

DRAFT

**Work Plan for the
Air Force Base Conversion Agency
Passive Diffusion Bag Sampler Demonstration**

Prepared For



**U.S. Department of the Army, Corps of Engineers
Omaha District
Omaha, Nebraska**

**Contract 44650-99-D-005
Delivery Order DK01**



U.S. AIR FORCE

February 2002

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**WORK PLAN FOR THE AIR FORCE BASE CONVERSION
AGENCY PASSIVE DIFFUSION BAG SAMPLER
DEMONSTRATION**

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Prepared for:

**U.S. Department of the Army, Corps of Engineers
Omaha District
Omaha, Nebraska**

and

**Air Force Base Conversion Agency
Roslyn, Virginia**

**CONTRACT F44650-99-D-005
Delivery Order DK01**

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE/ERT	Air Force Center for Environmental Excellence, Technology Transfer Division
BRAC	Base Realignment and Closure
CDRL	Contract Data Requirements List
COR	Contracting Officer's Representative
CPSMR	Contractor's Progress, Status, and Management Report
DNAPL	Dense non-aqueous phase liquid
DO	Delivery Order
ERPIMS	Environmental Restoration Program Information Management System
FSP	Field Sampling Plan
GIS	Geographical information system
HASP	Health and Safety Plan
HQ	Headquarters
IDW	Investigation derived waste
IRP	Installation Restoration Program
LNAPL	Light non-aqueous phase liquid
mL	Milliliter
ODC	Other direct cost
P&CR	Performance and Cost Report
Parsons	Parsons Engineering Science, Inc.
PDBS	Passive Diffusion Bag Sampler
PDF	Portable document format
PM	Project manager
POC	Point of contact
PPC	Project Planning Chart
PPE	Personal Protective Equipment
PPF	PDBS Placement Form
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative percent difference
SAP	Sampling and Analysis Plan
SOW	Statement of Work
USACE	U.S. Army Corps of Engineers
USAF	US Air Force
USGS	US Geological Survey
VOC	Volatile organic compound
WBS	Work breakdown structure

SECTION 1

PROJECT DESCRIPTION

On 22 January 2002, Parsons Engineering Science, Inc. (Parsons) was awarded contract F44650-99-D-005, Delivery Order (DO) DK01 by the U.S. Department of the Army, Corps of Engineers, Omaha District (USACE) to demonstrate the use of passive diffusion bag samplers (PDBSs) in existing groundwater monitoring programs at selected Base Realignment and Closure (BRAC) installations overseen by the Air Force Base Conversion Agency (AFBCA). The Technology Transfer Division of the Air Force Center for Environmental Excellence (AFCEE/ERT) has initiated the PDBS demonstration to introduce this technology to multiple Air Force installations and to improve the cost effectiveness of groundwater monitoring programs.

Diffusion sampling is a relatively new technology designed to utilize passive sampling techniques without 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 in a monitoring well. Over time (no less than 72 hours), the volatile organic compounds (VOCs) in the groundwater diffuse across the membrane and reach equilibrium with the water inside the sampler. The sampler is subsequently removed from the well, and the water within the diffusion sampler is transferred to a sample container and submitted for laboratory analysis. Some benefits of using PDBSs include reduced sampling costs and reduced generation of investigation-derived waste (IDW).

The PDBS demonstration will be performed so that groundwater analytical results obtained using the current (conventional) sampling method (e.g. micropurge/sample, 3-casing-volume purge/sample) can be compared with results obtained using the PDBS method. Using comparative statistics, the appropriateness of implementing PDBSs at each sampled well will be assessed.

Ten BRAC installations have been selected for inclusion in this demonstration including:

- Carswell Air Force Base (AFB), Texas
- Bergstrom AFB, Texas
- Kelly AFB, Texas
- Reese AFB, Texas

- England AFB, Louisiana
- Grissom AFB, Indiana
- Gentile AFB, Ohio
- Mather AFB, California
- Newark AFB, Ohio
- Wurtsmith AFB, Michigan

This work plan is organized into eight sections, including this introduction, and six appendices. The Work Breakdown Structure (WBS) is presented in Section 2. Section 3 presents the technical approach to the project including procedures for PDB sampling. Project staffing, schedule, and deliverables are summarized in Sections 4, 5, and 6, respectively. Project procedures and controls are presented in Section 7. References cited in this document are presented in Section 8. Appendix A contains a copy of the Statement of Work (SOW). Appendix B includes the Sampling and Analysis Plan (SAP) which is comprised of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP). Appendix C is the project Health and Safety Plan (HASP), and Appendix D is an example of a typical site-specific addendum to the project HASP. Appendices E and F present outlines for a site-specific work plan and a site-specific results report, respectively.

SECTION 2

WORK BREAKDOWN STRUCTURE

This section provides a brief description of the WBS that has been established for this project. The project number is 741436. The WBS for this project is as follows:

<u>WBS</u>	<u>DESCRIPTION</u>
08000	PDBS Project Management
11000	Bergstrom AFB
12000	Carswell AFB
13000	Kelly AFB
14000	Reese AFB
15000	England AFB
16000	Grissom AFB
17000	Gentile AFB
18000	Mather AFB
19000	Newark AFB
20000	Wurtsmith AFB

The following task/function codes have been established to track labor hours for separate activities that will be performed as part of this project (Table 2.1). WBS 08000 applies to activities that encompass the entire Delivery Order (DO), and incorporates Tasks 01000, 02000, 03000, 04000, 05000, 06000, 07000, 08000, 09000, 10000, 11000 and 12000 which are specific to the PDBS demonstration. WBS numbers 11000, 12000, 13000, 14000, 15000, 16000, 17000, 18000, 19000 and 20000 each incorporate Tasks 16000, 17000, 18000, and 22000. Finally, Task 21000 was established to track costs associated with statistical analyses that will be performed at select installations.

TABLE 2.1
TASK/FUNCTION CODES
DK01 PASSIVE DIFFUSION BAG SAMPLE DEMONSTRATION

TASK/FUNCTION	ACTIVITY
01000	DO Kick-Off Meeting
02000	Project Work Plan and Health and Safety Plan
03000	Monthly Progress Reports and Invoice Preparation, Communication
04000	Regional Kick-Off Meeting
05000	Quarterly and Final Progress Reports
06000	Integration and Planning Meetings
07000	Project Planning Charts (PPC)
08000	Program Management
09000	Draft Comprehensive PDBS Work Plan
10000	Final Comprehensive PDBS Work Plan
11000	Draft Comprehensive PDBS Report
12000	Final Comprehensive PDBS Report
16000	PDBS Kick-off Meeting
17000	Site-Specific Diffusion Sampler Evaluation Work Plan
18000	Diffusion Sampler Evaluation Mobilization/Field Work
21000	Statistical Alternate Algorithm Evaluation
22000	Site-Specific Diffusion Sampler Evaluation Report

SECTION 3

TECHNICAL AND MANAGEMENT APPROACH

This section describes Parsons' technical and management approach for this project. The following WBS as identified in Annex A to the SOW (Appendix A) has been established to fulfill the scope of work to be performed by Parsons under this delivery order.

- Project 741436, Project Planning and Management (WBS 08000)
- Project 741436, PDBS Evaluations (WBSs 11000 – 20000)

3.1 PROJECT PLANNING AND MANAGEMENT

3.1.1 Task 01000 – Delivery Order Kick-off Meeting

Within 14 calendar days after the issuance of this task order, the Parsons project manager and up to two technical staff members will participate in a Kick-off Meeting. For cost estimating purposes, it was assumed the meeting would be held at HQ AFBCA. The project goals, objectives, expectations, and schedule will be discussed for the entire project. The meeting also will be used as a forum to review the candidate bases for PDBS. The final selection of candidate bases will be made by the U.S. Air Force (USAF). Parsons will prepare the meeting agenda, presentation materials, and meeting minutes.

Within seven calendar days after the Kick-off Meeting, Parsons will prepare meeting minutes that will document all items discussed and list meeting participants. One (1) hard copy of the minutes will be submitted to meeting attendees, and one (1) electronic copy will be submitted to the USACE project manager (PM) and to AFCEE/ERT (Section 6).

3.1.2 Task 02000 – Delivery Order Work Plan

Within 30 calendar days after issuance of this task order, Parsons will submit a draft work plan that covers all work elements included in this SOW. The work plan will identify the Parsons technical resources, technical approach to complete the work, project HASP and SAP, and labor hour and cost estimates.

After client review (30 calendar days), Parsons will incorporate government comments and issue the final work plan within 15 days of receipt of comments on the draft work plan.

3.1.3 Task 03000 – Monthly Progress Report Preparation, Invoicing, and Communication

The Parsons Delivery Order Manager will schedule and coordinate the project activities with the USACE, AFCEE, AFBCA, and Parsons team members. A clerical and administrative effort is required to maintain project files and distribute information. The project will be billed monthly showing accumulated labor and other direct costs (ODCs) associated with the project.

This task includes project management labor costs and ODCs necessary over the course of the project. Delivery order management activities include project coordination and oversight, budget and schedule management, preparation of the monthly Contractor’s Progress, Status, and Management Report (CPSMR), including monthly Project Planning Charts (PPCs) created in Microsoft Project 98, status reports, a Performance and Cost Report (P&CR), and project accounting and billing.

Progress Report	Date of First Submittal	Date of Subsequent Submittals
CPSMR with P&CR	First report due by the 20 th day of month following the first complete monthly reporting period.	Monthly, 20 th day of the month for work completed the previous month.

The CPSMR will provide a concise summary of overall progress of the project, along with information regarding any potential problem areas. The CPSMR will include a summary of the events that occurred during the reporting period, discussion of performance, identification of problems, proposed solutions, corrective actions taken, and outstanding issues.

3.1.4 Task 04000 - Regional Kick-off Meetings

Once the candidate Bases have been confirmed, the Parsons PDBS task manager and up to one technical staff member will participate in up to three (3) regional kickoff meetings. The PDBS task goals, objectives, expectations, and schedule will be discussed for each of the Bases in the regional meetings. The meetings are assumed to be conducted at McClellan AFB, Brooks AFB, and Headquarters (HQ) AFBCA per Section 3.1.1 of the SOW. Parsons will prepare the meeting agenda, presentation materials, and meeting minutes.

3.1.5 Task 05000 - Quarterly Progress Meetings and Final Meeting

Per Section 3.1.2 of the SOW, Parsons will participate in two quarterly progress meetings held at AFBCA headquarters. Up to two Parsons team members (including the DO Manager) will attend these meetings. Parsons will prepare all materials and handouts for each briefing presented.

Per Section 3.1.5 of the SOW, Parsons will participate in a final meeting to present the results of the PDBS demonstration to the USAF. It was assumed that the meeting will be held at HQ AFBCA and that up to three Parsons team members will attend the meeting. Parsons will prepare all materials and handouts for the final briefing.

3.1.6 Task 06000 - Integration and Planning Meetings

Per Section 3.1.3 of the SOW, Parsons will conduct up to three (3) meetings at the Denver, Colorado office as PDBS tasks are executed. The purpose of these meetings is to review work plans and schedules associated with the PDBS tasks and identify any recommended variations from the site-specific work plans and technical reports. Parsons will prepare the meeting agenda, presentation materials, and meeting minutes for each briefing.

3.1.7 Task 07000 - Project Planning Charts (PPCs)

Parsons will submit monthly PPCs to the USACE PM Representative, AFCEE technical point of contact (POC), and AFBCA POC, in both hard copy and electronic formats using Microsoft Project 98. The PPCs will detail the project schedule, project tasks, percent complete, current status of all tasks, and current status of all resources using Gantt charts. The draft PPCs will be e-mailed monthly to the USACE PM Representative for review and comment. Once approved, the final PPCs will be e-mailed monthly to the POCs listed herein. In addition, color hard copies of the final PPCs will be distributed every other month to these individuals.

3.1.8 Task 08000 - Program Management

This task is designated for the labor and ODCs associated with managing this delivery order by the Parsons Fairfax office. Program Management activities include project coordination and oversight, quality assurance, budget and schedule management, review of the monthly CPSMR, and project accounting and billing.

3.1.9 Task 09000 - Draft Comprehensive PDBS Work Plan/HASP/SAP

Parsons will prepare a comprehensive work plan for the AFBCA installations to be included in the PDBS technology evaluation. The work plan will contain a project description and describe the work breakdown structure, technical approach, project organization, budget, schedule, and project procedures and controls. Per Annex A of the SOW, the currently scoped sites that are to be included are Bergstrom AFB (30 wells), Carswell AFB (30 wells), Kelly AFB (30 wells), Reese AFB (30 wells), England AFB (30 wells), Grissom AFB (30 wells), Gentile AFB (30 wells), Mather AFB (30 wells), Newark AFB (30 wells), and Wurtsmith AFB (30 wells). Please note that final selection of installations where PDBS evaluations will be conducted will be made by the USAF. Parsons will obtain and review existing monitoring data for the subject installations. A project-specific HASP and SAP will be prepared and included as an appendix to the program work plan. The SAP will consist of a QAPP and a FSP. The draft version of the work plan will be posted on the project website.

3.1.10 Task 10000 - Final Comprehensive PDBS Work Plan/HASP/SAP

Government comments on the draft PDBS Comprehensive Work Plan described above under Task 09000 will be reviewed, responded to, and incorporated into the final work plan. The final work plan will be posted on the project website and distributed in hard copy format.

3.1.11 Task 11000 - Draft Comprehensive PDBS Report

Parsons will prepare a comprehensive PDBS report. The draft comprehensive PDBS report will include a general description of the work performed and the common findings for all AFBCA installations sampled. Detailed site-specific reports will be included as appendices. The report will include an analysis of the effectiveness of the technology, a list of operational parameters that promote the usability of PDBS, and a list of operational parameters that indicate when poor performance is likely to occur. The report will recommend the cost-effective, routine metrics required to monitor the performance of PDBS and the existing monitoring systems. The report will present any recommendations for modifications to the existing monitoring programs that may enhance operational control, or terminate long-term monitoring. Issues common to various AFBCA sites will be cross-referenced. A cost and performance analysis will be included that includes implementation costs, cost comparison to traditional sampling, sampling cost avoidance generated by PDBS, and return on investment assessment. The draft version of the report will be posted on the project website.

