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SITE-SPECIFIC WORK PLAN FOR THE PASSIVE-DIFFUSION BAG SAMPLER DEMONSTRATION AT EDWARDS AFB, CALIFORNIA

August 2001

Prepared for:

Air Force Center for Environmental Excellence
Technology Transfer Division
and
Air Force Environmental Directorate

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AFILEV	Air Force Environmental Directorate
AFB	Air Force Base
AFCEE/ERT	Air Force Center for Environmental Excellence, Technology Transfer Division
amsl	above mean sea level
ANOVA	analysis of variance
AOC	area of concern
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylenes
DoD	Department of Defense
Dryden	Dryden Flight Research Center
DSITMS	Direct Sampling Ion Trap Mass Spectrometry
ft/ft	foot per foot
GIS	Geographical information system
HASP	Health and Safety Plan
JPL	Jet propulsion Laboratory
LOX	liquid oxygen
LTM	long-term monitoring
µg/L	micrograms per liter
NASA	National Aeronautical and Space Administration
NDMA	nitrosodimethylamine
Parsons	Parsons Engineering Science, Inc.
PDBS	passive diffusion bag sampler
QAPP	Quality Assurance Program Plan
RPD	relative percent difference
Rust	Rust Environment & Infrastructure, Inc.
SOP	Standard Operating Procedure
SVOC	semivolatile organic compound
TCE	trichloroethene
TEPH	total extractable petroleum hydrocarbons
TVPH	total volatile petroleum hydrocarbons
TO	task order
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WL	water level

1.0 INTRODUCTION

1.1 Project Description

On 27 February 2001, Parsons Engineering Science, Inc. (Parsons) was awarded a task order (TO) under Air Force Center for Environmental Excellence (AFCEE) contract F41624-00-D-8024 (TO24, Project Air Force Environmental Directorate [AFILEV]) to demonstrate the use of passive-diffusion bag samplers (PDBSs) in existing groundwater monitoring programs at selected AFILEV installations. The site of the PDBS demonstration outlined in this work plan is Edwards Air Force Base (AFB), located near Rosamond, California. The Technology Transfer Division of AFCEE (AFCEE/ERT) has initiated the PDBS demonstration to introduce this technology at multiple Department of Defense (DoD) installations and to improve the cost effectiveness of groundwater monitoring programs for volatile organic compounds (VOCs).

Diffusion sampling is a relatively new technology designed to utilize passive sampling techniques that eliminate the need for well purging. Specifically, a diffusive-membrane capsule is filled with deionized/distilled water, sealed, suspended in a well-installation device, and lowered to a specified depth below the water level in a monitoring well. Over time (no less than 72 hours), the VOCs in the groundwater diffuse across the membrane, and the water inside the sampler reaches equilibrium with groundwater in the surrounding formation. The sampler is subsequently removed from the well, and the water in the diffusion sampler is transferred to an analyte-appropriate sample container and submitted for laboratory analysis of VOCs. Benefits of diffusion sampling include reduced sampling costs and reduced generation of investigation-derived waste.

1.2 Objectives

The PDBS demonstration at Edwards AFB has two primary objectives:

- Develop vertical profiles of VOC concentrations across the screened intervals of the sampled monitoring wells, and

- Assess the effectiveness of PDBS by statistically comparing groundwater analytical results for VOCs obtained using the current (conventional) sampling method (i.e., micropurge and low-flow purge) during the upcoming long-term monitoring (LTM) events with results obtained using the PDBS method.

Vertical contaminant profiles will be developed by placing PDBSs at multiple discrete depths in each monitoring well included in the demonstration, and analyzing the resulting samples for VOCs. The statistical comparison of the conventional and diffusion sampling results will allow assessment of the appropriateness of implementing diffusion sampling for VOCs at each sampled well.

1.3 Scope

The Edwards AFB PDBS demonstration will be performed at Operable Units 5 and 6 (OU5 and OU6). The next LTM event for OU6 is scheduled to begin on September 10,

2001. The next LTM even for OU5 is scheduled for January 2002. In order to complete the PDBS evaluation at both OUs, three mobilizations to the site will be required:

- One to place the diffusion samplers in the selected monitoring wells,
- A second to retrieve the samplers installed in wells scheduled for sampling in September, 2001, and
- A third to retrieve the samplers installed in wells scheduled for sampling in January, 2002.

The PDBSs will be installed beginning August 27, 2001 to provide adequate equilibration time before the current environmental contractor for Edwards AFB, Earth Tech, Inc., begins the scheduled LTM sampling event at OU6 on September 10, 2001. The PDBSs will be retrieved on September 10 and 11 (OU6), and in January 2002 (OU5), immediately prior to sample collection from the same wells via the current conventional method. This will ensure temporal comparability of the analytical results obtained using the two methods. The PDBSs will be in place for a minimum of 14 days, which fulfills the 14-day minimum equilibration time period specified in the AFILEV PDBS Project Work Plan (Parsons, 2001).

