why not?

13. Was a continuing calibration standard analyzed every 12-hour time period in which samples were analyzed? YES NO

a. If no, why not?

14. Were percent differences (%D) for YES NO

target compounds in the continuing calibration standards within the QC requirement of _30%?

a. If no, specify the analyte(s) and %D(s) that were outside of the QC limits.

15. Were the RRFs for analytes in the initial calibration within the requirements specified Table D-3 of Exhibit D, Section V of the SAMLCO (10/92)? YES NO

In continuing calibrations? YES NO

a. If no, why not?

16. Was a 25-mL purge volume used for the analysis of all samples? YES NO

a. If no, why not?

17. Were the area counts of all internal standards within -50% to +100% of the area count for each respective internal standard in the associated continuing calibration? YES NO

a. If no, specify the sample(s) and internal standard(s) that were outside of the QC limits.

18. Were the retention times of all the internal standards within _30 seconds of the retention time for each respective internal standard in the associated continuing calibration? YES NO

a. If no, specify the sample(s) and internal standard(s) that were outside of the QC limits.

19. Were laboratory method blanks analyzed at a minimum frequency of 1 per each 12 hour period during sample analysis? YES NO

a. If no, at what frequency were method blank analyses performed.

20. Were laboratory method blanks free of contamination at concentrations greater than the CRQL for all analytes? YES NO

a. If no, specify contaminant(s) and at what level(s) it was (they were) present.

21. Were recoveries for system monitoring compounds within the requirements specified in Table 7 of Exhibit D, Section 17 of the CLP SOW (OLM02.1) for all samples? YES NO

a. If no, list the recoveries and the associated samples that were above this range.

b. If no, list the recoveries and the associated samples that were below this range.

c. How many noncompliant recoveries were caused by dilutions?

d. How many noncompliant recoveries were caused by matrix interferences?

e. Were samples with noncompliant recoveries reanalyzed? YES NO

If no, why not?

22. Were MS/MSD analyses performed at a minimum frequency of 1 per SDG? YES NO

a. If no, why not?

23. Were MS/MSD recoveries within the requirements specified in Table 8 of Exhibit D, Section 17, of the CLP SOW (OLM02.1) for all spike compounds? YES NO

a. If no, specify the analyte(s) and %R(s) that were outside of the QC limits.

24. Were the relative percent differences (RPDs) between MS/MSD recoveries within the requirements specified in Table 8 of Exhibit D, Section 17 of the SOW (OLM02.1) for all spike compounds? YES NO

a. If no, specify the analyte(s) and %RPD(s) that were outside of the QC limits.

25. Were the CRQLs met for all analytes? YES NO

a. If no, why not?

26. Was it possible to analyze all target compounds within the range of the initial calibration curve? YES NO

a. If no, were these samples diluted according to the instructions in Section 8.b.5 of the SAS Client Request Form? YES NO

b. List these samples, the analytes above range, and the analyte concentration.

c. If no, explain why not and list the samples.

U. S. ENVIRONMENTAL PROTECTION AGENCY REGION 9
Environmental Services Branch
75 Hawthorne Street
San Francisco, CA 94105
Phone: 415/744-1498

SITE NAME: Frontier Fertilizer
CASE/RAP NO.:

REGIONAL ANALYTICAL PROGRAM CLIENT REQUEST FORM

The analysis of water samples for 1,2-dibromoethane (EDB) and 1,2-dibromo-3-chloropropane (DBCP) by EPA Method 504, Revision 2.0 (1989).

1. **Definition and number of work units involved (specify whether whole samples or fraction; specify sample matrices; and specify concentration level):** 71 low level groundwater samples

2. **Estimated date(s) of collection (provide a sampling schedule):**

   March 15 to March 24, 1999

3. **Estimated date(s) and method of shipment:**

   Overnight courier - samples are to be shipped on the day of collection for next day delivery including Saturday deliveries. Laboratory must be capable of accepting Saturday deliveries.

4. **Number of days analysis and data required after laboratory receipt of samples:**

   a. The contract required holding time for extraction and analysis is twenty-six (26) days from the date of sample receipt by the laboratory.

   b. The method holding time for extraction and analysis is 28 days from the date of sample collection.

   c. Data packages and all other deliverables are required within 35 days from receipt of last sample in each sample delivery group (SDG). A SDG is defined as the following, whichever is most frequent:

      - Each case of field samples received; or
      - Each 20 field samples within a case; or
      - Each 14 calendar day period during which field samples in a case are received.