3.1.12 Task 12000 - Final Comprehensive PDBS Report

Government comments on the draft Comprehensive PDBS Report described above under Task 11000 will be reviewed, responded to, and incorporated into the final report. The final report will be posted on the project website and distributed in hard copy format.

3.2 PDBS DEMONSTRATIONS

Parsons will conduct a PDBS demonstration at Bergstrom AFB, Carswell AFB, Kelly AFB, Reese AFB, England AFB, Grissom AFB, Gentile AFB, Mather AFB, Newark AFB and Wurtsmith AFB. Each of these demonstrations will include five tasks (task/function codes 16000, 17000, 18000, 21000, and 22000) as described in the following sections.

3.2.1 Task 16000 – PDBS Kickoff Meeting

Parsons will attend a kickoff meeting for each AFBCA installation that will cover the following items:

1. A generic PDBS presentation will be given that describes the technology and the project objectives and scope;
2. A site visit will be performed to see the work sites, take photographs, inspect well construction and identify special considerations;
3. Historical information/data will be gathered to the extent feasible; and

4. Dialogue with the Base and the Base monitoring contractor will be initiated to coordinate logistics and schedules, obtain necessary information, discuss comments/questions/concerns, and discuss the roles of all project participants.

To ensure efficiency and value for Task 16000, the following activities will occur (to the extent feasible) prior to each kickoff meeting:

- At least 4 weeks prior to the kickoff meeting, identify and contact the Base POC and AFCEE/ERT to:
 - a) Initiate discussion of project scope and objectives with Base POC; and
 - b) Request any necessary Base-specific items or accommodations (e.g., conference room, Base access clearance).

The Base POC will be sent a checklist of requested information to be acquired at the kickoff meeting (a sample checklist is presented in Table 3.1).

- At least 2 weeks prior to the kickoff meeting:
 - a) Obtain information regarding travel accommodations, directions, etc.;
 - b) Finalize kickoff meeting schedule with all participants;
 - c) Arrange travel plans (purchase airline tickets, reserve hotel/rental car, etc.);
 - d) Confirm with Base POC the availability of requested information; and
 - e) Initiate alternate information gathering strategies if necessary.
- At least 1 week prior to the kickoff meeting:
 - a) Confirm travel arrangements/reservations;
 - b) Review generic PDBS presentation; and
 - c) Distribute kickoff meeting agenda and draft hand-outs.

Meeting minutes will be prepared by Parsons ES within 1 week after the kickoff meeting, and will be distributed according to the schedule presented in Section 6.

TABLE 3.1
AFBCA PDBS WORK PLAN
INFORMATION GATHERING CHECKLIST
DK01 PASSIVE DIFFUSION BAG SAMPLER DEMONSTRATION

Avail.	Item
<i>Administrative/Logistical</i>	
	Base access (i.e., access letter to main gate, contractor passes, security clearance, contact information, well keys, gate keys, info regarding security escorts if necessary)
<i>"Big Picture"</i>	
	Identify and select appropriate site and/or wells for PDBS demonstration (should have close to the number of wells we are scoped to include, best if wells are used primarily for LTM rather than initial site characterization, best not to include wells used to monitor compounds not appropriate for PDBS, conventional sampling of selected wells should occur within our project schedule)
	Identify and select appropriate site for MNO evaluation (should be limited to a monitoring network used to monitor a specific plume, can be different site than PDBS, best to have data from at least 4 previous sampling events, best to have at least 30 wells per hydrogeologic interval/unit).
<i>Current monitoring program plan</i>	
	Current sampling work plan, SAP, FSP, Standard Operating Procedures (SOPs), QAPP, IDW management/disposal Plan, and HASP
	Sampling schedule (approximate dates, frequency, etc.)
	Well schedule (which wells are sampled and in what order)
	Analytical schedule (which analyses are performed on which wells and at what frequency)
	Name and Contact Information for Analytical Laboratory, Scope of work agreement/wording with contract lab, QAPP
	Cleanup goals and/or regulatory limits for selected wells
	Chemicals of Concern for selected wells
	Purpose of selected wells (e.g. regulatory requirement, POC, sentry), and whether or not latitude is available to recommend changes to well purpose or sampling schedule
	Contaminant distribution maps (contour maps)
	Groundwater contour maps
Electronic copies of: (hardcopy if electronic not available)	
	Recent and historic groundwater chemical data
	Recent and historic groundwater elevation data
	Site layout map (CAD or GIS)
	Well location map (CAD or GIS)
<i>Well construction and Hydrogeologic Data</i>	
	Well location (surveyed) and coordinate system
	Elevation of: ground surface, top of well casing, screened interval
	Total well depth
	Screened interval
	Well diameter
	Casing and screen material (e.g. polyvinylchloride [PVC], stainless steel)
	Filter pack material
	Indication of any dedicated equipment (e.g. bladder pumps)
	Geologic logs, Cross-Sections
	Hydraulic Conductivity Data

3.2.2 Task 17000 – Diffusion Sampler Demonstration Work Plan

A site-specific PDBS work plan will be prepared for each installation after the kickoff meeting and receipt of requested installation documentation. Each site-specific work plan will include a scaled map showing well locations and an accompanying table identifying the wells targeted for the PDBS demonstration. Prior Installation Restoration Program (IRP) investigation reports will be obtained to use in developing the design/layout of the PDBS monitoring programs and the site-specific work plan. Monitoring wells to be used for PDBS demonstration purposes will be selected and identified. No more than 30 monitoring wells will be evaluated at each of the Bases. The scope of the PDBS demonstration at each Base is not expected to encompass the entire monitoring well network at that Base.

One general objective of the PDBS demonstration is to perform sampling across a wide range of conditions at each installation. Although only those wells scheduled for regular sampling and analysis of VOCs will be considered for inclusion in the PDBS demonstration, other criteria will be used to select wells for inclusion in the PDBS demonstration including:

- Wells at active and/or proposed pump-and-treat sites (vertical profiling at these wells could be used to optimize the pump-and-treat system),
- Local hydrogeology,
- Historical in-well contaminant concentrations,
- Spatial distribution of wells, and
- Well construction details including the presence/absence of a dedicated pump (dedicated pumps would preclude installation of the PDBSs).

Site-specific addenda to the umbrella HASP and QAPP will be prepared as necessary. The installation's HASP and QAPP will be adopted as appropriate. The draft version of this work plan will comply with requirements specified in CDRL A013. Government comments on the draft site-specific PDBS work plans will be reviewed, responded to, and incorporated into the final site-specific PDBS work plans. Both the draft and final versions of the site-specific work plan will be distributed according to the schedule presented in Section 6. An outline for the site-specific PDBS work plans is included in Appendix E.

3.2.3 Task 18000 – Diffusion Sampler Demonstration Mobilization/Field Work

3.2.3.1 Overview

The field work outlined in the site-specific work plan will be performed per the project schedule presented in Section 5. However, the schedule will be modified as necessary to accommodate regularly scheduled groundwater sampling events at each Base. One round of groundwater diffusion samples will be collected. The scope of the demonstration will require two mobilizations to the site: one to place the diffusion samplers inside the selected wells, and a second to retrieve the samplers from the wells and to collect the groundwater samples for analysis. Each PDBS sampling event will be performed immediately prior to a

regularly scheduled conventional sampling event to facilitate comparison of analytical results obtained from both methods. A minimum sampler equilibration period will be determined Based on site-specific hydrogeologic data, but will not be less than 14 days. Sampler placement will occur in a timely manner allowing the equilibration period to be met prior to sampler retrieval and the regularly scheduled conventional sampling event.

Diffusion sampling procedures will generally follow those outlined by the US Geological Survey (USGS) (Vroblesky, 2001) and are presented in detail in the project SAP (Appendix B). The standard PDBS used for this project will be constructed of 40-mil polyethylene tubing. The sampler dimensions are 18 inches long and 2 inches in diameter; the sampler membrane volume is approximately 350 milliliters (mL). Dimensions of the diffusion samplers may be modified to allow their placement in smaller diameter wells and to allow larger volume samplers for the collection of quality control (QC) samples. The samplers will be placed in “flex-guard” low-density polyethylene mesh tubing for abrasion resistance and attached to a weighted polyester rope (90-pound test, 3/16-inch braided) with cable ties. The samplers will be purchased from Eon Products (800-474-2490) unless an acceptable alternative supplier is identified which can provide comparable samplers at the same or lower pricing. Samplers will be shipped to the field pre-filled with distilled/deionized water.

Dissolved contaminant concentrations may vary with depth in the aquifer, particularly at locations where the density of the primary contaminant is significantly different than that of water (light non-aqueous phase liquid [LNAPL] or dense non-aqueous phase liquid [DNAPL]) or at locations where significant vertical hydrogeologic heterogeneities or hydraulic gradients exist. Even at locations where the vertical extent of groundwater contamination is large, it is possible for the contaminant concentrations to be unequally distributed vertically. For these reasons, whether collecting groundwater samples for site characterization, monitoring extraction system performance, or for regulatory compliance, it is advantageous to identify vertical contaminant stratification within a well prior to sample collection. Knowledge of vertical contaminant stratification allows for the collection of groundwater from the depth interval that has the highest concentration of contaminants.

Some conventional well purging methods including bailing and high-flow pumping typically draw groundwater from the entire screened interval of a well. Groundwater samples collected from a well after this type of purge will generally represent average contaminant concentrations across an interval (e.g., the entire screened interval). As such, these sampling methods can underestimate the actual maximum concentration of contaminant at a well by diluting the contaminant concentration present at a discrete depth interval with less contaminated water from other depths.

Alternate well sampling methods, including micropurging and diffusion sampling, collect groundwater from a discrete depth interval. If the sampling device is placed at the appropriate depth, these methods provide a more precise representation of the maximum contaminant concentrations at a specific well. For micropurging however, frequently no explicit determination of the ideal sample depth interval is made prior to sampler placement. Instead, standard conventions are sometimes followed which typically recommend placing the sampling device at either the center or near the top of the well screen depending on the type of contaminant being monitored, or in a relatively permeable horizon. Since these conventions may not actually result in the sample being collected

from the ideal depth, this approach can lead to misinterpretation of the magnitude of contaminant concentrations at a particular well.

To adequately evaluate contaminant stratification in a monitoring well, a vertical profile of contamination across the entire saturated screened interval of the monitoring well must be considered. In order to achieve this vertical profile for the PDBS demonstration, an estimated average of three PDBSs will be positioned in each well. The samplers will be distributed at a frequency of one sampler per three feet of saturated screen. Samples will be collected from each of the samplers upon retrieval for submittal to a fixed base analytical laboratory. The laboratory selected will be the same laboratory used to analyze the conventional samples.

3.2.3.2 Pre-Mobilization Preparation

Prior to field mobilization, the following tasks will be completed:

- Finalize site-specific work plan, which will identify the wells selected for the PDBS demonstration.
- Coordinate sampling schedule with Base contractor and Base POC. Schedule the field effort so that PDBS retrieval will occur within 24 hours of the conventional sampling performed by Base contractor to the extent feasible, and will allow for the required equilibration period for the PDBSs (at least 14 days).
- Identify and contact laboratory. In order to maintain consistency, the same laboratory used by the Base contractor for regular groundwater sample analysis will be used for this demonstration.
- Order sample containers and PDBSs.
- Develop modified sampling procedures for any non-standard wells.
- Complete PDBS Placement Forms (PPFs) (Figure 3.1) for all wells to be evaluated.
- Assemble supplies and check for proper operation.
- Make travel and lodging arrangements (including Base access).

3.2.3.3 PDBS Deployment, Recovery, and Sampling

SOPs for the PDBS deployment and recovery are included in the Project SAP (Appendix B).