1.4 Document Organization

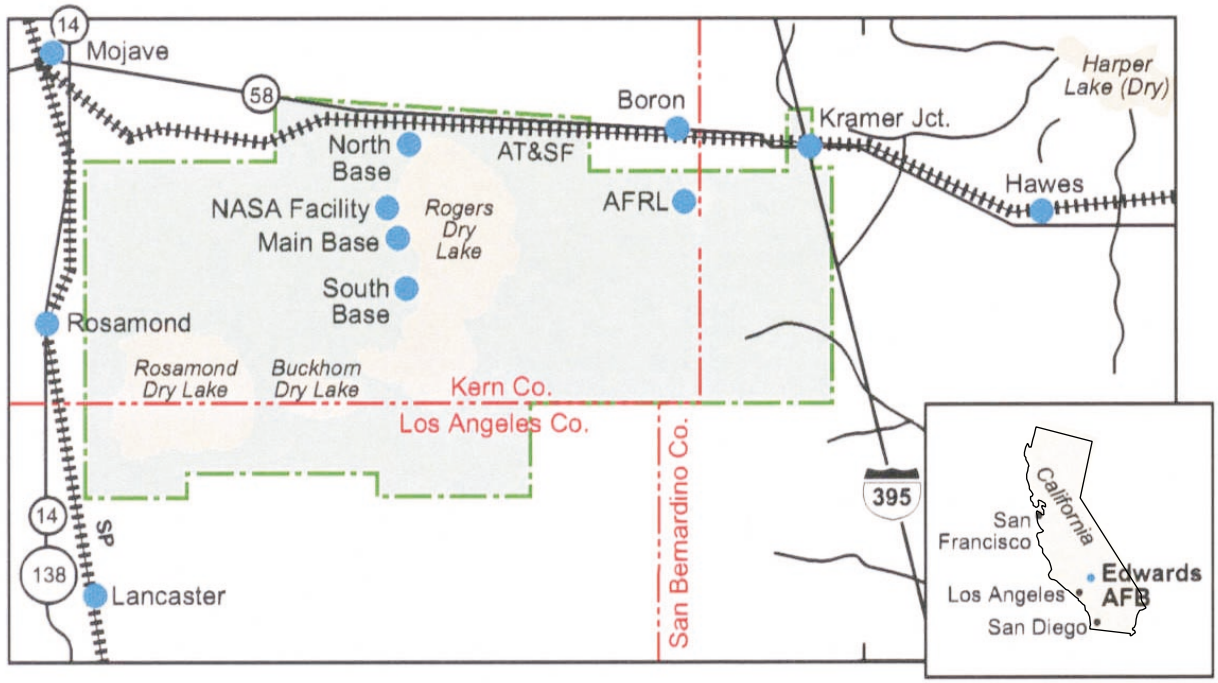
This work plan is organized into seven sections, including this introduction, and two appendices. The Edwards AFB site description is presented in Section 2. Section 3 details the scope of the PDBS investigation at Edwards AFB. Project organization, schedule, and an overview of the PDBS site-specific results report are summarized in Sections 4, 5, and 6, respectively. References used in the preparation of this work plan are presented in Section 7. A site-specific addendum to the Project Health and Safety Plan (HASP) (Parsons, 2001) is provided in Appendix A, and available boring logs and well-construction forms for the wells selected for PDBS sampling are provided in Appendix B.

2.0 SITE DESCRIPTION

2.1 Location and Description of Edwards Air Force Base, California

Edwards AFB is located at the western edge of the Mojave Desert in Kern, Los Angeles and San Bernardino counties, California, due east of the city of Rosamond and approximately 90 miles north of Los Angeles (Figure 2.1). Edwards AFB was established in 1933 as Muroc Army Air Field, and currently occupies 470 square miles of high desert plains and mountains. Edwards AFB is the home of the Air Force Flight Test Center, the Air Force Research Laboratory, the National Aeronautics and Space Administration (NASA), and many other tenant organizations. The Base is primarily involved in aircraft research, development, and testing.

During past Base's operation, hazardous materials and waste were used and hazardous wastes were generated. Releases of these substances have impacted soils and groundwater at numerous locations throughout the installation. More than 460 remedial