5. **Analytical protocol required (attach copy if other than a protocol currently used in this program):**

   a. Requirements for the gas chromatograph (GC) system and GC columns are provided in Section 6.7 of Method 504. Columns other than those recommended in Sections 6.7.3 through 6.7.5 are permissible if the laboratory demonstrates that the analyses meet all the

performance and QA/QC criteria specified in Method 504 and in this contract. The use of a linearized electron capture detector (ECD) is required.

b. A five point initial calibration is required. Aqueous calibration standards are prepared (see Sections 9.1.1 through 9.1.3) and extracted (see Sections 11.1.3 and 11.2.1 through 11.2.6) in a manner identical to sample extraction. These standards are used for instrument calibration and sample quantitation to account for potential analyte losses during extraction.

c. Follow EPA Method 504 (Section 11) for extraction and analysis of samples and QC samples. Section 8 presents the required target analytes and contract required quantitation limits (CRQLs).

d. Confirmation on a second column with a liquid phase different from that of the primary column is required for all positive results. Refer to Section 5.a (above) for acceptable confirmation columns. Confirmation analyses must meet all instrument calibration criteria and blank acceptance criteria specified in Sections 6.a and 6.b.2, respectively, of this Client Request Form (CRF).

6. **Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):**

a. <u>Calibration Procedure and Criteria</u>:

Calibrate according to Section 8.0 of Method 504, with the following specifications:

1. Perform a five-point initial calibration containing both target analytes and the surrogate compound with a low standard at the concentrations of the CRQL or lower. Single point calibration (Method 504, Section 9.1.4) is not a permissible option.

a) If the external standard method is used, either peak area or peak height may be used for (instrument) response in the calculations. Calculate the calibration factor (CF) for each analyte in each calibration standard following Section 9.1.3 of EPA Method 504.

$$CF = x \div y$$

where CF = calibration factor [in µg/L]
x = concentration of the standard [in µg/L]
y = response, which may be peak area or height [unitless]

Calculate the mean and standard deviation (σ_{n-1}) of the CFs in the five calibration standards. Calculate the percent relative standard deviation (%RSD) by dividing the standard deviation by the mean. The %RSD for both analytes and the surrogate compound must not exceed 20.

b) Alternatively, linear regression that does not force the resulting straight line to pass through the origin may be used for instrument calibration. For each analyte, perform a linear regression on the response versus the concentration of the standards. The linear

regression analysis will produce the slope and y-intercept values for a linear equation in the following form:

$y = ax + b$

where:

y = response, which may be peak area or height
x = concentration of the standard [in $\mu g/L$]
a = slope of the straight line
b = the y-intercept

The correlation coefficient (r) generated by the linear regression must be greater than or equal to 0.99 for each target and surrogate compound. If calibration curves are used, provide sufficient documentation so that all analytical results can be recalculated, as specified in Section 7.a.4 of this CRF. Provide the equation for the line generated by the data system.

c) The low concentration standard must have a signal-to-noise ratio of 5:1 or greater for both target analytes. If this requirement cannot be met, the laboratory must submit a method detection limit (MDL) study as part of the data package, in order to validate its ability to achieve the CRQLs. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero.

2. Determine a retention time (RT) window for each target and surrogate compound. Calculate the mean and standard deviation (σ_{n-1}) of the 5 retention times for each compound over the 5 concentration levels in the initial calibration. Calculate the window as the mean RT ± 3 times the standard deviation.

3. Demonstrate that the individual analytes in the mid-point calibration standard are resolved by the chromatographic system. The analytes must be ≥90? resolved.

4. Extract and analyze a continuing calibration at the mid-point concentration for each analyte at the beginning of each day, after every 10 injections, and at the end of the analytical sequence. This standard is to be used to verify instrument performance. Percent differences between the nominal amount and calculated amount for each analyte in the continuing calibrations must be within ±15% for both EDB and DBCP.

5. Calculate the daily RT windows as the continuing calibration RT ± 3 times the standard deviation as determined in Section 6.a.2 of this CRF. Use these daily RT windows for target analyte identification.

b. <u>Internal Quality Control Checks, Control Limits and Corrective Actions</u>:

1. When calibration standard measurements exceed the quality control (QC) requirements for the initial calibration or the

continuing calibration, terminate analysis, correct the problem, and recalibrate the instrument.