**FIGURE 3.1
PDBS PLACEMENT FORM
DK01 PASSIVE DIFFUSION BAG SAMPLER DEMONSTRATION**

PRE-MOBILIZATION DATA

Installation:	Carswell AFB
Installation abbreviation:	CSWL
Project Number:	741436
WBS:	12000
Well ID (exclude dashes and slashes):	N7MW5
Well diameter (in):	4
Well scheduled for QC sample collection (dup, MS, MSD)?	<input checked="" type="checkbox"/> YES
Elevation of TOC (ft amsl):	2280.52
Elevation of ground surface (ft amsl):	
Historical maximum groundwater depth (ft btoc):	
Historical minimum groundwater depth (ft btoc):	
Top of screen depth (ft btoc):	6.00
Bottom of screen depth (ft btoc):	36.00
Analytical method:	8260B

FIELD MEASUREMENTS/PDBS PLACEMENT DATA

Depth to water (ft btoc):	4.70
Total well depth (ft btoc):	36.00
Length of saturated screen (ft):	30.00
Calculated saturated screened interval (ft btoc):	6.00 - 36.00
Number of PDB samplers to deploy:	10
Place bottom of sampler at the following depths (ft from bottom of weight)	
(deeper)	
Sampler #1	0.75
Sampler #2	3.75
Sampler #3	6.75
Sampler #4	9.75
Sampler #5	12.75
Sampler #6	15.75
Sampler #7	18.75
Sampler #8	21.75
Sampler #9	24.75
Sampler #10	27.75
Sampler #11	NA
Sampler #12	NA
Sampler #13	NA
Sampler #14	NA
Sampler #15	NA
PDBS deployment date:	
PDBS deployment time:	

PDBS RETRIEVAL DATA

PDBS retrieval date:	10/2/01
PDBS retrieval time:	
Sampler(s) initials:	DMM

Sampler #1 ID	CSWL\N7MW5\34.5\01	Matrix Spike #1 ID	CSWL\N7MW5\34.5\MS
Sampler #2 ID	CSWL\N7MW5\31.5\01	Matrix Spike #2 ID	CSWL\N7MW5\31.5\MS
Sampler #3 ID	CSWL\N7MW5\28.5\01	Matrix Spike #3 ID	CSWL\N7MW5\28.5\MS
Sampler #4 ID	CSWL\N7MW5\25.5\01	Matrix Spike #4 ID	CSWL\N7MW5\25.5\MS
Sampler #5 ID	CSWL\N7MW5\22.5\01	Matrix Spike #5 ID	CSWL\N7MW5\22.5\MS
Sampler #6 ID	CSWL\N7MW5\19.5\01	Matrix Spike #6 ID	CSWL\N7MW5\19.5\MS
Sampler #7 ID	CSWL\N7MW5\16.5\01	Matrix Spike #7 ID	CSWL\N7MW5\16.5\MS
Sampler #8 ID	CSWL\N7MW5\13.5\01	Matrix Spike #8 ID	CSWL\N7MW5\13.5\MS
Sampler #9 ID	CSWL\N7MW5\10.5\01	Matrix Spike #9 ID	CSWL\N7MW5\10.5\MS
Sampler #10 ID	CSWL\N7MW5\7.5\01	Matrix Spike #10 ID	CSWL\N7MW5\7.5\MS
Sampler #11 ID	NA	Matrix Spike #11 ID	NA
Sampler #12 ID	NA	Matrix Spike #12 ID	NA
Sampler #13 ID	NA	Matrix Spike #13 ID	NA
Sampler #14 ID	NA	Matrix Spike #14 ID	NA
Sampler #15 ID	NA	Matrix Spike #15 ID	NA
Duplicate #1 ID	CSWL\N7MW5\34.5\10	MS Duplicate #1 ID	CSWL\N7MW5\34.5\MD
Duplicate #2 ID	CSWL\N7MW5\31.5\10	MS Duplicate #2 ID	CSWL\N7MW5\31.5\MD
Duplicate #3 ID	CSWL\N7MW5\28.5\10	MS Duplicate #3 ID	CSWL\N7MW5\28.5\MD
Duplicate #4 ID	CSWL\N7MW5\25.5\10	MS Duplicate #4 ID	CSWL\N7MW5\25.5\MD
Duplicate #5 ID	CSWL\N7MW5\22.5\10	MS Duplicate #5 ID	CSWL\N7MW5\22.5\MD
Duplicate #6 ID	CSWL\N7MW5\19.5\10	MS Duplicate #6 ID	CSWL\N7MW5\19.5\MD
Duplicate #7 ID	CSWL\N7MW5\16.5\10	MS Duplicate #7 ID	CSWL\N7MW5\16.5\MD
Duplicate #8 ID	CSWL\N7MW5\13.5\10	MS Duplicate #8 ID	CSWL\N7MW5\13.5\MD
Duplicate #9 ID	CSWL\N7MW5\10.5\10	MS Duplicate #9 ID	CSWL\N7MW5\10.5\MD
Duplicate #10 ID	CSWL\N7MW5\7.5\10	MS Duplicate #10 ID	CSWL\N7MW5\7.5\MD
Duplicate #11 ID	NA	MS Duplicate #11 ID	NA
Duplicate #12 ID	NA	MS Duplicate #12 ID	NA
Duplicate #13 ID	NA	MS Duplicate #13 ID	NA
Duplicate #14 ID	NA	MS Duplicate #14 ID	NA
Duplicate #15 ID	NA	MS Duplicate #15 ID	NA

3.2.3.4 Waste Management Plan

Per the contract, all investigation-derived waste (IDW) will be managed and disposed of by the installation. IDW is expected to include at a minimum: excess groundwater and decontamination fluids, personal protective equipment (PPE) and sampling equipment, and discarded sample containers. Specific procedures regarding IDW management and disposal will be identified during the kickoff meeting for each site, and will be described in the site-specific work plans.

3.2.4 Task 21000 – Monitoring Well Network Optimization

All or a portion of the groundwater monitoring network at selected installations 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-related information. Locations and completion intervals of individual monitoring wells and sampling points will be examined, and the contribution of each well or sampling point to the network 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.

No more than 30 monitoring wells at each installation will be evaluated using this algorithm. Sites with 30 wells or less are recommended for this study to maximize benefits. A single evaluation of the monitoring network will be completed as part of this task. The results of the evaluation will be included in the Site-Specific Diffusion Sampler Demonstration Report (Task 22000).

3.2.5 Task 22000 – Site-Specific Diffusion Sampler Demonstration Report

Analytical results will be compared to current practice in a scientifically defensible manner using statistical analyses, and results will be presented in easy-to-read tables. Statistical methods will include calculation of relative percent differences (RPDs) between PDBS and conventional sampling results. The report will provide a table identifying the location and depth for each PDBS. The draft version of this report will be distributed according to the schedule shown in Section 6. Each site-specific report also will be included as an appendix to the Comprehensive PDBS Report for AFBCA sites (WBS 08000, Tasks 11000 and 12000).

If the maximum analytical result obtained for a well using the PDBS is greater than or equal to the conventional sampling result for that well, it will indicate that the PDBS method is appropriate for use in that well (Vrobleski, 2001). However, comparison of the two sets of results will be performed in all instances. Specifically, analytical results for all 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

A RPD value of 30 will be used as the criterion for this PDBS demonstration. This value was also used as the comparison criterion for the basewide PDBS demonstration performed at McClellan AFB (McClellan AFB, 2000). The PDBS acceptance criteria will be as follows:

- If at least one PDBS result for a given well is equal to or greater than the conventional sampling result, PDBS will be deemed appropriate for use in that well.
- If either the PDBS or the conventional sample result is greater than three times the laboratory reporting limit (RL), and the PDBS result is less than the conventional result, an RPD of 30 will be used as the acceptance.
- If both the PDBS and conventional sample results are less than three times the laboratory RL, a value of \pm the minimum RL will be used as the range of acceptance between the two values.

3.3 TECHNICAL APPROACH ASSUMPTIONS

When developing the technical approach for this project, several assumptions were made, including:

1. Site- or Base-specific presentations will not be given at the kick-off meetings; rather, a generic PDBS presentation will be prepared that is given at each kick-off meeting.
2. For costing purposes, Parsons priced airfare and lodging Based on the primary installation listed for a WBS (not the alternate site).
3. The Parsons PM (or his designee) and one additional staff member (e.g., the site manager) will attend the on-site kick-off meeting. The kick-off meeting will last no more than 4 hours, and an additional day will be spent at the Base by the additional staff member to gather data/report information.
4. Parsons assumed 30 wells per PDBS evaluation.
5. Parsons will complete a Level 3 data validation of the laboratory analytical results for 10 percent of the primary PDBS samples submitted to a fixed-Base laboratory from each Base. 10 percent of the conventional sampling data also will be validated by Parsons.
6. It was assumed that it takes 2 days to install and 2 days to retrieve the PDBS samplers.

7. Fixed-Base laboratory sample numbers assume 25 percent additional QA/QC samples will be collected (field duplicates, matrix spikes, matrix spike duplicates and blanks).
8. One round of sampling will be performed in two mobilizations. During the first mobilization, 1 sampler per 3 feet of saturated well screen will be installed to obtain vertical profiling data. For costing purposes, installation of 3 samplers per well is assumed. During the second mobilization, the vertical profiling samplers will be retrieved.
9. Groundwater samples collected using PDBS technology will only be analyzed for VOCs.
10. Laboratory audits will not be performed on the analytical laboratories used for this project, including those currently servicing AFBCA installations.
11. No permits will be required to conduct the PDBS demonstrations at the Bases.
12. Parsons will not provide an Environmental Restoration Program Information Management System (ERPIMS) deliverable for PDBS data. The PDBS data will be redundant with the VOC groundwater sample data collected using conventional methods. Summary tables of data to be included in the PDBS results reports will not be in ERPIMS format.
13. All IDW will be managed and disposed of by the installation. Two-person field crews will be used.
14. Parsons will not be required to remove dedicated pumps from sampled monitoring wells.

SECTION 4

PROJECT ORGANIZATION

DK01 will be managed from the Parsons Denver office. The DO team organization is described below.

Program Management activities will be accomplished by Edward Bishop, Ph.D., P.E., CIH, in the Parsons Fairfax, Virginia office. Mr. Bishop will be responsible for contract administration, and will serve as primary client interface on programmatic issues.

The DO/Project Manager will be Peter Guest, P.E., in the Parsons Denver office. Mr. Guest will coordinate all activities to meet the requirements of the DO SOW and ensure technical review of all deliverables. These activities will include meetings, document reviews, monthly reporting, and project management activities. He will be responsible for coordinating with the USACE Contracting Officer's Representative (COR), Mark Mercier, and the AFBCA and AFCEE POCs identified in the SOW.

Mr. Doug Downey, P.E. and Mr. John Anthony will serve as the technical directors for DK01. Mr. Downey and Mr. Anthony are with the Parsons Denver office and will provide technical guidance and oversight to meet the project's technical directives with respect to PDBS and statistics, respectively.

Mr. John Hicks and Mr. John Tunks will serve as the PDBS task manager and deputy task manager, respectively, for DK01. Both Mr. Hicks and Mr. Tunks are with the Parsons Denver office and will provide project management and technical coordination for the PDBS tasks.

Addresses and telephone numbers of the DO management team are as follows:

Name	Title	Address	Phone / E-mail	Fax
Mark Mercier	USACE PM	USACE, Omaha Dist. CENWO-PM-HC 106 So. 15 th St. Omaha, NE 68102	402 / 221-7664 email: mark.a.mercier@usace.army.mil	402 / 221-7796
Rafael Vazquez	AFCEE POC	AFCEE/ERT 3207 North Road Brooks AFB, TX 78235-5363	210 / 536-1431 email: rafael.vazquez@brooks.af.mil	210 / 536-4330
David Becker	USACE POC	USACE CENWO-HX G 12565 West Center Rd. Omaha, NE 68144	402 / 697-2655	402 / 697-2595
Mario Ierardi	AFBCA POC	HQ AFBCA 1700 Moore St Roslyn, VA 22202	703 / 663-5518 email: mierardi@afbda1.hq.af.mil	703 / 663-8828
Ed Bishop	Parsons Program Manager	10521 Rosehaven Street; Two Flint Hill Fairfax, VA 22030	703 / 591-7575 email: edward.bishop@parsons.com	703 / 591-1305
Peter Guest	Parsons Project Manager / RPO Task Manager	1700 Broadway, Suite 900 Denver, Colorado 80290	303 / 831-8100 email: peter.guest@parsons.com	303 / 831-8208
Doug Downey	Parsons Technical Director	1700 Broadway, Suite 900 Denver, Colorado 80290	303 / 831-8100 email: doug.downey@parsons.com	303 / 831-8208
John Anthony	Parsons Technical Director for Statistics	1700 Broadway, Suite 900 Denver, Colorado 80290	303 / 831-8100 email: john.anthony@parsons.com	303 / 831-8208
John Hicks	Parsons PDBS Task Manager	1700 Broadway, Suite 900 Denver, Colorado 80290	303 / 831-8100 email: john.hicks@parsons.com	303 / 831-8208
John Tunks	Parsons PDBS Deputy Task Manager	1700 Broadway, Suite 900 Denver, Colorado 80290	303 / 831-8100 email: john.tunks@parsons.com	303 / 831-8208
Jon Horin	Mitretek Systems, Project Manager	3150 Fairview Park Dr. South Falls Church, VA 22042-4510	703 / 610-2059 email: horin@mitretek.org	703 / 610-2059
Marc Gill	Mitretek Systems	17526 George Rd., Suite 200 San Antonio, TX 78230	703 / 610-2059 email: mgill@mitretek.org	210 / 408-4544

SECTION 5
SCHEDULE

The schedule for comprehensive work plans and reports is provided below. The schedule for PDBS demonstration at each installation is not known at this time, but is being developed by AFCEE/ERT.

Deliverable	Due Date
Draft Comprehensive PDBS Work Plan	2/21/02
Final Comprehensive PDBS Work Plan	4/17/02
Draft Comprehensive PDBS Report	3/7/03
Final Comprehensive PDBS Report	5/19/03

SECTION 6

PROJECT DELIVERABLES

All hard copy deliverables will be submitted on recycled content paper unless otherwise specified by the Air Force. The project deliverables will be prepared and submitted as presented in Table 6.1. A number designation in Table 6.1 denotes the number of copies that will be transmitted on recycled content paper. The designation “E” denotes that a deliverable will be transmitted via e-mail (preferred) or on a compact disk. The designation “W” indicates that a deliverable will be posted on an approved project website (see Section 7.3). All deliverables posted to the project website will be in “read only” format.

**TABLE 6.1
PROJECT DELIVERABLE SUMMARY
DK01 PASSIVE DIFFUSION BAG SAMPLER DEMONSTRATION**

PDBS Deliverables:

ITEM	Distribution					
	NUMBER OF PAGES	BASE POC	AFCEE/ERT	MEETING ATTENDEES	USACE POC	USACE PM
Meeting Minutes	5	0	E	1	0	E
Draft Comprehensive Work Plan	100	0	W	0	W	0
Final Comprehensive Work Plan	100	0	1/E/W	0	2	1/E/W
Draft Site-Specific Work Plan	25	0	W	0	W	0
Final Site-Specific Work Plans	25	0	1	0	2	1
Draft Technical Site-Specific Report. (also included as an appendix in the Technical Comprehensive Report)	NA	W	W	0	0	0
Draft Comprehensive Technical Report	200	W	W	0	W	W
Final Comprehensive Technical Report	200	5/E/W	3/E/W	0	3	E/W

A number designation in Table 6.1 denotes the number of copies that will be transmitted on recycled content paper.
The designation "E" denotes that a deliverable will be transmitted electronically via e-mail.
The designation "W" indicates that a deliverable will be posted on an approved project website.