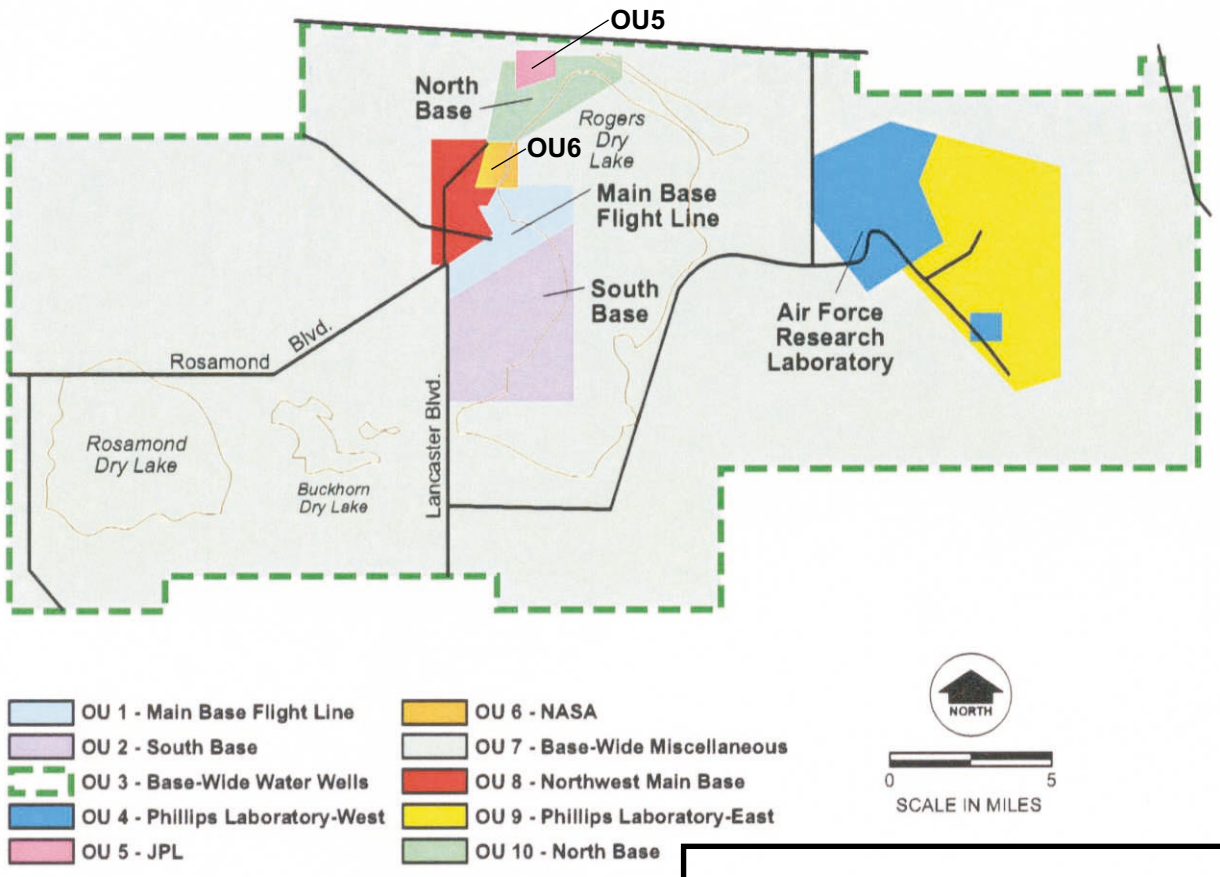


FIGURE 2.1

EDWARDS AFB AND OPERABLE UNIT LOCATIONS

Passive Diffusion Bag Sampler Demonstration
Edwards AFB, California

Source: Edwards AFB Installation Restoration Program: An Investment Report. April 2000. www.edwards.af.mil/about_edwards/index.html

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sites and areas of concern (AOCs) have been identified on the Base, and Edwards AFB was placed on the National Priorities List (NPL) in 1990. To manage this large program, Edwards AFB has been organized into 10 OUs based on geographical proximity of sites with common contaminant sources and similar receptor exposure pathways.

2.2 PDBS Site Description

The approximate locations of the two OUs that are targeted for the PDBS demonstration, OUs 5 and 6, are shown on Figure 2.1. OU5 consists of the occupied portion of North Base, which includes the North Base complex and the former NASA Jet Propulsion Laboratory (JPL). OU6 comprises approximately 520 acres on the northwestern edge of Rogers Dry Lake, which is occupied by the NASA Dryden Flight Research Center (Dryden).

OU5 and OU6 include several sites and AOCs that are suspected sources of groundwater contamination. Those sites/AOCs targeted for the PDBS demonstration, along with the primary chemicals of concern associated with them, are summarized in Table 2.1.

2.3 Environmental Setting

2.3.1 Operable Unit 5

2.3.1.1 Geology

The general stratigraphy in the area consists of an upper layer of younger, well-sorted alluvial deposits composed of unconsolidated sand, boulders, cobbles, and gravel with small quantities of silt and clay, underlain by older alluvial deposits. The thickness of the younger alluvium is variable, and reportedly ranges from 80 feet to 100 feet. The underlying older alluvium is more consolidated, and is composed of poorly sorted, highly weathered gravel and sand. This unit reportedly extends from the bottom of the younger alluvium to approximately the top of the bedrock complex. The bedrock complex below OU5 consists of quartz monzonite and other granitic rocks. The depth to the bedrock complex is variable, and in the vicinity of OU5, ranges from 230 feet to greater than 400 feet below ground surface (bgs) (Earth Tech, Inc., 2001b).