The continuing calibration standard reflects the conditions under which the analysis of samples was performed. Associated samples are considered to be the samples analyzed following the continuing calibration up to the subsequent acceptable continuing calibration standard. Reanalyze all samples associated with an out-of-control continuing calibration standard.

2. Extract and analyze laboratory reagent blanks (LRBs) at a frequency of one per SDG or one for each extraction batch, whichever is greater. The method blanks must contain less than or equal to the CRQL of the target analytes listed in Section 8.

   If a LRB exceeds these criteria, the laboratory must consider the analytical system to be out of control. The source of the contamination must be investigated and appropriate corrective measures must be taken and documented before further sample analysis proceeds. All samples associated with a LRB that is out of control must be re-extracted and reanalyzed at no additional cost to the Region.

3. Spike all standards, samples, LRBs, and QC samples with an appropriate surrogate (i.e., 4-bromofluorobenzene). The amount of surrogate added must be at least 10 times the concentration of the lowest standard. Recoveries of 65-125% are required, unless documentation (such as control charts) is available to support a different range of recoveries. The laboratory must submit, as part of the data package, all supporting documentation for surrogate recoveries, and historical surrogate recovery data if necessary.

   If surrogate control limits are exceeded, take appropriate actions to identify the problem by re-analyzing the affected samples. If reanalysis does not solve the problem, the affected sample must be re-extracted and re-analyzed. If re-extraction and re-analysis solves the problem, then the problem was within the laboratory's control. Therefore, submit only data from the analyses with surrogate recoveries within QC limits. If re-extraction and re-analysis of the sample does not solve the problem, then submit the surrogate recovery data and sample analysis data from the initial analysis of both sample extracts.

4. Dilute and reanalyze sample extracts containing one or more analytes at concentrations above the initial calibration range. If dilution is necessary, the dilution must be selected so that the highest concentration analyte is determined at a concentration in the upper half of the calibration range. Report the results and submit documentation for both the diluted and undiluted analyses.

5. Analyze laboratory fortified matrix and laboratory fortified matrix duplicate (LFM/LFMD) at the frequency of one per SDG. Both EDB and DBCP must be spiked into the LFM/LFMD analyses. The concentration of the matrix spike solution should be such that the final extracts contain each analyte at an amount at the mid-range of the calibration curve.

Recoveries of 75-115% and relative percent differences (RPDs) of ≤15% are required. Re-extraction and reanalysis are not required if the LFM/LFMD criteria are exceeded. However, document LFM/LFMD outliers in the SDG narrative.

6. Extract and analyze a laboratory fortified blank (LFB) for each SDG or each batch of samples prepared, whichever is more frequent. The final extracts should contain EDB and DBCP at a concentration of 0.25 µg/L each. Percent recovery limits of 60-140% are required. If the QC limits are exceeded, re-extract and reanalyze the LCS and all samples associated with the noncompliant LCS.

7. Perform weekly MDL checks according to Section 10.4 of Method 504. Recovery must be 60-140% for each analyte. Document outliers in the SDG narrative.

8. Analyze a QC sample from an external source quarterly according to Section 10.5 of Method 504. Document outliers in the SDG narrative.

9. The QC requirements listed above are the minimum required. It is impossible to address all analytical situations that might be experienced by a laboratory during the analysis of environmental samples. The laboratory is expected to adhere to good laboratory practices when analyzing samples. If the laboratory has questions concerning the analyses of samples not addressed in this document, the Region must be notified IMMEDIATELY. The Laboratory Manager, or designee, must address problems and their solutions in the SDG narrative.

7. **Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion.**

a. <u>Data Calculations and Reporting Units</u>:

1. Quantitation of target and surrogate compounds in field and QC samples are performed as follows.

a) To calculate the concentration of an analyte or surrogate using the external standard method, use the average CF for the compound from the initial calibration (see Section 6.a.1.a) in the equation:

$$\text{Concentration } [\mu g/L] = (y \times \text{average CF} \times DF \times 35 \text{ mL}) \div V_s$$

where y = response, which may be peak area or height
CF = calibration factor [µg/L]
DF = dilution factor
V_s = volume of the sample in mL

b) If using linear regression for data calculations, then use the following equation:

$$x = (y - b) \div a$$

x = concentration of the detected analyte [µg/L]
y = response, which may be peak area or height
b = the y-intercept

a = slope of the line

2. The sample results are to be reported in the concentration units of micrograms per liter (µg/L) for water samples. Report all results to two significant figures.