SECTION 7

PROJECT PROCEDURES AND CONTROLS

This section describes the standard procedures that will be used to efficiently complete the assigned work and the project controls which will be implemented to track costs and organize project documents. This section has three subsections: project communications, field data collection and sample identification, and project website.

7.1 PROJECT COMMUNICATIONS

All written communication with AFCEE, USACE, or AFBCA installation officials will be signed by the project manager unless the task/site managers or other project personnel are specifically authorized to do so. Any person having verbal communication that will impact cost or schedule will prepare a record of telephone conversations and provide a copy to the project manager. The project manager will inform the program manager, who will write a letter to the USACE Contracting Officer providing notification of the cost or schedule impact. Site managers will provide the primary line of communication with Base personnel while arranging site demonstration support and throughout each demonstration. If the conversations involve decisions that will impact budget or completion dates, they will be recorded in writing and provided to the project manager as soon as practicable. Copies of phone conversations will be kept in appropriate program- or installation-specific files. If parties to the conversations request copies, they will be provided. All correspondence with AFCEE and USACE should be addressed to Mr. Rafael Vazquez and Mr. Mark Mercier, respectively (the primary technical POCs). Key project personnel are listed in Section 4.

Parsons does not plan to communicate with regulatory agencies under this delivery order. The document originator will log all correspondence and transmittals with the proper file designation, (in the upper right hand corner) per the filing system.

All deliverables associated with this DO will be reviewed by the Parsons Project Manager or their designee. The number of reports required for each deliverable is shown in Table 6.1.

7.2 FIELD DATA COLLECTION AND SAMPLE IDENTIFICATION

7.2.1 Field Personnel and Documentation Requirements

The field team will consist of the site manager or his/her designee and a field engineer/scientist/technician. These people will be responsible for collecting all required field data in an organized, legible fashion. Data will be recorded in bound field log

books, computer spreadsheets, and/or hardcopy field data forms. Documentation activities are described more fully in the project SAP (Appendix B).

7.2.2 Sample Identification System

Including primary samples and Quality Assurance (QA)/QC samples (duplicate, matrix spike, matrix spike duplicate, field blank, and trip blank samples), a total of six different types of samples will be collected as part of this investigation for laboratory analysis. Each laboratory sample will be assigned a unique sample identification number that describes where the sample was collected and provides decoding information to identify QA/QC samples. The sample numbering system that will be used is unique to the site and location sampled. Each number will consist of 4 identifying pieces of information separated by slashes.

[Code for BASE]\[Code for LOCATION]\[Code for DEPTH]\[Code for TYPE]

The codes to be used in all sample identification numbers are summarized in Table 7.1.

**TABLE 7.1
SAMPLE IDENTIFICATION NUMBERING SYSTEM
DK01 PASSIVE DIFFUSION BAG SAMPLER DEMONSTRATION**

BASE	LOCATION	DEPTH	TYPE
Bergstrom = BGRM	Well identification number	Depth (ft) below top of well casing (TOC) of PDBS midpoint.	Primary = 01
Carswell = CSWL			Duplicate = 10
Kelly = KELY			Field Blank = 02
Reese = RESE			Trip Blank = 03
England = ENGD			Matrix Spike = MS
Grissom = GRSM			Matrix Spike Duplicate = MD
Gentile = GNTL			
Mather = MTHR			
Newark = NWRK			
Wurtsmith = WURT			

Example Sample Number:

CSWL\MW235\12.4\01 Primary sample (01) from the PDBS whose middle depth was 12.4 feet (12.4) below the top of well casing (TOC) at monitoring well MW-235 (MW235), Carswell AFB (CSWL).

7.2.3 Holding Times

After samples have been collected, they will be delivered to the laboratory for analysis as soon as possible after collection in order to ensure that the most reliable and accurate results will be obtained. The holding time begins from the time of collection in the field. The laboratory holding time for VOC groundwater analysis is 14 days, if the sample is properly preserved.

7.2.4 Shipping Requirements

Shipping containers will be secured using packaging tape and signed custody seals to document that the samples have not been disturbed during transport. The custody seals will be placed on the containers so they cannot be opened without breaking the seal. Copies of the signed Chain-of-Custody forms will be delivered to Parsons with the laboratory data packages. The originals will remain on file with the laboratory.

7.3 PROJECT WEBSITE

A project website for DK01 will be implemented. This site will be published by Parsons to facilitate the review and comment process of draft reports and for the posting of final reports identified in Table 6.1 with a “W”. To access the site, type the following address into your web browser:

<http://project1.parsons.com/AFBCA RPO>

This will open up the login page. A password must be entered at the login page in order to access the website home page. The password to enter the site is: **GeyserDK01**. Please note that the password is case sensitive and should be entered exactly as shown here.

On the home page of the website are active links to each type of deliverable posted. Clicking on any of the active links will take the user to the associated deliverable page. On each deliverable page are active and inactive links to each site-specific document. The complete list of each type of document will be present as inactive links on each deliverable page. As each document is completed it will be posted to the web page and the associated link will become active.

Each document will be posted as one or more Adobe Acrobat Portable Document Format (PDF) files. When an active link to a document is clicked the user will be prompted to choose whether to view the document on the web site or download it and view it on a local computer. In order to view a PDF file, the user must have a copy of Adobe Acrobat Reader installed on their computer. If the user does not have a copy of the Adobe Acrobat Reader, they can follow a link that is provided at the website home page which will direct them to a location where they can download this software at no charge.

For comment documentation purposes, download the comment template beneath the active link on the home page. The recipient list on the home page beneath the active link provides installation-specific recipient lists. When the review process is complete, each reviewer will E-mail their completed comment template to the installation-specific recipient list associated with the associated document just reviewed. The comment template must be complete to facilitate the comment-response process.

The DK01 project website is managed and maintained by Parsons. Please forward any comments or suggestions to the Parsons Project Manager, Peter Guest.

SECTION 8

REFERENCES

- McClellan AFB, 2000. Final Passive Diffusion Membrane Samplers Technology Application Analysis Report. National Environmental Technology Test Sites (NETTS). August.
- Vroblesky, Don 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 – STATEMENT OF WORK

STATEMENT OF WORK

For

**REMEDIAL PROCESS OPTIMIZATION SUPPORT AND
DEMONSTRATION OF PASSIVE DIFFUSION BAG SAMPLING
TECHNOLOGY AT SEVERAL
DEPARTMENT OF DEFENSE INSTALLATIONS**

Revised

26 February, 2002

Contract No. F44650-99-D0005

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STATEMENT OF WORK

for

REMEDIAL PROCESS OPTIMIZATION SUPPORT AND DEMONSTRATION OF PASSIVE DIFFUSION BAG SAMPLING TECHNOLOGY AT SEVERAL DEPARTMENT OF DEFENSE INSTALLATIONS

1. INTRODUCTION

The purpose of this statement of work (SOW) is to provide services, technical man-hours, and materials, under a time and materials type delivery order, to support Remedial Process Optimization (RPO) evaluations, demonstrate the effectiveness of Passive Diffusion Bag Samplers (PDBS), and perform natural attenuation related studies at selected Department of Defense locations worldwide. Services shall include developing a Work Plan with supporting documents, and a project schedule; preparing project management reports; installing and operating the PDBS(s), collecting and analyzing environmental samples; demobilizing at the end of the demonstration; preparing technical reports; and attending meetings, as requested. An RPO Phase II Evaluation is an intensive evaluation to explore system optimization, new technology, regulatory opportunities, or monitoring optimization at a particular restoration site/system. Benefits of RPO include better tracking of remediation progress, reevaluation of cleanup goals, reduced O&M costs, ensuring protectiveness, and accelerated site closure. Benefits of PDBS include significant reduction of investigation generated waste, reduction in sampling man-hour requirement, and capability to vertically profile the well being sampled.

1.1 SCOPE

1.1.1 Title I Services.

1.1.1.1 In carrying out any work assignment issued, the Contractor shall furnish the necessary personnel, services, equipment, materials, and facilities and otherwise do everything necessary for or incidental to the performance of work set forth herein.

1.1.1.2 Primary services include three major groups

1.1.1.2.1 RPO Phase I and Phase II assessments as discussed in 1.1.1.3 - 1.1.1.6

1.1.1.2.2 PDBS implementation as described in 1.1.1.7

1.1.1.3 Primary services under this task order include the performance of an RPO Phase I Evaluation at various DOD installations (see annex A).

1.1.1.3.1 The anticipated RPO Scoping Visit (RSV) Phase I Evaluation locations under this task order listed in Annex A

1.1.1.4 For each RSV Phase I, the Contractor shall provide one team member and accomplish the following tasks:

- Review the pre-visit information package/become familiar with the sites' location, conceptual site model, risk issues, and status.
- Attend the RSV Scoping Visit
- Interview project managers on the approach and system operation of each site
- Make specific RPO recommendations based on the 8 RPO strategy components
- Identify sites/areas which could benefit from detailed RPO Phase II Evaluations
- Contribute to the draft RPO Scoping Visit Report
- Contribute to the RPO Scoping Visit Out-brief
- Make additional comments on the draft RPO Scoping Visit Report after the RSV

1.1.1.5 The anticipated RPO Phase II Evaluation locations under this task order are listed in Annex A:

1.1.1.6 RPO Phase II Evaluation activities include inspection of extraction and treatment systems, collection of environmental samples, and completion of field tests to identify and evaluate optimization opportunities. The Contractor shall accomplish the following general tasks for each Phase II Evaluation:

- Review key regulatory decision documents and historical monitoring and system performance data and complete a site visit to become familiar with site complexities and remediation system operations. Prepare a Phase II work plan outlining site-specific evaluation activities;
- Review the ultimate remediation goals for the site to ensure they are appropriate and reflect current regulatory options;
- Complete a design review and update of the conceptual site model. Review current performance criteria. If no performance criteria exist, develop performance criteria that are clearly defined and measurable;
- Evaluate remedial system effectiveness to determine if ultimate cleanup goals can be achieved with the existing remedy (or are new technologies required);
- Evaluate site and system monitoring and analytical protocols to determine if they are appropriate for the in-place remedy and remediation time frame;
- Evaluate system efficiencies and identify both short-term and long-term optimization opportunities;
- If needed, identify new regulatory approaches and/or new technical approaches to achieve the ultimate remediation goals for the site and perform a cost-benefit analysis for recommended changes
- Prepare a Phase II final report which summarizes system protectiveness and effectiveness evaluations and recommends new regulatory and technical approaches, including short- and long-term optimization opportunities.

1.1.1.7 Primary services shall also include those items necessary to demonstrate and evaluate PDBS technology, “beta test” the Draft Final Interagency *Guidance Document For Use Of Polyethylene-Based Passive Diffusion Bag Samplers To Obtain Volatile Organic Compound Concentrations In Wells (PDBS Guidance)*, and provide feedback to the PDBS workgroup to update the Interagency PDBS Guidance Document for Installation Restoration Program (IRP) managers. It is expected that this document will be used when designing new monitoring programs, and revising existing Remedial Action Operation (RA-O) monitoring and long-term monitoring (LTM) programs. The work shall include the following:

- 1.1.1.7.1 The contractor shall initially prepare a work plan (WP) applicable at any DoD facility.
- 1.1.1.7.2 The work plan will consider implementation of PDBS technology demonstration at the sites listed in Annex A. Implementation shall be conducted for thirty (30) VOC wells at each site.
- 1.1.1.7.3 PDBS analytical results will be compared to current practice in a scientifically defensible manner using statistical analysis, and presenting the comparison in easy to read tables as specified in the PDBS Users Guide (2001).
- 1.1.1.7.4 The Contractor shall obtain and review existing monitoring data from the installations listed in Annex A.
- 1.1.1.7.5 The Contractor shall identify any data gaps in the existing site information and brief the COR on the need for, and an estimated cost to obtain, the missing data.
- 1.1.1.7.6 At every PDBS site except DDJC-Sharpe, the Contractor shall apply an appropriate algorithm (such as MAROS) to determine the site wells that provide relevant and sufficient information. Wells that are redundant will be recommended for decommissioning.
- 1.1.1.7.7 The Contractor shall prepare one comprehensive report.
- 1.1.1.7.8 The PDBS report shall include an analysis of the effectiveness of the technology, a list of operational parameters that promote the usability of PDBS, and a list of operational parameters that indicate when poor performance is likely to occur. The report shall recommend the cost effective, routine metrics required to monitor the performance of PDBS and the existing monitoring systems. The report shall also present any recommendations for modifications to

the existing monitoring program(s) that may enhance operational control, or terminate long-term monitoring. Issues common to BRAC & ERA will be identified.

- 1.1.1.7.9 The Contractor shall include a cost and performance analysis in the technical reports. These report shall include implementation costs, cost comparison to traditional sampling, sampling cost avoidance generated by PDBS, and return on investment assessment.

1.1.2 Title II Services.

- Not Applicable

1.1.3 Other Environmental A-E Services.

- 1.1.3.1 Secondary services incidental to the primary services include collecting and analyzing groundwater samples for volatile organic contaminants of concern and potential intermediate degradation products. Any interfering component will be identified.
- 1.1.3.2 Whenever possible, the Contractor shall use the analytical laboratory sub-contracted by the installations' prime contractor to maintain data comparability. Quality assurance samples such as blind samples will be used to determine the laboratory's precision. This information is essential to assess the contribution of analytical variance to the analytical result due to sampling method (PDBS vs. traditional).

1.2 DOCUMENTS

The Contractor shall comply with the most current version of the associated installations' regulator-approved planning-documents and guidance and will be followed to assure data comparability. In all cases, existing installation documents will be used to their fullest extent to minimize duplication of effort in developing plans called for in this SOW.