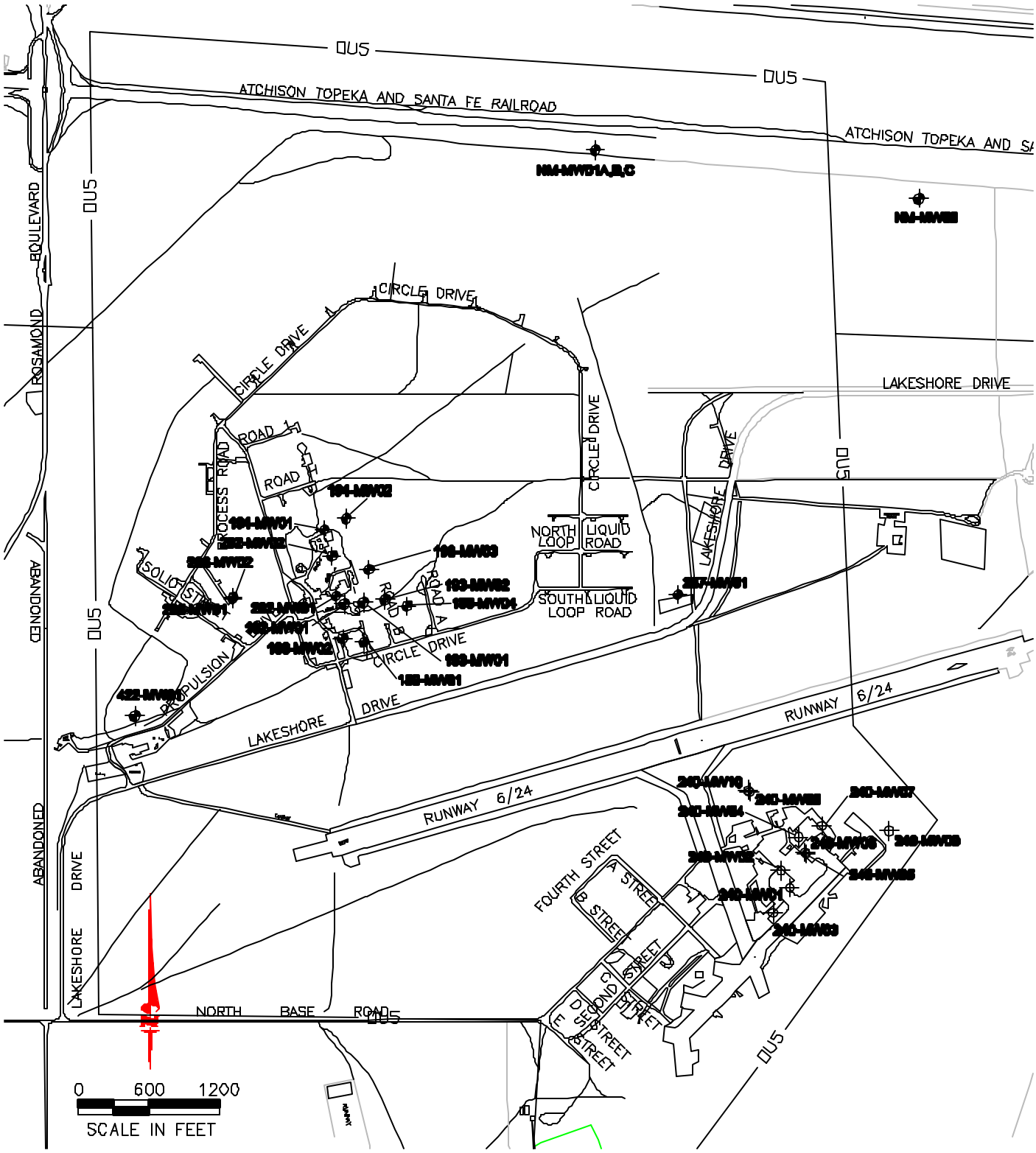
2.3.1.2 Hydrogeology

Groundwater at OU5 is encountered in the older alluvium at depths ranging from approximately 95 to 130 feet bgs. Shallow groundwater elevations measured during November-December 2000 ranged from 2177.63 feet above mean sea level (amsl) to 2235.12 feet amsl (Earth Tech, 2001b). The shallow aquifer is unconfined, and is recharged via precipitation in the fractured bedrock hills on the east and west sides of Rogers Dry Lake and from the northern end of the Lancaster basin. The flow direction converges radially toward the center of the lakebed, and then becomes northerly as groundwater from the fractured bedrock aquifers accumulates below the lake bed.

TABLE 2.1
SITES AND AREAS OF CONCERN SELECTED FOR PDBS DEMONSTRATION
PASSIVE-DIFFUSION BAG SAMPLER DEMONSTRATION
EDWARDS AFB, CALIFORNIA

Site Number	Name	Primary Contaminants
Operable Unit 5		
189	Building E-8 Septic System	Solvents
192	Test Stand B Catch Basin	Trichloroethene
193	Test Stands A, B, & C Retention Sumps and Topographic Depression	Solvents
194	Building E-24 at Test Stand D, Catch Basin and Former Drainage Area	Solvents
240	Building 4505 Oil/Water Seperator and Former Uderground Storage Tank NOO1 (Formerly Site 241)	Fuels
282	Building E-18 Test Stand C/Fluorine Scrubber Basin/Emission Control System/Retention Sump/Satellite Accumulation Point	Solvents
287	Building E-57 Former Pond	Trichloroethene
422	Building E-32 Leach Field	Solvents
Operable Unit 6		
N1	Northern Retention Pond	Solvents
N2	Building 4801 – Former Auxiliary Power Unit Drainage Area	Trichloroethene
N3	Buildings 4886 and 4889 Gas Station – Removed USTs	Trichloroethene, Benzene, Toluene, Ethlyenzene, and Xylenes
N4	Southern Retention Pond and Liquid Oxygen (LOX) Wash Rack	Solvents and Fuels
N7	Building 4827 Drum Storage Area	Trichloroethene

The hydraulic gradient is relatively steep on the fringes of the lakebed and gradually decreases toward the center of the lakebed and to the north, where it is approximately 0.0025 foot per foot (ft/ft) (Earth Tech, 2001b). Hydraulic conductivity is approximately 2×10^{-5} feet per second. Assuming the average porosity of the aquifer materials is 0.30, the average groundwater flow velocity is estimated to be 5.2 feet per year (Earth Tech, 2001b).