3. For rounding results, adhere to the following rules:

   a) If the digit following those to be retained is less than 5, round down;
   b) If the digit following those to be retained is greater than 5, round up; or
   c) If the digit following the last digit to be retained is equal to 5, round down if the digit is even, and round up if the digit is odd.

4. All records of analysis, dilutions and calculations must be legible and sufficient to recalculate all sample concentrations and QC results. Include an example of the calculations in the data package.

b. <u>Documentation and Deliverables</u>:

Deliverables (in the form of a purge file, i.e., original documents) for each SDG shall include the following items:

1. All original shipping documents and sample tracking reports, including signed chain-of-custody forms, airbills, and traffic reports.

2. A completed and signed document inventory on a modified Organics Complete SDG File (CSF) Inventory Sheet (CLP Form DC-2).

3. All original sample receipt documents, including sample log-in information on a modified CLP Form DC-1, an SDG cover sheet, and any other sample receipt records.

4. A copy of the CRF, as provided by the Region (so that any additions or revisions authorized by the Region will be known). Only the technical portion of the CRF is required.

5. Any telephone logs referring to the samples.

6. An SDG Narrative, signed by the laboratory manager or designee, certifying the accuracy and validity of all data reported. The SDG Narrative must contain: laboratory name; case/RAP number; SDG number; EPA sample numbers in the SDG, differentiating between initial analyses and reanalyses; the corresponding laboratory sample identification (ID) numbers; and contract number. The SDG narrative must provide a description of all GC columns used for analysis, including brand name, the internal diameter in millimeters (mm), the length in meters, coating material, and film thickness. The SDG narrative must describe any administrative or technical problems encountered such as QC, sample shipment, or analytical problems and the resolution of these problems. The SDG narrative must include an explanation for any manual integrations or manual edits. The SDG narrative must include a formula (including definitions) showing how the results were calculated, and an example of an actual calculation for a sample in the SDG.

7. Include the following information in the header for each data reporting form: laboratory name, contract number, laboratory code, case/RAP number, and SDG number.

8. Tabulated analysis results for all field and QC samples on a modified CLP Form 1. Include both compound name and Chemical Abstracts Service (CAS) registry number for both analytes. Clearly specify concentration units and laboratory data qualifiers. Include the following additional information in the header: EPA sample number, laboratory sample ID, matrix, laboratory file ID, instrument ID, validated time of sample receipt (VTSR), extraction method, sample volume in milliliters (mLs), concentrated extract volume and injection volume in microliters (µLs), and dilution factors.

9. Raw sample data, including:

   a) All data system printouts, including: RT and corresponding peak area or height for each peak detected. The printouts must be labeled with the EPA sample number. When manual integrations or edits are made, analyst must sign and date each edit and include the integration time range.

   b) All chromatograms, including: EPA sample number; volume injected (µL); date and time of injection; GC instrument ID; GC column identifier including stationary phase and internal diameter; and scaling factor.

   c) Any manual worksheets

10. Surrogate result summaries on a modified CLP Form 2 with QC acceptance criteria and calculated percent recovery (%R) values rounded to the nearest whole number. If dual columns are used, surrogate recoveries should be reported from each column. Identify on the form header the GC column ID. Flag all recoveries outside the QC limits with an asterisk.

11. LFM/LFMD and LFB result summaries on a modified CLP Form 3 with calculated percent recovery (%R) and RPD values. Include in the form the recovery and RPD QC limits for each spike compound. Tabulate also the concentration of the spike in the sample, the sample concentration, and the LFM and LFMD or the LFB concentrations on the form. If dual columns are used, report the lower result from the two columns for each target compound. Flag all percent recoveries and RPDs exceeding the QC limits. Include the EPA sample number in the header. Also provide on a modified Form 3, the results from the weekly MDL analyses and the quarterly QC sample. It is not necessary to provide the raw data for analyses of MDLs and the quarterly QC sample.