1.3 COMPLIANCE DOCUMENTS

The Contractor shall comply with all federal, state, and local regulatory agency requirements and applicable statutes, policies, and regulations.

1.4 GUIDANCE DOCUMENTS

All work for this SOW shall conform to the maximum extent practicable to the applicable requirements of the following guidance documents:

- 1.4.1 Guidance for Conducting RI/FSs Under CERCLA (Office of Solid Waste and Emergency Response [OSWER] Directive 9335.3-01)
- 1.4.2 Test Methods for Evaluating Solid Waste (SW-846), Third Edition (1986) and Updates (U.S. Environmental Protection Agency [EPA], OSWER)
- 1.4.3 Guidance on Remedial Action for Contaminated Groundwater at Superfund Sites (OSWER Directive 9283.1-2), 1988
- 1.4.4 A Compendium of Superfund Field Operation Methods (EPA/540/P-87/001, OSWER Directive 9335.0-14), December 1987
- 1.4.5 Draft Final, Guidance Document For Use Of Polyethylene-Based Passive Diffusion Bag Samplers To Obtain Volatile Organic Compound Concentrations In Wells, October 2000
- 1.4.6 *Air Force/Defense Logistics Agency Remedial Process Optimization Handbook , July 2001(RPO Handbook)*
- 1.4.7 HQ Air Combat Command (HQ ACC) Site Closure Guidance Manual (SCGM)
- 1.4.8 AFCEE Remedial Action Operation/Long-Term Monitoring (RAO/LTM) Guidance Manual
- 1.4.9 Other AFCEE, USACE and DoD guidance relevant to the installation
- 1.4.10 User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells (USGS Water-Resources Investigation Report 01-4060; 2001)

1.5 BASE-SPECIFIC DOCUMENTS

The Contractor shall be responsible for obtaining through the base Environmental Management Office any documents that may assist the Contractor in accomplishing the scope of work. In particular, the Contractor shall be responsible for obtaining prior IRP investigation reports to use in determining the history of the site, design/layout of the monitoring program(s), and development of a site-specific Work Plan.

3. ADMINISTRATIVE AND MANAGERIAL REQUIREMENTS

Perform management and planning functions, as well as performance measurement and cost status reporting, during the course of this effort as specified in 4.1.

3.1 MEETINGS AND CONFERENCES

3.1.1 Post Award Meeting/Teleconference.

After the issuance of the work order, the Contractor shall attend a post award meeting to obtain consensus on the goals, objectives, expectations, and schedule for the project. The meeting will also review candidate bases for PDBS and confirm selection of candidate bases. The final version of the post award meeting minutes shall be prepared and distributed prior to commencement of any site visits for gathering of project data. Once candidate bases have been confirmed each selected base shall be visited and three regional kickoff meeting will be held (McClellan AFB, Brooks/Kelly AFB, HQ AFBCA at Roslyn, VA). The following personnel may participate in the on-site meetings: COR, AFCEE representative, AFBCA representative (for BRAC bases), the Contractor, regulatory representatives (if invited by the installation), and base personnel.

3.1.2 Progress Meetings.

The contractor shall attend up to two (2) quarterly progress meetings held at AFBCA headquarters. The Contractor shall prepare all materials and handouts for each briefing they present. Attend progress meetings with the installations and/or COR as listed in the site specific workplans.

3.1.3 Integration and Planning Meetings.

The contractor shall hold meetings (not to exceed 3) with the COR as the RPO projects move from phase I to Phase II. Responsible federal facility personnel will also attend these meetings. The purpose of these meetings shall be to review workplans and schedule implementation of PDBS and RPO recommendations. It is through these meetings that any recommended variations from the project plan(s) and specifications shall be identified.

3.1.4 Attend Public Meetings and Hearings.

As requested, the Contractor shall present the RPO/PDBS results to the Restoration Advisory Board (RAB) at the selected bases. The Contractor shall present technical information and provide logistical support (e.g., preparation of handouts, report(s), recordings, verbatim transcripts, slides, or synopsis of the meetings/hearings) for events and/or meetings in support of the Government's position.

3.1.4 Final Meeting.

The Contractor shall attend a final meeting to present the results of the demonstration to the Air Force. The Contractor shall be responsible for preparing all presentation materials.

3.2 REGULATORY/ PROFESSIONAL INTERFACE

The contractor shall prepare for and attend two regulatory agency meetings at each selected BRAC facility to brief concerned parties. These meetings do not apply to the PDBS tasks. The primary purpose of the first meeting is to gain consensus and acceptance of the optimization recommendations for the RA-O and LTM programs, and to gain concurrence on the relative priorities for RPO/ Phase II implementation and follow up. The Contractor shall attend a second regulatory agency meeting (for AFBCA sites only) at each selected facility to present a six-month update of the implementation. Feedback and comments from these meetings shall be addressed in the final document submittals.

3.2.1 Interactions.

Assist in interactions with: military and federal activities/agencies; state/local/host nation agencies; the public; and other interested parties during administrative or judicial proceedings related to the assigned project. Assistance shall include providing presentation materials, agendas, minutes, publications, news releases, public notices, and maintain/update mailing list.

3.2.2 Comments.

Assist in project technical review, analysis, and discussions to integrate comments from federal, state, host nation, and local Governments on programs and related data and studies. Develop options for responses and prepare report(s) to communicate Government environmental priorities to regulatory agencies, consultants, interested parties, and other private/public/Government interest, as directed.

3.2.3 Interpretation.

Assist with the review and interpretation of new statutory and regulatory requirements and make recommendations for Government facility planning and environmental policy integration as it applies to the assigned project.

3.3 SPECIAL NOTIFICATION

3.3.1 Health Risks.

Immediately report to the Contracting Officer and the Contracting Officer's Representative (COR), via telephone or e-mail any issues or incidents which may indicate potential imminent risk to contracted, federal, or host nation personnel, or the public at large or the environment. Following the telephone or e-mail notification, a written notice with supporting documentation shall be prepared and delivered within three (3) working days to the Contracting Officer. Upon request of the Contracting Officer, or their COR, provide pertinent raw laboratory data within three (3) weeks of the telephone or e-mail notification, documenting the concern and risk.

3.3.2 Identification and Change of Critical Contractor Personnel.

Submit an organizational chart displaying key personnel involved in the effort and their respective labor categories. Notify the COR of all professional personnel to work on specific tasks under the task order. Obtain COR approval of any proposed changes in project personnel along with the steps taken/proposed to ensure there are no impacts to the schedule or costs associated with individual tasks. Identify to the COR all subcontractors to be used under task orders issued pursuant to this SOW, prior to contract and work being initiated. Provide to the COR subcontractor qualifications prior to contract utilization.

3.3.3 Unexploded Ordinance (UXO).

If UXOs are discovered during field activities, immediately report the discovery to the base point of contact (POC) and COR via telephone. Commencement of field activities cannot continue until clearance is authorized by the CO.

3.4 LABORATORIES

The default laboratory in all cases will be the laboratory being used to analyze the DoD installation environmental samples. Vertical profiling PDBS samples will be screened in the field whenever possible. The highest concentration PDBS and the one located at the traditional sampling depth will be submitted to the fixed-base laboratory.

3.4.1 General.

Laboratories shall be USACE approved and may be subject review of their Quality Assurance/Quality Control (QA/QC) protocols and procedures. All laboratories shall meet Data Quality Objectives (DQOs) specified in task order project-specific Sampling and Analysis Plan(s) (SAP). The labs shall perform QA/QC requirements as specified in the project/site specific SAPs. The analytical capabilities of the laboratory shall be sufficient for the methods specified in the SAP, and the laboratory shall have sufficient through-put capacity to handle the necessary analytical load during all field activities.

3.4.2 On-site Laboratories.

An on-site laboratory may be utilized for the analytical methods required by the approved project/site specific SAP. The laboratory shall meet all applicable certification requirements for the necessary analysis methods prior to its implementation. On-site laboratories shall meet the DQO and QA/QC requirements specified in the site specific SAP. All proposed deviations from the above requirements shall be submitted in writing to the COR for concurrence prior to proceeding with the affected work.

3.5 WORK SITE REQUIREMENTS

3.5.1 Safety Requirements.

Responsible for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment, avoiding work interruptions and complying with OSHA safety and health regulations and Base safety office requirements. All on-site workers (contractor and subcontractor) performing hazardous operations, including working with hazardous materials, must have completed the OSHA 1910.120 HAZWOPER training and/or other applicable training, plus annual refresher courses. Maintain documentation supporting training records and have written Health and Safety Plan on site available for workers and/or regulatory review. Provide the CO copies of any OSHA report(s) submitted during the duration of the TO.

3.5.2 Work-Site Maintenance.

Maintain the work site to: prevent the spread of contamination, provide for the integrity of the samples obtained, provide for the safety of all individuals in the vicinity of the work site areas, and prevent the release of any contamination to the environment. The work site shall be well marked to prevent inadvertent entry into all work areas. Access to work areas shall be monitored and thoroughly controlled. Standard work zones and access points for controlled operations shall be established and maintained as the site conditions warrant. Ensure compliance with any federal, state, host nation, and local regulations and QA/QC protocols and procedures for decontaminating tools, equipment, or other materials, as required. At all times, keep the work area free from accumulation of waste and hazardous materials. Remove non-essential equipment from the work site when not in use. The work-site shall be maintained to present an orderly appearance and to maximize work efficiency. Before completing the work at each sampling site, remove, from the work premises, any rubbish, tools, equipment, and materials that are not property of the Government. Properly dispose of all investigation derived waste. Upon completing the work, leave the area clean, neat, orderly, and return work site(s) to the original condition.

3.5.3 Minimize Impacts to Existing Operations.

The contractor shall only install PDBS equipment at existing wells that previously have been surveyed (i.e., have northing and easting data) and that do not contain dedicated sampling equipment that would require removal. The installation POC and the COR shall be consulted to properly position sampling locations (wells, borings, soil gas probes, etc.) with respect to site locations, to minimize the disruption of installation activities, to minimize disruption of natural and cultural resources, and to avoid penetrating underground utilities. If drilling is required for Phase II RPO activities, the contractor shall coordinate all field activities with installation personnel. Provide for the detection of underground utilities utilizing geophysical or other techniques. All necessary permits and coordination shall be completed prior to commencement of individual sampling operations. Frequent communication and coordination with installation personnel shall be necessary to accomplish these goals.

3.5.4 Storage.

Responsible for security and weatherproofing of stored material and equipment. Equipment or materials used in the work, requiring storage on the installation, shall be placed at site(s) designated by the installation POC. At the completion of the work, all temporary fences and structures (used to protect materials and equipment) shall be removed from the installation unless directed otherwise by the COR. Clean the storage area of all debris and material, performing all repairs as required to return the site to its original condition. Maintain an inventory of Government property, a copy of Government property control procedures at the site, and dispose of Government property as directed by the CO.

3.5.5 Site Access Badges.

Responsible for obtaining and monitoring assigned (used by his/her own staff) security badges used during the duration of this contract. All security badges or passes shall be returned to the base POC upon expiration of the badge, upon completion of the project, or when possession of the badge is no longer necessary (e.g., upon removal of contracted personnel from specific projects).

3.5.6 Permits and Site Access Agreements.

Provide technical support in the identification and procurement of permits and/or access (including off-base easements and leases) agreements as required to implement a site-specific project.

3.6 WORK BREAKDOWN STRUCTURE

Proposals, project schedules, and financial report(s) shall be organized according to the work breakdown structure (WBS) proposed by the contractor and approved by the COR.

3.7 MANAGEMENT, PLANNING, AND REPORTING REQUIREMENTS

Plan project activities, including the development, implementation, and maintenance of project schedules, events, status of resources, report(s) on the activities and progress toward accomplishing project objectives, and document for Government review and approval the results of the project efforts for this TO.

3.7.1 WBS Requirements.

Prepare and submit for approval a work breakdown structure (WBS). This WBS shall be used to report the cost and schedule status for each project.

3.7.2 Integrated Master Schedule.

Not applicable

3.7.3 Project Planning Chart.

Prepare and submit a project planning chart (PPC) for approval. The PPCs will be created using Microsoft Project 98. The Contractor shall submit monthly Project Planning Charts to the COR, AFBCA POC, via e-mail. Hard copies of the PPC will be distributed to the COR and POCs every other month. The PPC shall detail the project schedule, project tasks, current status of all tasks, and current status of all resources through the use of Gantt charts. The percent complete for each task shall also be depicted. The COR, AFBCA POC shall approve the format of the PPCs. The PPC shall detail the project schedule and status through the use of Gantt charts, which shall depict percent complete for each task. Schedule activities shall be reported by the approved WBS.

3.7.4 Contractor's Progress, Status, and Management Report.

Prepare and submit a Contractor's Progress, Status, and Management Report (CPSMR). The CPSMR shall be used to review and evaluate the overall progress of the project, along with any existing or potential problem areas. The CPSMR shall be submitted with the monthly invoice for payment and include a summary of the events that occurred during the reporting period, discussion of performance, identification of problems, proposed solutions, corrective actions taken, and outstanding issues. A preliminary payment and monitoring plan follows and shall be adjusted accordingly based on accepted efforts as proposed:

<u>Task</u>	<u>% of Work/Payment</u>
1. System RPO	45
2. Sampling, PDBS	35
3. Guidance Evaluation/Reports	20

3.7.5 Performance and Cost Report (P&CR).

Implement and maintain a cost accounting system and prepare a P&CR to correlate the status of expensed funds and man-hours against the progress of the work completed. The P&CR and associated graphics shall detail the current project status and identify funds and man-hours required to complete the assigned tasks.