LEGEND

- 280-MW02 — MONITORING WELL
- OPERABLE UNIT BOUNDARY

SOURCE: EARTH TECH, INC. 2001b

FIGURE 2.2

OU5 MONITORING WELL LOCATIONS

PASSIVE DIFFUSION BAG SAMPLER DEMONSTRATION EDWARDS AFB, CALIFORNIA

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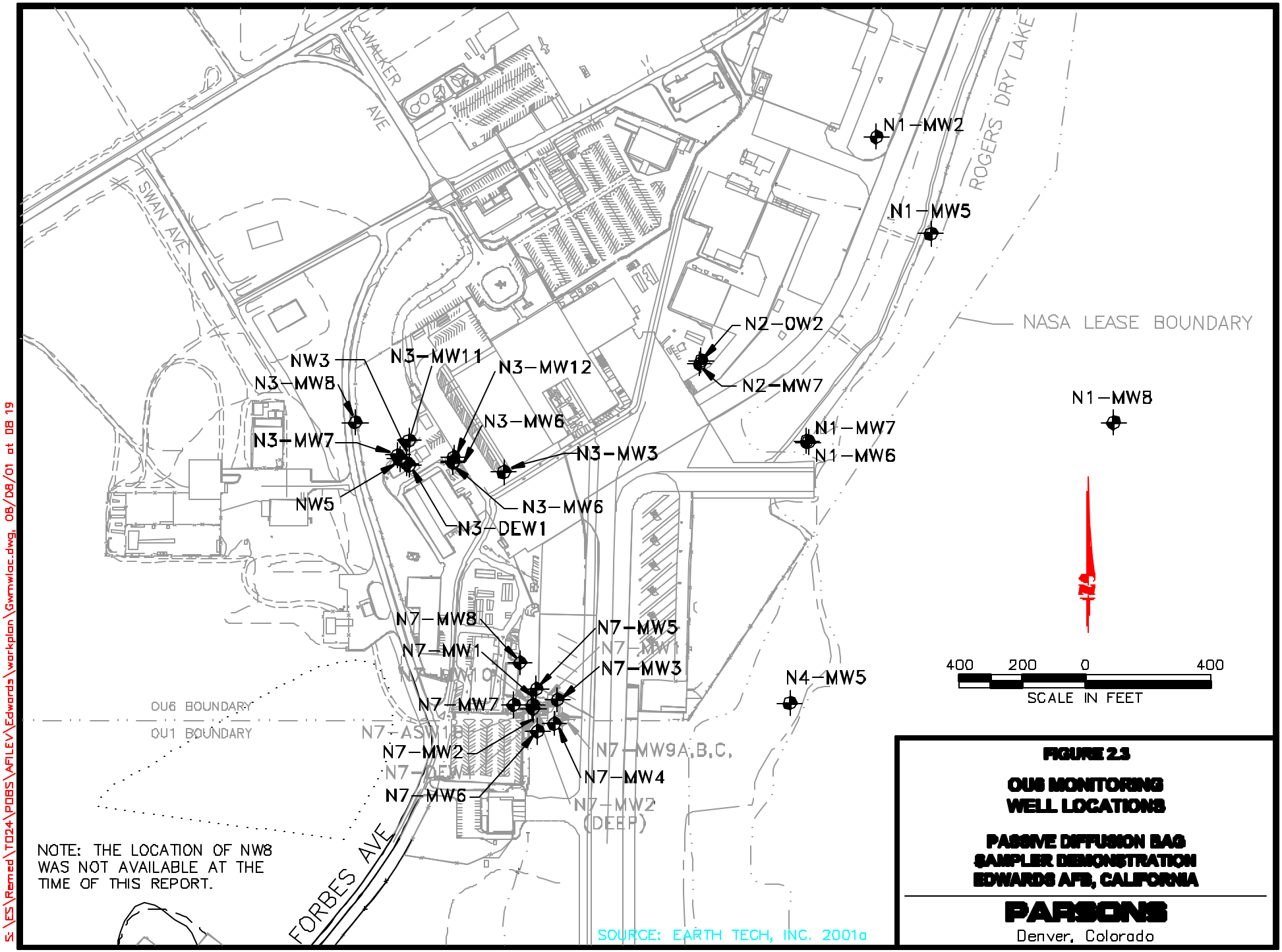

FIGURE 2.3

OU6 MONITORING WELL LOCATIONS

PASSIVE DIFFUSION BAG SAMPLER DEMONSTRATION EDWARDS AFB, CALIFORNIA

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2.3.2 Operable Unit 6

2.3.2.1 Geology

There are three major geologic complexes at OU6: a basement complex of igneous and metamorphic rocks; an intermediate complex of continental volcanic and sedimentary rocks; and valley fill deposits. The granitic bedrock is overlain by a relatively thin cover of unconsolidated alluvial and lake-bed deposits. The alluvial layer consists of sandy deposits that appear to have been derived from outcrops of granitic bedrock. The playa deposits typically are typically fine grained silty sands. The bedrock is generally competent, except for surface weathering and localized fractures (Rust Environment and Infrastructure, Inc. [Rust], 1998a). Geologic boring logs completed during the installation of several OU6 wells are included in Appendix B.

2.3.2.2 Hydrogeology

At OU6, the saturated zone lies almost entirely within fractures in the shallow granitic bedrock; portions of the overlying alluvium and playa deposits also are saturated. Unconfined groundwater occurs at depths ranging from approximately 5 feet bgs along the east side of Dryden to approximately 30 feet bgs along the west side of Dryden. The local groundwater flow direction is east toward Rogers Dry Lake at a hydraulic gradient ranging between approximately 0.06 ft/ft to 0.008 ft/ft (Rust, 1998b). Hydraulic conductivities range from 0.00012 to 3.3 feet per day, and transmissivities range from 0.0012 to 0.14 square foot per minute. Lower values were generally indicative of competent bedrock and higher values in weathered bedrock and alluvium (Rust, 1998b). The average flow velocity is less than 0.12 foot per day (<44 feet per year). Well construction forms and geologic boring logs for several wells at OU6 are presented in Appendix B.

3.0 SCOPE OF PDBS DEMONSTRATION

It is estimated that approximately 110 passive diffusion samplers will be installed in 41 monitoring wells at Edwards AFB (15 wells at OU5, and 26 wells at OU6) as part of this technology demonstration. The monitoring wells selected for sampling are summarized in Table 3.1, and their locations are shown on Figures 2.2 and 2.3.