12. Method blank summary on a modified CLP Form 4 specifying which samples are associated with each blank. Include on the form header the blank EPA sample number, the laboratory sample ID, the laboratory file ID, matrix, method blank extraction date, method blank analysis date and time, the instrument ID, and the GC column ID. The EPA sample number, the laboratory sample ID, and date analyzed must be included for each sample associated with the referenced blank. If

dual columns are used, report the items listed above for each column.

13. Instrument calibration data for each GC instrument and GC column used for analysis.

a) Initial Calibration

1) Standards summaries for initial calibration on modified CLP Form 6 tabulating: CFs, mean CFs, %RSD values, RTs, mean RTs, and RT windows for each compound. Include the following additional information in the header: GC instrument ID, column ID, concentration levels for each standard, and analysis date.

2) Resolution of the mid-point standards for each set analyzed in the initial calibration on a modified Form 6I with analyte names, retention time, and percent resolution. Include the following additional information in the header: GC instrument ID, column ID, standard EPA sample number, laboratory sample ID, and date and time analyzed.

3) All data system printouts, including: RT and corresponding peak area or height for each peak detected. Label printouts with standard EPA sample number and the total nanograms injected for each analyte. When manual integrations or edits are made, analyst must initial and date each edit and include the integration time range. Chromatograms must be labeled with the following: standard EPA sample number, volume injected (µL), date and time of injection, GC instrument ID, GC column ID, and scaling factor.

4) If linear regression is used for quantitation, include for each analyte the equation of the straight line, correlation coefficient, and graph of the straight line on axes labeled to identify what is plotted.

b) Continuing Calibration

1) Standard summaries for continuing calibration on modified CLP Form 7 tabulating: the nominal amount, calculated amount, the %D values, RTs, and daily RT windows for each compound. Include the following additional information in the header: dates of associated initial calibration, GC column ID, EPA sample number and laboratory sample ID for the continuing calibration standard(s), and date and time of continuing calibration standard(s).

2) All data system printouts, including: RT and corresponding peak area or height for each peak detected. Label printouts with the standard EPA sample number and the total nanograms injected for each analyte. When manual integrations or edits are made, analyst must initial and date each edit and include the integration time range. Chromatograms must be labeled with the

following: standard EPA sample number, volume injected (µL), date and time of injection, GC instrument ID, GC column ID, and scaling factor.

14. Analytical sequence information on a modified CLP Form 8 for each GC instrument and GC column used for analysis. Tabulate the EPA sample number, the laboratory sample ID, the date and time of analysis, and surrogate RTs for all standards and field and QC samples associated with the initial calibration reported in the header. Include the following additional information in the header: instrument ID, GC column ID with internal diameter, and date of initial calibration.

15. Target analyte results on a modified CLP Form 10 for each field and QC sample that has one or more detected result(s). Include the names of the detected analytes, the RTs, the RT windows, the concentrations, and %D between the concentrations on the two columns. Include the following additional information in the header: laboratory sample ID, analysis date, instrument ID, and GC column ID.

16. Raw QC data must include the following items for both primary and confirmation analyses:

    a) Blank data, in chronological order:

        1) Tabulated results on a modified CLP Form 1

        2) All data system printouts, including: RT and corresponding peak area or height for each peak detected. The printout must be labeled with the EPA sample number. When manual integrations or edits are made, analyst must initial and date each edit and include the integration time range. Chromatograms must be labeled with the following: EPA sample number, volume injected (µL), date and time of injection, GC instrument ID, GC column ID, and scaling factor.

        3) Any manual worksheets

    b) MS/MSD and LCS data, in chronological order:

        1) Tabulated results on a modified CLP Form 1

        2) All data system printouts, including: RT and corresponding peak area or height for each peak detected. The printout must be labeled with the EPA sample number. When manual integrations or edits are made, analyst must initial and date each edit and include the integration time range. Chromatograms must be labeled with the following: EPA sample number, volume injected (µL), date and time of injection, GC instrument ID, GC column ID, and scaling factor.

        3) Any manual worksheets

17. All computer printouts resulting from sample screening, with integrated areas, peak heights, and calibration factors.

18. Bench sheets for sample preparation and analysis, including the following:

   a) Extraction dates and times
   b) Sample extraction or preparation method
   c) Spiking solution identification with volumes and concentrations added
   d) Instrument run logs listing instrument ID and time and date of analyses

19. Standards preparation logs, for all standard solutions used for either calibration or spiking, which include source, traceable lot number, and concentrations of all compounds.