4. WORK TASKS

The contractor shall evaluate through laboratory tests the comparability of analytical results using PDBS versus traditional sampling methods. The Contractor shall demonstrate this technology at the sites listed above to determine whether PDBS can successfully detect (identify and quantify) volatile organic contaminants in groundwater. The Contractor shall be responsible for accomplishing the following tasks to optimize the monitoring program(s):

- The Contractor shall provide the following design documentation in the Work Plan and final report:
 - ◆ A scaled map identifying the wells to be sampled, and an accompanying table identifying depths for each PDBS in each well.
 - ◆ Identify all redundant wells (sampling locations), and recommend decommissioning (this task incorporates only wells sampled using PDBS).
 - ◆ Identify appropriate sampling frequency for each well (sampling location) (this task incorporates only wells sampled using PDBS).

The Contractor shall obtain any permits required to demonstrate/validate the PDBSs. The Contractor shall install the PDBS as described in the Work Plan. Sampling should be coordinated with the installations' Prime Contractor (RA-O/LTM contractor) and base personnel. The Contractor shall instruct the installations' RA-O/LTM contractor on the appropriate protocol to install PDBSs. Equipment will be installed in the selected site VOC wells. One PDBS sampling round will be performed to statistically determine the performance of the PDBSs as compared to samples taken using "standard" groundwater sampling techniques.

The Contractor shall return the selected site to its original condition.

- **Sampling and Analysis.** The Contractor shall collect groundwater samples in accordance with the procedures specified in the SAP. Samples shall be collected in a manner that is unbiased to any particular sampling technique.
- During the PDBS sampling round, the Contractor shall collect groundwater samples from each of the identified monitoring wells at the demonstration base. Duplicate, trip and other QA/QC samples will be taken according to the installations' SAP guidance. Samples will be analyzed according to the methods outlined in the approved FSP. Screening analytical methods may be used by the contractor to identify the optimum location of the PDBSs in the wells.
- **Performance Assessment.** Upon completion of each demonstration, the Contractor shall prepare a report to document the observations pertinent to the technology performance. These reports will form the appendices of the Final reports to be submitted. The Final BRAC report shall list all the demonstrations performed at BRAC sites. The Final ERA report shall list all the demonstrations performed at ERA sites. The Contractor shall evaluate the performance of the technology in terms of contaminant identification and quantification relative to the fixed laboratory samples. At the end of this beta test of the PDBS, the contractor shall ship items purchased as identified and directed by the COR.

4.1 PROFESSIONAL PLANNING AND PROGRAMMING

The Contractor shall coordinate as necessary to conduct RPO studies. On selected installations, the contractor shall assist in the selection of the monitoring wells for the demonstration of the PDBS. The selected wells shall satisfy the installation RA-O/LTM program(s).

4.1.1 Planning Actions.

Review all available documentation and develop criteria to prioritize requirements, analyze projected environmental projects, provide execution options (funding release dates, obligation schedules and Notice to Proceed milestones), and accomplish other similar recommendations. The Contractor shall prepare a site-specific Work Plan and a project-specific Quality Program Plan (QPP) that includes a Health and Safety Plan (HSP) and SAP. The installations' HSP should be adopted if available. The SAP shall consist of a

QAPP and FSP. The installations' SAP should be adopted if available. The Contractor shall prepare schedules and discretely prioritized cost estimates, as specified in this SOW. When developing these plans, the Contractor shall make practical use of previously approved plans. The Contractor shall comply with the specifications, procedures, and methodologies of the approved, contractor-prepared QPP. The CO, COR, and base POC shall be notified in writing of any proposed modification to or deviation from any activity described in these documents.

4.1.2. Programming Actions.

Prepare and submit all documentation necessary to acquire the authority and resources to accomplish the work recommended by the RPO Phase II Studies. Maintain a Record File of all actions taken and/or discussed in a secured location by project, by installation and by category of funding authorization (AFBCA). Proactive status reporting shall be maintained showing the progress of every project assigned from its inception through final closure and project release. Specific project identifiers will be established (using established project numbering system for that installation) for each requirement. Prepare and submit report(s) summarizing the programming actions assigned, their status and highlight those items requiring resolution. All documentation shall be retained in an electronic database. All costing information regardless of its stage in development shall be secured as directed by the CO.

4.1.3. Program Management Integration.

Together with the COR develop a master schedule to execute support programs.

4.1.4 Tracking of Performance Metrics and Quality Performance Indicators.

Assist in the development of performance metrics, including the tracking of data, development of report(s), and recommendation of improvements.

4.1.5 Statement Of Work (SOW).

Not applicable

4.2 TASK ORDER SCOPING AND PLAN DEVELOPMENT SERVICES

Perform task order scoping and plan development services to include:

4.2.1 Site Survey.

Not Applicable

4.2.2 Easement Survey

Not Applicable

Project Plans.

The Contractor shall submit monthly PPCs to the COR & AFBCA POC in both hard copy and electronic formats (via Microsoft Project). The PPC shall detail the project schedule, project tasks, current status of all tasks, and current status of all resources through the use of Gantt charts. The percent complete for each task shall also be depicted. The COR and AFBCA POC shall approve the format of the Project Planning Charts.

4.2.3.1 Quality Program Plans (QPPs).

Develop a QPP which will consist of any or all of the following:

4.2.3.1.1 Work Plans.

Installation approved QA programming documents will be used to complete work specified in this TO. Whenever such documents do not exist, USACE guidance documents and direction shall be used for all phases of work specified in this TO. RPO and PDBS work plans require adherence to data quality objectives (DQO).

4.2.3.1.2 Health and Safety Plan.

Utilize to the fullest extent possible existing Health and Safety Plans (HSP), tailoring them to the current effort. If no HSP is available at the installation, the Contractor shall prepare a HSP to comply with USAF,

Occupational Safety and Health Administration (OSHA), US EPA, state, host nation, and local health and safety regulations regarding the proposed work effort. Use US EPA guidelines for designating the appropriate levels of protection needed at the study site(s). The Contractor shall certify that the approved Health and Safety Plan has been reviewed with each employee and subcontractor's employees prior to the time each employee engages in field activities.

4.2.3.1.3 Sampling and Analysis Plan (SAP).

Utilize to the fullest extent possible existing SAPs. The SAP shall consist of both a Field Sampling Plan (FSP) and a QAPP. If a SAP already has been prepared for a specific base, each TO may require the preparation of project/site specific addenda to the plan(s). SAPs shall be prepared using the installations' appropriate guidance as agreed by the restoration project managers and/or BCTs.

4.2.3.2 Design Work Plan.

Not Applicable

4.3 STUDIES AND SERVICES

Provide all labor, materials, and services necessary to deliver, for government review and approval, those studies and services that support environmental programs and projects at locations of interest to the Government. These activities include:

4.3.1 Community Involvement.

Support the installation community involvement program for RPO sites only. Work includes internal as well as public meeting support and facilitation, risk communication, support of Government to Government Relations activities, Community Advisory Board (CAB) support, and Restoration Advisory Board (RAB).

4.3.2- Not Applicable

4.3.2 Not Applicable

4.3.4 Not Applicable

4.3.5 Repository.

Provide a repository of technical and regulatory documents applicable to the accomplishment of this task order and maintain a database of due-in deliverables, and an on-line inventory of data management processes to ensure compliance with applicable regulations and requirements. The contractor shall maintain the project deliverable schedule, Gantt charts, and copies of the draft and final documents in a project specific website similar to the existing one for the current RPO studies i.e. <http://project1.parsons.com/rpo>. All draft deliverables shall be posted to the appropriate website.

4.3.6 Not Applicable

4.3.7 Not Applicable

4.3.8 Not Applicable

4.3.9. Not Applicable

4.3.10 Quality Assurance and Quality Control (QA/QC).

Review, plan and/or develop QA/QC procedures and activities to ensure that data collected by or for the Contractor for this Task Order are accurate and defensible, and support project/program activities. When QA/QC elements for emerging technologies are not available, the contractor shall develop them to meet program DQO needs.

4.3.11 – 4.3.45 Not Applicable

4.3.46 Remedial Process Optimization.

Perform all studies to monitor and evaluate the remedial process to plan, design and implement RPO . The purpose of remedial process optimization is to ensure the effectiveness and efficiency of the remedial process through feedback of information into the decision process.

4.3.46.1 Remedial Process Evaluation.

Not Applicable

4.3.46.2 RPO Scoping Visit.

The Contractor shall conduct base-wide assessments to identify opportunities to implement the 6 RPO strategy components.

4.3.46.3 Evaluation of Remedial Systems and Environmental Equipment.

Not Applicable

4.3.46.4 Monitoring Optimization.

The contractor shall evaluate environmental monitoring programs and plan and design optimization of environmental monitoring programs in accordance with the USACE guidance, MAROS or other appropriate geostatistical package, and project-specific DQOs. Recommendations regarding well redundancy and sampling frequency will be made only for those wells sampled using PDBS.

4.3.47 Remedial Action Operations.

Not Applicable

4.3.48 Warranty of Installed Equipment and Systems.

Not Applicable

4.4 TECHNOLOGY (DEMONSTRATION) EVALUATIONS

Evaluate cost, performance, and applicability of PDBS. Recommendations shall consider cost, schedule, protection of human health and the environment, public acceptance and technical risk.

4.4.1 Initial Methodologies.

Not Applicable

4.4.2 Commercial and Emerging Technologies.

Not Applicable

4.5 MISCELLANEOUS DELIVERABLES

4.5.1 Photo Documentation.

Prepare photo documentation for training purposed of PDBS implementation. Photography of any kind must be coordinated through the installation POC.

4.5.2 Environmental Restoration Program Information Management System (ERPIMS) Data Management.

Not Applicable

4.6 TITLE I SERVICES

Perform all surveys, plans, studies, evaluations, and investigations identified in Section 1.1.1.6, and 1.1.1.8 of this SOW as necessary to support design efforts.

4.7 EVALUATION SUPPORT

4.7.1 Title II Services.

Provide services related to specific or proposed construction project(s).

4.7.1.1 thru 4.7.1.6 Not Applicable

4.7.1.7 Evaluation of Ongoing Actions.

As recommended by the RPO phase II, the Contractor shall perform on-site technical surveillance of field operations being performed by others. Provide integrated management oversight and technical assessment of ongoing field work. Assure conformance with the RPO selected remedies and regulatory requirements. Provide an evaluation to ensure that remedies are performing as designed.

4.7.2 Review of Deliverables.

Not Applicable

4.7.3 Technical Evaluation of Response to Solicitations.

Not Applicable

5. DATA MANAGEMENT

The Contractor shall collect, prepare, publish, and distribute the data in the quantities and types as designated. Designate a focal point who shall integrate the total data management effort and manage changes, additions or deletions of data items. Identify items to be added, recommend revisions or deletion of items as appropriate, and maintain the status of all data deliverables.

5.1 DELIVERABLE SCHEDULE.

5.2 DELIVERABLES SHALL BE PREPARED AND SCHEDULED FOR AS FOLLOWS AND SHALL BE INCLUDED AS PART OF THE CONTRACTOR PREPARED PLANNING CHART AND PROGRESS REPORT. THE PLANNING CHART SHALL BE DUE 10 DAYS FOLLOWING AN INITIAL PLANNING MEETING TO BE HELD WITH USAF, USACE, AND CONTRACTOR PERSONNEL AND CONDUCTED APPROX. MID JAN '02 TIMEFRAME.:

1. Meeting Minutes shall be prepared and submitted within 4 days following meetings.
2. RPO and Sampling Submissions Phase I field study efforts shall commence in Jan 02 and preceding field studies shall follow and be conducted on a monthly schedule (approx. 1 per month for RPO's and 2 per month for PDBS). Order of study shall be initially based on order listed in Annex A. This list will be reviewed and updated at the initial planning meeting.
3. Guidance Evaluation Reports. Draft and Final reports shall be provided for each technical area for review/update. Efforts for all areas shall commence upon date of award and be conducted concurrently. Drafts shall be due 3 months after date of award. Finals shall be due 6 months after date of award.

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7. ABBREVIATIONS, ACRONYMS, AND TERMS

ACM	Asbestos Containing Materials
ACOE	Army Corps of Engineers
ADP/BDP	Area and Base Development Plan(s)
A-E	Architect-Engineering
AF	Air Force
AFCEE	Air Force Center for Environmental Excellence
AFH	Air Force Handbook
AFHCP	Air Force Hazard Communication Program
AFI	Air Force Instruction
AHERA	Asbestos Hazard Emergency Response Act
AICUZ	Air Installation Compatible Use Zone
ARAR	Applicable or Relevant and Appropriate Requirements
ASCII	American Standard Code Information Interchange
ASTM	American Society for Testing and Materials
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CADD	Computer Aided Design Drawings
CAPP	Compliance Assurance and Pollution Prevention
CDRL	Contract Data Requirements List
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	Contracting Officer
COR	Contracting Officer Representative
CPSMR	Contractor's Progress, Status, and Management Report
CQP	Construction Quality Plan
CRP	Community Relations Plan
CSM	Conceptual Site Model
CSPER	Cleanup System Performance Effectiveness Review
CSSRA	Chemical and Site Specific Risk Analysis
CTP2	Compliance Through Pollution Prevention
CWA	Clean Water Act
DAA	Detailed Analyses of Alternatives
DD	Decision Document
DENIX	Defense Environmental Network & Information Exchange
DIDs	Data Item Description(s)
DOD	Department of Defense
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DOPAA	Description of the Proposed Action and Alternatives
DOT	Department of Transportation
DQA	Data Quality Assessment
DQOs	Data Quality Objectives
EA	Environmental Assessment
EBS	Environmental Baseline Survey
ECAMP	Environmental Compliance Assessment and Management Program
EE/CA	Engineering Evaluation/Cost Analysis
EDMS	Environmental Data Management System
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right To Know Act
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System