3.1 Diffusion Sampling

3.1.1 Field Activities

Monitoring wells selected for VOC sampling using the PDBS technique (Table 3.1) were chosen from the list of monitoring wells targeted for sampling by EarthTech during the LTM sampling events scheduled to begin in September 2001 (OU6) and in January

TABLE 3.1
PDBS WELL SUMMARY
PASSIVE-DIFFUSION BAG SAMPLER DEMONSTRATION
EDWARDS AFB, CALIFORNIA

Well ID	Analyses Scheduled for Next Conventional Sampling Event [a/]							Top of Casing Elevation (ft amsl) [b/]	Screened Interval (ft btoc) [c/]	Screen Length (feet)	Well Diameter (inches)	Reported Well Depth (feet)	Most Recent Groundwater Elevation (ft btoc)	Expected Saturated Screen Length (feet)	Expected Number of PDB Samplers	Dedicated Pump?	Expected Elevation of Pump Inlet (ft btoc)	Most Recent TCE (µg/L) [d/]	Most Recent Benzene (µg/L)
	VOCs	SVOCs	Perchlorate	NDMA	TEPH	TVPH	Water Level												
OU5 - Next sampling to occur in January '02																			
189-MW01	X		X	X			X	2304.64	115 - 130	15	4	130	124.31	5.69	2	No	126.4	170	ND [f/]
189-MW02	X		X	X			X	2310.33	NA [e/]	NA	4	141	126.6	NA	6*	No	128.5	5200	ND
189-MW04	X			X			X	2305.92	NA	NA	4	136	122.42	NA	6*	No	124.5	11	ND
192-MW01	X						X	2307.18	115 - 135	20	4	135	123.46	11.54	4	No	125.17	47	ND
193-MW02	X						X	2305.77	115 - 130	15	4	133	123.46	6.54	2	No	130	17	ND
193-MW03	X						X	2306.95	121 - 136	15	4	136	123.51	12.49	4	No	125.2	6.7 J	ND
194-MW01	X						X	2308.61	NA	NA	NA	NA	NA	NA	6*	No	NA	11	ND
194-MW02	X						X	2310.88	122 - 137	15	4	137	127.25	9.75	3	No	129.0	2.6 J	ND
282-MW01	X						X	2306.07	117 - 137	20	4	137.4	124.45	12.55	4	No	126.4	37	ND
282-MW02	X						X	2306.07	118.5 - 148.5	30	4	149	124.07	24.43	8	No	125	25	NA
287-MW01	X			X			X	2286.27	105 - 125	20	4	130	103.84	20	6	No	117	2.7	ND
422-MW01	X		X				X	2313.65	122 - 142	20	4	147	129.6	12.4	4	No	131	11	ND
240-MW04	X	X			X	X	X	2275.26	90 - 110	20	4	110	95.18	14.82	1	Yes	100	1.7 J	29
240-MW06	X	X			X	X	X	2275.23	130 - 150	20	6	150	95.81	20	6	No	140	ND	4.8
240-MW07	X	X			X	X	X	2277.32	130 - 150	20	NA	153	98.05	20	6	No	140	0.7 J	0.84 J

TABLE 3.1 (Continued)
PDBS WELL SUMMARY
PASSIVE-DIFFUSION BAG SAMPLER DEMONSTRATION
EDWARDS AFB, CALIFORNIA

Well ID	Analyses Scheduled for Next Conventional Sampling Event [a/]							Top of Casing Elevation (ft amsl) [b/]	Screened Interval (ft btoc) [c/]	Screen Length (feet)	Well Diameter (inches)	Reported Well Depth (feet)	Most Recent Groundwater Elevation (ft btoc)	Expected Saturated Screen Length (feet)	Expected Number of PDB Samplers	Dedicated Pump?	Elevation of Pump Inlet (ft btoc)	Most Recent TCE (µg/L) [d/]	Most Recent Benzene (µg/L)
	VOCs	SVOCs	Perchlorate	NDMA	TEPH	TVPH	Water Level												
OU6 - Next sampling to occur 9/10-9/21/01																			
N1-MW2	X						X	2278.83	13 - 28	15	NA	NA	7.01	15	1	Yes	NA	0.91	NA
N1-MW5	X						X	2275.392	6.5 - 21.5	15	NA	NA	5.96	15	1	Yes	NA	5	NA
N1-MW6	X	X					X	2275.174	7 - 22	15	NA	NA	7.63	14.37	1	Yes	NA	73	NA
N1-MW7	X						X	2276.41	114 - 134	20	4	140	9.06	20	1	Yes	NA	190	NA
N1-MW8	X						X	2274.11	8 - 23	15	4	23	12.69	10.31	1	Yes	NA	0.31	NA
N2-OW2	X						X	2282.678	8 - 23	15	4	25	13.248	9.75	1	Yes	NA	3.7	NA
N2-MW7	X						X	2282.53	45 - 55	10	6	59	13.65	10	1	Yes	NA	51	NA
N3-DEW1	X						X	NA	5.7 - 50.7	45	6	55	NA	NA	1	Yes	NA	NA	NA
N3-MW3	X			X	X		X	2286.187	13 - 33	20	4	34.5	13.97	19.03	1	Yes	NA	280	NA
N3-MW6	X			X	X		X	2285.504	20 - 38	18	4	42	13.56	18	1	Yes	NA	750	13
N3-MW7	X	X	X	X	X		X	2287.1902	41 - 51	10	4	51.3	9.48	10	1	Yes	NA	8300	71
N3-MW8	X			X	X		X	2303.146	15 - 30	15	4	30.5	20.58	9.42	1	Yes	NA	10	NA
N3-MW11	X						X	2288.8146	80 - 110	30	4	170	8.89	30	1	Yes	NA	1600	1.5
N3-MW12	X			X	X		X	2285.44	192 - 202	10	NA	NA	11.67	10	1	Yes	NA	950	25
N4-MW5	X		X				X	2276.368	5 - 20	15	NA	NA	12.37	7.63	1	Yes	NA	57	0.63
N7-MW1	X					X	X	2280.24	12 - 22	10	NA	22	7.13	10	1	Yes	NA	3 U	0.5
N7-MW2	X					X	X	2280.71	45 - 55	10	6	57	7.69	10	1	Yes	NA	3 U	0.61
N7-MW3	X			X		X	X	2280.95	25 - 50	25	6	52	10.69	25	1	Yes	NA	160	NA
N7-MW4	X						X	2281.04	25 - 50	25	4	52	9.73	25	1	Yes	NA	(<0.5)U	0.17
N7-MW5	X						X	2280.52	6 - 36	30	4	38.5	NA	NA	10	No	NA	17	NA
N7-MW6	X						X	2281.66	6 - 31	25	4	43	NA	NA	8	No	NA	70	NA
N7-MW7	X						X	2282.27	5 - 35	30	4	37	NA	NA	1	Yes	NA	33	NA
N7-MW8	X						X	2280.79	5 - 35	30	4	35	5.22	29.78	1	Yes	NA	140	NA
NW3	X			X	X		X	2286.9863	NA	NA	NA	NA	14.4763	NA	1	Yes	NA	480	130
NW5	X			X	X		X	2285.9236	NA	NA	NA	NA	5.8036	NA	1	Yes	NA	4000	4.6
NW8	X				X		X	2286.42	NA	NA	NA	NA	14.63	NA	1	Yes	NA	4.2	4.6