20. Any internal laboratory sample or sample extract transfer records and tracking sheets.

8. **Data Requirements**

The required target compounds with corresponding contract required quantitation limits (CRQLs) are provided below.

Compound	CAS Number	Water (µg/L)
1,2-Dibromoethane	106-93-4	0.05
1,2-Dibromo-3-chloropropane	96-12-8	0.05

9. **Other (use additional sheets or attach supplementary information, as needed):**

If a copy of the "U.S. EPA Region 9 Laboratory QC Summary Report" form is attached, complete the form by following the directions on the first page of the form.

U. S. EPA REGION 9
LABORATORY QC SUMMARY REPORT

LABORATORY: _____ SAS #:

SUBMITTED BY: _____ # SAMPLES:

TITLE: _____ MATRIX:

ANALYSIS: EDB and DBCP by EPA METHOD 504 DATE:

QC SUMMARY TABLE

QC PARAMETER	QC LIMITS	FREQUENCY
Laboratory Blank	<CRQL for all analytes	1 per SDG (1/20)
Initial Calibration (%RSD)	5-pt Calibration Curve <20% for all analytes	as needed
Continuing Calibration (%D)	Midpoint Concentration < 15% for all analytes	Daily
MS/MSD (%R)	75-115%	1 per SDG (1/20)
MS/MSD (RPD)	_15%	1 per SDG (1/20)
Surrogates (%R)	65-125%	all standards, blanks, samples and QC samples

1. Were all samples analyzed within the contract required holding time of 28 days from sample receipt? YES NO

   a. If no, list the samples that were analyzed outside of the holding time

   b. How many days outside of the holding time were these samples analyzed?

2. Were all samples received intact and in good condition? YES NO

3. Was the data package sent within 35 days from the receipt of the last samples in the SDG? YES NO

   a. If no, how many days late was the data package sent?

4. Was EPA Method 504 used to analyze these samples? YES NO

a. If no, specify which method was used.

b. If no, why was this method used and who authorized its use?

c. Was the approved method followed without modifications or deviations? YES NO

d. If no, specify what the modification or deviations were and who approved them.

5. Was a 5-point initial calibration curve run? YES NO

a. If yes, when?

b. If no, why not?

6. Did the initial calibration curve meet the QC requirement of <20% RSD for all analytes? YES NO

a. If no, specify the analyte(s) and RSD(s) that were outside of the QC limits.

7. Was a continuing calibration run on each day samples were analyzed? YES NO

a. If no, why not?

8. Did the continuing calibration standards meet the QC requirement of <_15%D for all analytes? YES NO

a. If no, specify the analyte(s) and %D(s) that were outside of the QC limits.

9. Were laboratory blanks analyzed at a minimum frequency of 1 per SDG? YES NO

a. If no, at what frequency were blanks performed.

10. Was blank contamination, if any, <CRQL for all analytes? YES NO

a. If no, specify contaminant(s) and at what level(s) it was (they were) present.

11. Specify the surrogate(s) used.

12. Were surrogate recoveries within the QC requirement of 65-125%? YES NO

a. If no, list the recoveries that were above this range.

b. If no, list the recoveries that were below this range.

c. How many non-compliant recoveries were caused by dilutions?

d. How many non-compliant recoveries were caused by matrix interferences?

e. Where samples re-analyzed to confirm matrix interference? YES NO

If no, why not?

13. Were MS/MSD analyses performed at a minimumfrequency of 1 per SDG? YES NO

a. If no, why not?

14. Did the MS/MSD meet the percent recovery (%R) QC requirements of 75-115%? YES NO

a. If no, specify the analyte(s) and %R(s) that were outside of the QC limits.

15. Did the MS/MSD meet the relative percent difference (RPD) QC requirement of <_15%? YES NO

a. If no, specify the analyte(s) and RPD(s) that were outside of the QC limits.

16. Was it possible to analyze all analytes within the initial calibration range? YES NO

a. If no, were these samples diluted according to the instructions in Section 8.b.5 of the SAS CRF? YES NO

b. List these samples and the associated analytes.

c. If no, explain why not and list those samples.

17. Was second column confirmation performed on all samples with positive results? YES NO

a. If no, why not?

18. Were the CRQLs met for all analytes? YES NO

a. If no, why not?