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ERPTOOLS/PC	ERPIMS Quality Control Tool (software)
ESDD	Environmental Suitability Decision Documents
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FMER	Funds and Man-Hours Expenditure Report
FONPA	Findings of No Practicable Alternative
FONSI	Finding of No Significant Impact
FRA	Full Risk Assessment
FS	Feasibility Study
FSP	Field Sampling Plan
GCD	Guidance for Contract Deliverables
GIS	Geographic Information System
GPS	Global Positioning System
HABS/HAER	Historic American Building Survey/Historic American Engineering Record
HAZWOPER	Hazardous Waste Operations and Emergency Response
HMA	Hazardous Materials Act
HSP	Health and Safety Plan
HSWA	Hazardous and Solid Waste Act
HTRW	Hazardous, Toxic, and Radioactive Waste
IMS	Integrated Master Schedule
INRMP	Integrated Management Plans
ISA	Initial Screening of Alternatives
ITIR	Informal Technical Information Reports
LBP	Lead-Based Paint
LTM	Long-term Monitoring
MAJCOM	Major Command
MAP	Management Action Plan
MWRS	Morale, Welfare, Recreation and Services
NATO	North Atlantic Treaty Organizations
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NFA	No Further Action
NFAR	No Further Action is Required
NFRAP	No Further Response Action Plan
NHPA	National Historic Preservation Act
NHRP	National Register of Historic Places
NMFS	National Marine Fisheries Service
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCS	National Resources Conservation Service
NRDA	Natural Resource Damage Assessment
NRUA	Natural Resource Use Analysis
O&M	Operations and Maintenance
OEBGD	Overseas Environmental Baseline Guidance Document
OPA	Oil Pollution Act
ORM	Operational Risk Management
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
P2	Pollution Prevention
P2OA	Pollution Prevention Opportunity Assessment
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PC	Personal Computer
PCBs	Polychlorinated Biphenyls
PCOCs	Potential Chemicals of Concern

PCR	Performance and Cost Report
POC	Point of Contact
POL	Petroleum, Oil, Lubricants
PP	Proposed Plan
PPC	Project Planning Chart
QA/QC	Quality assurance and Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
QPP	Quality Program Plan
RACER	Remedial Action Cost Engineering and Requirements System
RAGS	Risk Assessment Guidance for Superfund
RAMP	Radon Assessment and Mitigation Program
RCRA	Resource Conservation and Recovery Act
RDBMS	Relational Database Management System
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RFP	Request for Proposal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RMP	Resource Management Plan
ROD	Record of Decision
RPO	Remedial Process Optimization
RSA	Risk Screening Analysis
RSV	Remedial Process Optimization Scoping Vsit
SAM	Sampling , Analysis and Monitoring
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCS	Site Characterization Summary
SCS-ITIRs	Site Characterization Summary ITIRs
SDWA	Safe Drinking Water Act
SI	Site Inspection
SIAS	Socioeconomic Impact Analysis Study
SOW	Statement of Work
SWP3	Stormwater Pollution Prevention Plan
TEAM	The Environmental Assessment Manual
TO	Task Order
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage and Disposal
TSMP	Toxic Substance Management Plan
US	United States
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	Unexploded Ordnance
WBS	Work Breakdown Structure
WofUS	Waters of the United States

ANNEX A

TASKS	Installation	Type of Work
WBS 01000	All Sites (Project Planning & Management)	All Tasks
WBS 02000	Castle AFB CA	RSC/PO Phase I
WBS 03000	George AFB CA	RSC/PO Phase I , II
WBS 04000	March AFB CA	RSC/PO Phase I
WBS 05000	McClellan AFB CA	RSC/PO Phase I
WBS 06000	Mather AFB CA	RSC/PO Phase I , II
WBS 07000	Norton AFB CA	RSC/PO Phase I
WBS 08000	Laboratory Flow-Related NA Study	Source Removal - Enhanced Bioremediation
WBS 09000	Newark AFB	RSC/PO Phase II (Veg-Oil Injection)
WBS 11000	Bergstrom AFB Texas	PDBS
WBS 12000	Carswell AFB Texas	PDBS
WBS 13000	Kelly AFB Texas	PDBS
WBS 14000	Reese AFB Texas Alternate (Eaker AFB)	PDBS
WBS 15000	England AFB Alternate Richard-Gebaur	PDBS
WBS 16000,	Grissom AFB	PDBS
WBS 17000	Gentile AFB Alternate K.I. Sawyer AFB	PDBS
WBS 18000	Mather AFB Alternate Rickenbacker ARB	PDBS
WBS 19000	Newark AFB Alternate Loring AFB	PDBS
WBS 20000,	Wurtsmith AFB and Peace AFB	PDBS

**APPENDIX B – PROJECT SAMPLING AND ANALYSIS PLAN
(QAPP AND FSP)**

DRAFT

**SAMPLING AND ANALYSIS PLAN FOR A PASSIVE DIFFUSION
BAG SAMPLER DEMONSTRATION**

February 2002

Prepared for:

**US Department of the Army
Corps of Engineers
Omaha District
Omaha, Nebraska**

And

**Air Force Base Conversion Agency
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**CONTRACT NO. F44650-99-D-005
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ACRONYMS AND ABBREVIATIONS

%D	Percent difference
%R	Percent recovery
°C	Degrees Celsius
µs/cm	Microsiemens per centimeter
µg/kg	Microgram per kilogram
µg/L	Microgram per liter
A2LA	American Association Of Laboratory Accreditation
AFILEV	Air Force Environmental Directorate
ANSI	American National Standards Institute
ASQC	American Society Of Quality Control
BFB	4-Bromofluorobenzene
BRAC	Base Realignment and Closure
btoc	Below top of casing
CCAL	Continuing calibration
CCB	Continuing calibration blank
CCC	Continuing calibration check
CCS	Contract compliance screening
CCV	Continuing calibration verification
CF	Control factor
CFR	Code Of Federal Regulations
COC	Chain Of Custody
DCA	Dichloroethane
DCB	Dichlorobenzene
DCE	Dichloroethene
DD	Decision document
DF	Dilution factor
DLA	Defense Logistics Agency
DQA	Data quality assessment
DQO	Data quality objective
DSITMS	Direct-sampling ion-trap mass-spectrometry
EDB	1,2-dibromoethane
EDD	Electronic data deliverable
EICP	Extracted ion current profile
EPA	United States Environmental Protection Agency
FID	Flame ionization detector
FSP	Field Sampling Plan
ft	Feet
G	Glass
GC/MS	Gas chromatograph/mass spectrometer
gm	Gram
HCl	Hydrochloric acid
H2SO4	Sulfuric acid
ICAL	Initial calibration
ICB	Initial calibration blank

ACRONYMS AND ABBREVIATIONS (Continued)

ICV	Initial calibration verification
IDL	Instrument detection limit
IDW	Investigation-derived waste
IS	Internal standard
LCL	Lower control limit
LCS	Laboratory control sample
LCS D	Laboratory control sample duplicate
MB	Method blank
MDL	Method detection limit
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
ml	Milliliter
MS/MSD	Matrix spike/matrix spike duplicate
Na ₂ S ₂ O ₃	Sodium thiosulfate
NBS	National Bureau Of Standards
NFG	National Functional Guidelines
NIROP	Naval Industrial Reserve Ordnance Plant
NIST	National Institute Of Standards And Technology
P	Polyethylene
PARCC	Precision, accuracy, representativeness, comparability, and completeness
Parsons	Parsons Engineering Science, Inc.
PC	Percent complete
PDBS	Passive diffusion bag sampler
PID	Photo-ionization detector
ppb	Parts per billion
PQL	Practical quantitation limit
PRL	Project reporting limit
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
r	Correlation coefficient
r ²	Coefficient of determination
RBC	Risk-based concentration
RF	Response factor
RPD	Relative percent difference
RRF	Relative response factor
RSD	Relative standard deviation
RT	Retention time
RTW	Retention time window
SAP	Sampling and Analysis Plan
SD	Sample duplicate
SDG	Sample delivery group
SOP	Standard operating procedure

ACRONYMS AND ABBREVIATIONS (Continued)

SPCC	System performance check compound
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
T	Brass sleeves in sample barrel
TCA	Trichloroethane
TCE	Trichloroethene
TIC	Tentatively identified compound
TOC	Total organic carbon
UCL	Upper control limit
VOA	Volatile organic analysis
VOC	Volatile organic compound

SECTION 1

FIELD SAMPLING PLAN

This Field Sampling Plan (FSP) presents Standard Operating Procedures (SOPs) to be used for all field activities conducted as part of the passive diffusion bag sample (PDBS) evaluation. Although every effort has been made to include a SOP for each field activity, additional SOPs may be added to this FSP as needed throughout the project duration. The following SOPs are included in this FSP.

SOP #1 – Diffusion Sampler Installation

SOP #2 – Diffusion Sampler Recovery and Sample Collection

SOP # 3 – Equipment Decontamination

SOP # 4 – Sample Handling and Documentation

Standard Operating Procedures (SOPs)

SOP # 1 - Diffusion Sampler Installation

This SOP describes the procedures for placing PDBS in a groundwater monitoring well. In order to assist the field sampling team, PDBS Placement Forms (PPFs) (Figure 1.1) will be completed to the extent possible for each well included in the evaluation prior to initiation of field work.

New and clean nitrile gloves should be worn by any sampling personnel who will be in direct contact with any material that will, or that has the potential to, contact the groundwater.

1. Measure the water elevation in the monitoring well in accordance with applicable site-specific SOPs. This will be used to determine how much of the well screen is in the saturated zone (*i.e.*, saturated well-screen length). Note this depth on the PPF (Figure 1.1).
2. Measure the total well depth and compare the measured depth with the depth to the reported bottom of the well screen on the PPF. This will provide information on whether sediment has accumulated in the bottom of the well or whether there is a blank section of pipe (sump) below the well screen.

FIGURE 1.1 PDBS PLACEMENT FORM

PRE-MOBILIZATION DATA

Installation:	Carswell AFB
Installation abbreviation:	CSWL
Project Number:	741436
WBS:	12000
Well ID (exclude dashes and slashes):	N7MW5
Well diameter (in):	4
Well scheduled for QC sample collection (dup, MS, MSD)?	<input checked="" type="checkbox"/> Yes
Elevation of TOC (ft amsl):	2280.52
Elevation of ground surface (ft amsl):	
Historical maximum groundwater depth (ft btoc):	
Historical minimum groundwater depth (ft btoc):	
Top of screen depth (ft btoc):	6.00
Bottom of screen depth (ft btoc):	36.00
Analytical method:	8260B

FIELD MEASUREMENTS/PDBS PLACEMENT DATA

Depth to water (ft btoc):	4.70
Total well depth (ft btoc):	36.00
Length of saturated screen (ft):	30.00
Calculated saturated screened interval (ft btoc):	6.00 - 36.00
Number of PDB samplers to deploy:	10
Place bottom of sampler at the following depths (ft from bottom of weight)	
(deeper)	
Sampler #1	0.75
Sampler #2	3.75
Sampler #3	6.75
Sampler #4	9.75
Sampler #5	12.75
Sampler #6	15.75
Sampler #7	18.75
Sampler #8	21.75
Sampler #9	24.75
Sampler #10	27.75
Sampler #11	NA
Sampler #12	NA
Sampler #13	NA
Sampler #14	NA
Sampler #15	NA
PDBS deployment date:	
PDBS deployment time:	

PDBS RETRIEVAL DATA

PDBS retrieval date:	10/2/01
PDBS retrieval time:	
Sampler(s) initials:	DMM

Sampler #1 ID	CSWL\N7MW5\34.5\01	Matrix Spike #1 ID	CSWL\N7MW5\34.5\MS
Sampler #2 ID	CSWL\N7MW5\31.5\01	Matrix Spike #2 ID	CSWL\N7MW5\31.5\MS
Sampler #3 ID	CSWL\N7MW5\28.5\01	Matrix Spike #3 ID	CSWL\N7MW5\28.5\MS
Sampler #4 ID	CSWL\N7MW5\25.5\01	Matrix Spike #4 ID	CSWL\N7MW5\25.5\MS
Sampler #5 ID	CSWL\N7MW5\22.5\01	Matrix Spike #5 ID	CSWL\N7MW5\22.5\MS
Sampler #6 ID	CSWL\N7MW5\19.5\01	Matrix Spike #6 ID	CSWL\N7MW5\19.5\MS
Sampler #7 ID	CSWL\N7MW5\16.5\01	Matrix Spike #7 ID	CSWL\N7MW5\16.5\MS
Sampler #8 ID	CSWL\N7MW5\13.5\01	Matrix Spike #8 ID	CSWL\N7MW5\13.5\MS
Sampler #9 ID	CSWL\N7MW5\10.5\01	Matrix Spike #9 ID	CSWL\N7MW5\10.5\MS
Sampler #10 ID	CSWL\N7MW5\7.5\01	Matrix Spike #10 ID	CSWL\N7MW5\7.5\MS
Sampler #11 ID	NA	Matrix Spike #11 ID	NA
Sampler #12 ID	NA	Matrix Spike #12 ID	NA
Sampler #13 ID	NA	Matrix Spike #13 ID	NA
Sampler #14 ID	NA	Matrix Spike #14 ID	NA
Sampler #15 ID	NA	Matrix Spike #15 ID	NA
Duplicate #1 ID	CSWL\N7MW5\34.5\10	MS Duplicate #1 ID	CSWL\N7MW5\34.5\MD
Duplicate #2 ID	CSWL\N7MW5\31.5\10	MS Duplicate #2 ID	CSWL\N7MW5\31.5\MD
Duplicate #3 ID	CSWL\N7MW5\28.5\10	MS Duplicate #3 ID	CSWL\N7MW5\28.5\MD
Duplicate #4 ID	CSWL\N7MW5\25.5\10	MS Duplicate #4 ID	CSWL\N7MW5\25.5\MD
Duplicate #5 ID	CSWL\N7MW5\22.5\10	MS Duplicate #5 ID	CSWL\N7MW5\22.5\MD
Duplicate #6 ID	CSWL\N7MW5\19.5\10	MS Duplicate #6 ID	CSWL\N7MW5\19.5\MD
Duplicate #7 ID	CSWL\N7MW5\16.5\10	MS Duplicate #7 ID	CSWL\N7MW5\16.5\MD
Duplicate #8 ID	CSWL\N7MW5\13.5\10	MS Duplicate #8 ID	CSWL\N7MW5\13.5\MD
Duplicate #9 ID	CSWL\N7MW5\10.5\10	MS Duplicate #9 ID	CSWL\N7MW5\10.5\MD
Duplicate #10 ID	CSWL\N7MW5\7.5\10	MS Duplicate #10 ID	CSWL\N7MW5\7.5\MD
Duplicate #11 ID	NA	MS Duplicate #11 ID	NA
Duplicate #12 ID	NA	MS Duplicate #12 ID	NA
Duplicate #13 ID	NA	MS Duplicate #13 ID	NA
Duplicate #14 ID	NA	MS Duplicate #14 ID	NA
Duplicate #15 ID	NA	MS Duplicate #15 ID	NA

3. If using the PPF the saturated well-screen length will be calculated automatically. If the PPF is not used, calculate the saturated well-screen length using the following equations:

a. If the water level (Step #1) is above the top of the well screen, then the saturated well-screen length is calculated as follows:

$$L_{\text{sat}} = D_{\text{se}} - D_{\text{sb}}$$

where, L_{sat} = Saturated well-screen length (feet [ft])

D_{se} = Depth to bottom of well screen or top of sediment (ft below top of casing [btoc])

D_{sb} = Depth to top of well screen (ft btoc).

b. If the water level (Step #1) is lower than the top of the well screen (i.e. the well screen extends above the water level), then the saturated well-screen length is calculated as follows:

$$L_{\text{sat}} = D_{\text{se}} - \text{WL}$$

where, L_{sat} = Saturated well-screen length (ft)

D_{se} = Depth to bottom of well screen or top of sediment (ft btoc)

WL = Water level in the well (ft btoc).