[a/] VOCs = volatile organic compounds; SVOCs = semivolatile organic compounds; NDMA = nitrosodimethylamine; TEPH = total extractable petroleum hydrocarbons; TVPH = total volatile petroleum hydrocarbons.

[b/] ft amsl = feet above mean sea level.

[c/] ft btoc = feet below top of casing.

[d/] TCE = trichloroethene; µg/L = micrograms per liter.

[e/] NA = Information was not available at the time of this report.

[f/] ND = not detected.

* = Indicates an estimated number based on the average screen length for OU5 wells.

2001 (OU5). Monitoring wells were selected based primarily on VOC concentrations detected during recent sampling events (EarthTech, 2001a and 2001b), as represented by trichlorethene (TCE) and benzene concentrations in Table 3.1. All of the wells that were identified to be sampled by Earth Tech (Earth Tech, 2001a and 2001b) in OU5 and OU6 as part of the upcoming sampling events and which had historically exhibited detectable concentrations of VOCs (Table 3.1) were included in this demonstration.

PDBSs deployed during this investigation will be installed and retrieved in accordance with the diffusion sampler installation and recovery standard operating procedures (SOPs) presented in Appendix B of the AFILEV PDBS Project Work Plan (Parsons, 2001). The schedule for PDBS deployment and retrieval is presented in Sections 1.3 and 5.0. At OU5, PDBSs will be installed throughout the screened interval of each well at a frequency of one PDBS for every 3 feet of saturated screen to obtain a vertical profile of contaminant concentrations. Analysis of the vertical profiling samples is discussed in Section 3.1.2. At OU6, dedicated pumps are installed in the majority of the wells. The presence of dedicated pumps reduces the annular space between the pump and the well screen which can make it difficult (and sometimes impossible) to lower a PDBS down beyond the pump, thereby precluding the ability to perform a vertical profile contamination through the screened interval of the well. Therefore, for OU6 wells that have dedicated pumps, only one PDBS will be placed in the well at an elevation immediately above or adjacent to the dedicated pump. For OU6 wells that do not have dedicated pumps, vertical profiling will be performed in a manner consistent with that planned for OU5. However, rather than perform field screening of vertical profiles on OU6 wells, all samples collected from OU6 wells will be sent to BC Labs for analysis of VOCs using EPA Method 8260B. All PDBS samples will be collected prior to conventional sampling of the wells.

Sample aliquots from all PDBSs installed in OU6 wells targeted for sampling will be shipped to BC Laboratories, Inc. (BC Labs) in Bakersfield, California, while all samples collected from OU5 wells that are identified for fixed-base laboratory analysis will be shipped to Severn-Trent Laboratories (STL) in Santa Ana, California. Samples will be analysed for VOCs using United States Environmental Protection Agency (USEPA) Method 8260B. BC Labs and STL are the laboratories currently used by EarthTech for analysis of the samples collected via conventional techniques during the LTM event starting in September 2001 (OU6) and January 2002 (OU5), respectively. A percentage of the samples collected by EarthTech and analyzed by BC Labs also will be sent to an alternate laboratory for confirmation analysis. To ensure comparability of results, PDBS results will be compared only with results reported by BC Labs for conventionally collected samples at OU6.

Quality-control samples will be collected at the following frequencies:

- 10 percent field duplicates;
- 5 percent matrix spikes and matrix spike duplicates;
- 1 pre-installation source-water blank
- 1 pre-installation equipment-rinseate blank; and
- 1 trip blank per sample shipping container.

The Quality Assurance Program Plan (QAPP) for the LTM program at Edwards AFB (Earth Tech, 1998) will be adopted as the site-specific addendum to the PDBS QAPP, as appropriate.

3.1.2 Contaminant Profiling

Per the AFILEV project work plan (Parsons, 2001), contaminant profiling within the screened intervals of monitoring wells is intended to be conducted using field-screening methods, with only the sample exhibiting the greatest VOC concentrations, based on the field-analysis method, being submitted for laboratory analysis. As discussed in Section 3.1.1, vertical profiling will only be performed for wells at OU5.

Field screening of vertical profiling samples from OU5 will be performed using USEPA's direct-sampling ion-trap mass-spectrometry (DSITMS) Method 8265. DSITMS is an innovative technology for determining the presence or absence and measuring the concentration of VOCs and semivolatile organic compounds (SVOCs) in air, water, and soil samples. DSITMS introduces sample materials directly into an ion-trap mass spectrometer by means of a very simple interface such as a capillary restriction or a polymer membrane. There is very little, if any, sample preparation required, and no chromatographic separation of the sample constituents, meaning that the response to the contaminants in a sample is instantaneous.

All OU5 samples will be analyzed in the field using a field ready DSITMS by Tri-Corders Environmental, Inc. (McLean, VA). For each well, the sample from the PDBS which is positioned closest to the depth interval from which Earth Tech will collect their conventional sample will be shipped to STL for VOC analysis using EPA Method 8260B.

If the field screening results indicate that the highest concentration of contamination occurs at a depth that is different than that of the conventional sampling depth, the PDBS sample from the most contaminated depth may also be sent to STL for VOC analysis using EPA Method 8260B as long as the additional analytical cost is within the project budget.

3.1.3 Analytical Results Comparison/Evaluation

Analytical results for groundwater samples collected using the PDBSs and using conventional techniques will be compared, and the results will be evaluated. Typically, if maximum concentrations from the PDBS are higher than concentrations in samples collected using the conventional method, it is probable that the concentrations from the PDBS are more representative of ambient groundwater chemistry conditions than are the conventional-sampling data (Vroblesky, 2001). If, however, the conventional method produces VOC results that are higher by a predetermined amount than the concentrations reported for the PDBS, then the PDBS may not adequately represent local ambient groundwater conditions. In this case, the difference may be due to a variety of factors, including hydraulic and chemical heterogeneity within the saturated screened interval of the well, vertical flow of groundwater within the well, and/or the relative permeability of the well screen with respect to the surrounding aquifer matrix (Vroblesky, 2001).

Considering the above guidance, if the maximum analytical result obtained using the PDBS is greater than or equal to the conventional sampling result for the same well, it will be inferred that the PDBS method is appropriate for use in that particular well, and no further comparison of results will be performed. However, if the maximum PDBS result is less than the conventional sampling result, further comparison of the two sets of results will be undertaken. In this instance, analytical results for samples collected using the diffusion samplers will be compared to results from the conventional sampling using relative percent-difference (RPD), as defined by the following equation:

$$RPD = 100*[abs(D-C)]/[(D+C)/2]$$

Where:

abs = absolute value

D = diffusion sampler result

C = conventional sample result.

For this investigation, an RPD of less than 15 (McClellan AFB, 2000) will be considered to demonstrate good correlation between sample results. Calculated RPDs in excess of 15 will be reviewed individually in an attempt to determine the reason for the variance.

3.2 Monitoring Network Optimization Evaluation

A portion of the groundwater monitoring network at this installation will be evaluated using both qualitative assessments and a geographical information system (GIS)-based algorithm that performs statistically based temporal and spatial analyses of monitoring-well information. Locations and completion intervals of individual monitoring wells and sampling points will be examined, and the informational contribution of each well or sampling point to the network will be weighed against the cost of monitoring at that point. Monitoring protocols and analytical methods also will be evaluated. Where warranted, recommendations will be developed for optimization of the portion of the monitoring network that is evaluated. Methods to be used in the evaluation will include, but are not limited to, qualitative hydrogeologic and hydrochemical analyses, application of statistical optimization techniques, and application of decision-logic structures.

A maximum of 60 monitoring wells at this installation will be evaluated as part of this task. Parsons will coordinate with Edwards AFB to determine which wells to include in the LTM program evaluation. The results of the evaluation will be included in the Site-Specific Diffusion Sampler Demonstration Report for Edwards AFB (see Section 6.0).

4.0 PROJECT ORGANIZATION

The names, addresses, and contact numbers for members of the Edwards PDBS management and support team are as follow:

Name	Title	Address	Phone/Email	Facsimile
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Ms. Linnea Coffee-Lopez	STL	STL Los Angeles 1721 South Grand Avenue Santa Ana, CA. 92705	(714) 258-8610 lcoffey@stl-inc.com	(714) 258-0921

5.0 SCHEDULE

Work performed as part of this technology demonstration at Edwards AFB will be completed according to the schedule summarized below.

- Submit the Draft Edwards AFB PDBS Work Plan to commenting parties: August 8, 2001
- Receipt of comments on the Draft Edwards AFB PDBS Work Plan: August 22, 2001
- Submit the Final Edwards AFB PDBS Work Plan: August 31, 2001
- Install PDBS samplers in monitoring wells at Edwards AFB: August 27-29, 2001
- Remove PDBS samplers from monitoring wells at Edwards AFB: September 10-11, 2001 (OU6) and January 2002 (OU5) (coordinate with EarthTech)
- Preparation of the Draft Edwards AFB PDBS Reports: Spring 2002.

6.0 REPORTING

The site-specific results report will provide a map and accompanying table identifying the location and depth for each PDBS sample collected. Analytical results obtained as part of this study will be compared to conventional-sampling analytical results collected by Earth Tech in a scientifically defensible manner using statistical analyses. The results of the statistical comparisons will be presented in a clear and logical manner in the results report. Statistical methods will include calculation of RPDs between PDBS and conventional sampling results, and possibly parametric or non-parametric analysis of variance (ANOVA) tests. The draft of this report will be distributed according to the schedule presented in Section 5.

7.0 REFERENCES

McClellan AFB. 2000. Final Passive Diffusion Membrane Samplers Technology Application Analysis Report. National Environmental Technology Test Sites (NETTS). August.

Parsons. 2001. *Draft Work Plan for the Air Force Environmental Directorate Passive Diffusion Sampler Demonstration*. April.

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Rust Environment & Infrastructure, Inc. 1998a. IRP, OU6, Semi-Annual Groundwater Monitoring Report, April 1998, Final. September.

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Vroblesky, D. A. 2001. *User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells*. US Geological Survey Water-Resources Investigations Report 01-4060. Columbia, South Carolina.

APPENDIX A

HEALTH AND SAFETY PLAN ADDENDUM

APPENDIX B

WELL CONSTRUCTION RECORDS AND BOREHOLE LOGS FOR SELECTED OU6 WELLS

Data available upon request from
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