4. If using the PPF, the total number of samplers to be deployed in the well will be automatically calculated. If the PPF is not used, refer to Table 1.1 below to determine the maximum number of samplers to be installed in a well.

**TABLE 1.1
NUMBER OF PDB SAMPLERS PER SATURATED WELL SCREEN LENGTH**

Range of Saturated Well Screen Length (ft)	Maximum Number of PDB Samplers
0-2.49	0
2.50-5.49	1
5.50-8.49	2
8.50-11.49	3
11.50-14.49	4
14.50-17.49	5
17.50-20.49	6
Greater than 20.50	Contact Site Manager

5. The diffusion samplers should be placed entirely within the upper and lower limits of well screen and should be completely submerged throughout the equilibration period. The top of the uppermost diffusion sampler should be placed 1 foot below the measured water level to allow some water elevation fluctuations during the equilibration period without exposing the diffusion sampler. If water elevation changes in excess of 1 foot are anticipated (based on historical data), the top diffusion sampler should be placed deeper.
6. If using the PPF, the spacing of diffusion samplers along the length of the well screen will be automatically calculated. If the PPF is not used, calculate the distance from the bottom of the well, or top of the sediment in the well, up to the point where the lowest diffusion sampler is to be placed, keeping in mind the following criteria:
 - a. The top of the uppermost sampler should be no less than 1 foot below the water surface,
 - b. A spacing interval of 1.5 feet should be maintained between all samplers, and
 - c. The total number of samplers should not exceed that specified in Table 1.1.
7. Prepare the ground surface near the well for assembly of the diffusion sampler string. To avoid contaminating the sampling assembly during construction, clean plastic sheeting will be placed near the well and sample string construction will be performed on the plastic sheeting.
8. Attach a stainless steel weight to the bottom of the rope. This weight should just rest on the bottom of the well or on the sediment in the well when installed.
9. Measure the distance from the bottom of the stainless steel weight up the rope to the point that corresponds to the calculated bottom of the lowermost PDB sampler. Insert a zip-tie in the rope at this location.
10. Move up the rope placing zip-ties at intervals corresponding to the spacing calculated in step 6 above until the appropriate number of zip-ties have been inserted (two zip-ties per PDBS). Finally, place a knot or a zip-tie at the location on the rope that corresponds to the top of the well casing.
11. Record in the field logbook and the PPF the depths at which each sampler is to be installed. Including primary samples and QA/QC samples (duplicate, field blank, and trip blank samples), a total of four different types of samples will be collected as part of this investigation for laboratory analysis. Each laboratory sample will be assigned a unique sample identification number that describes where the sample was collected and provides decoding information to identify QA/QC samples. The sample numbering system that will be used is unique to

the site and location sampled. Each number will consist of 4 identifying pieces of information separated by slashes.

[Code for BASE][Code for LOCATION][Code for DEPTH][Code for TYPE]

The codes to be used in all sample identification numbers are summarized in Table 1.2.

**TABLE 1.2
SAMPLE IDENTIFICATION NUMBERING SYSTEM**

BASE	LOCATION	DEPTH	TYPE
See PDBS Umbrella Work Plan for BASE codes	Well identification number	Depth (ft) below top of well casing (TOC) of PDBS midpoint.	Primary = 01
			Duplicate = 10
			Field Blank = 02
			Trip Blank = 03
			Matrix Spike = MS
			Matrix Spike Duplicate = MD

Example Sample Number:

CSWL\4MW13\58.4\01 = Primary sample (01) from the PDBS whose middle depth was 58.4 feet (58.4) below the top of well casing (TOC) at monitoring well 4MW-13 (4MW13), Carswell ARB (CSWL).

12. Attach the top and bottom of each diffusion sampler to the rope using the zip-ties that were inserted into the rope in Steps 9 and 10 above. If no obvious hook exists on the sampler to which to attach the sampler to the rope using the zip-tie, attach the sampler to the rope by weaving the zip-tie through the mesh tubing of the diffusion sampler. The zip-ties should be threaded through the mesh tubing in a way that prevents the polyethylene diffusion bag from sliding out of the mesh and in a way that prevents slack from developing in the rope between the bottom and top of the sampler.
13. Samples that will be collected in duplicate for quality control (QC) purposes will require additional sample volume to fill the required sample containers. In these instances, utilize either oversized, longer samplers (for 2-inch diameter wells) or attach two regular samplers to the same depth interval on the rope (for wells with a casing diameter larger than 2-inches).

14. Using decontaminated scissors (see SOP #3 –Decontamination), trim the excess from the zip-ties before placing the sampling string down the well.
15. Gently lower the diffusion sampling string into the well (weight first) until the weight rests on the bottom and the upper knot or zip-tie (indicating the top of the well casing) is even with the top of the well casing. The diffusion samplers should now be positioned at the correct depths.
16. Secure the rope at the wellhead in this position. A suggested method is to attach the rope to a hook (if one exists) on the inside of the well cap. If after the initial site visit it is determined that no viable method for attaching the rope to the wellhead exists, Parsons will provide well caps fitted with hooks for temporary use.
17. Install a temporary cover over the well casing to prevent debris from entering well.
18. Close and lock the well protective covering.
19. Leave the sampling string in place for at least 14 days.

SOP # 2 - Diffusion Sampler Recovery and Sample Collection

This SOP describes the procedures for retrieving PDB samplers from a groundwater monitoring well. Following the equilibration period, the diffusion sampling string will be retrieved and samples will be collected for field screening and laboratory analysis using the following procedures.

1. Measure the water level in the monitoring well in accordance with applicable site-specific SOPs. Note this depth on the sample collection form and verify that the uppermost PDBS is completely submerged below the water level.
2. Gently but quickly pull to the surface the first sampler on the string.
3. To avoid possible cross-contamination at the surface and exposure to excessive heat, secure the sampler string at the wellhead to allow the deeper samplers to hang in the well during transfer of water from the first sampler to volatile organics analysis (VOA) vials.
4. Cut the cable ties and remove the diffusion sampler from the rope. Examine the surface of the diffusion sampler for evidence of algae or a film that could affect the performance of the diffusion membrane. Note any observations in the sampling field book and on the Sample Collection Form.
5. Cut open the diffusion sampler using a properly decontaminated pair of scissors and gently pour the water into five (two for field screening and three for potential laboratory submittal) 40-mL VOA vials. As an alternative to using scissors, a fill kit may be provided by the PDBS supplier for transferring water from the PDBS to the sample container. Regardless of the method of

transference, the water should be carefully poured down the inner walls of the sample bottle to minimize aeration of the sample. WATER NEEDS TO BE TRANSFERRED FROM THE DIFFUSION SAMPLERS TO THE VOA VIALS AS QUICKLY AS POSSIBLE TO MINIMIZE CONTAMINANT VOLATILIZATION.

6. Once filled to the brim, sample bottles will be sealed in a manner such that there is no headspace (i.e., no air bubbles).
7. Sample bottle preservation, labeling, and shipment will be performed according to the procedures detailed in SOP #4 – Sample Handling and Documentation.
8. Proceed with sampling, down the string assembly, until the bottom sample is transferred to VOA vials.
9. Excess water from the diffusion samplers will be collected in sealable plastic buckets or steel drums for containment until it is disposed of. All investigation derived waste (IDW), including excess sample water, spent diffusion samplers, disposable sampling equipment, and personal protective equipment will be managed according to the criteria specified in Section 3.2.3.5 of the umbrella waste plan and in the site-specific work plans.

SOP # 3 – Equipment Decontamination

This SOP describes the procedures to be used for equipment decontamination during the PDBS evaluation. Although the PDBS method requires minimal decontamination, all portions of sampling and test equipment that will contact the sample will be thoroughly cleaned before each use. This equipment may include water-level probe and cable, scissors, test equipment for onsite use, and other equipment or portions thereof that will contact the samples. The following decontamination protocol will be used:

- Clean with potable water and phosphate-free laboratory detergent (Liquinox® or equivalent);
- Rinse with potable water;
- Rinse with distilled or deionized water;
- Rinse with isopropanol; and
- Air dry the equipment prior to use.

All decontamination fluids will be temporarily placed in suitable containers for proper disposal.

Any deviations from these procedures will be documented in the field scientist's field notebook and on the groundwater sampling form. If pre-cleaned, dedicated sampling equipment is used, the decontamination protocol specified above will not be required. Laboratory-supplied sample containers will be cleaned and sealed by the laboratory and

therefore will not need to be cleaned in the field. Field/trip blanks and equipment rinseate samples will be collected as described in project SAP to ensure that all containers and field equipment are free of contamination.

SOP # 4 – Sample Handling and Documentation

This SOP describes the handling of groundwater samples from the time of sampling until the samples arrive at the laboratory, as well as all documentation that is required.

Sample Containers and Labels

Sample containers and appropriate container lids will either be provided by the analytical laboratory or will be purchased from an independent supplier. The sample containers will be filled as described in SOP #2 – PDBS Recovery, and the container lids will be tightly closed. Container lids will not be removed at any time prior to sample collection. The sample label will be firmly attached to the container side, and the following information will be legibly and indelibly written on the label:

- Facility name;
- Sample identification;
- Sampling date;
- Sampling time;
- Preservatives added; and
- Sample collector's initials.

Sample Preservation

All filled sample bottles will be placed in a re-sealable plastic bag immediately after sample collection and labeling. The plastic bag will in-turn be placed on ice in a cooler.

With the exception of cooling to 4°C, as described above, no other preservation will be required for sample bottles designated for field screening. These bottles will be identifiable as designated for field screening by the sample label that will indicate that no preservative has been added.

Samples designated for laboratory analysis will be preserved with hydrochloric acid to a pH of less than 2. Acid will be added to these bottles prior to shipping the containers to the site. Samples will be properly prepared for transportation to the laboratory by placing the samples in a cooler containing ice to maintain a shipping temperature of 4°C.

Sample Packaging and Shipment

After the samples are sealed and labeled, they will be packaged for transport to the analytical laboratory. Samples will be shipped priority overnight via Federal Express®

using the Government Account # 167402461. The following packaging and labeling procedures will be implemented:

- Package sample bottles in cushioning material so that they will not break;
- Place fresh ice in cooler (in plastic bag to prevent leakage);
- Label shipping cooler with:
 - Appropriate completed airbill,
 - Laboratory's name, address, and telephone number, and
 - Sample collector's name, address, and telephone number (e.g., a business card).

The packaged samples will be delivered to the laboratory as soon as possible after sample acquisition to allow analysis within method-specific holding times.

Chain-of-Custody Control

After the samples have been collected, chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory. Each shipping container will have a chain-of-custody form completed in triplicate by the sampling personnel. One copy of this form will be kept by the sampling team and the other two copies will be sent to the laboratory. One of the laboratory copies will become a part of the permanent record for the sample and will be returned with the sample analytical results. The chain-of-custody will contain the following information:

- Sample identification number;
- Sample collector's printed name and signature;
- Date and time of collection;
- Place and address of collection;
- Sample matrix;
- Analyses requested;
- Signatures of individuals involved in the chain of possession; and
- Inclusive dates of possession.

The chain-of-custody documentation will be placed inside the shipping container so that it will be immediately apparent to the laboratory personnel receiving the container, but will not be damaged or lost during transport. The shipping container will be sealed so that it will be obvious if the seal has been tampered with or broken.

Sampling Records

In order to provide complete documentation of the sampling event, detailed records will be maintained by the Parsons field scientist. At a minimum, these records will include the following information:

- Sample location (facility name);
- Sample identification;
- Sample location map or detailed sketch;
- Date and time of sampling;
- Sampling method;
- Field observations of
 - Sample appearance,
 - Sample odor;
- Weather conditions;
- Water level prior to PDBS deployment and recovery;
- Total well depth;
- Well condition;
- Sampler's identification; and
- Any other relevant information.

Groundwater sampling activities will be recorded on the PPF (Figure 1.1).

SECTION 2

QUALITY ASSURANCE PROJECT PLAN

2.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed for use in conjunction with sampling activities for the evaluation of passive diffusion bag samplers (PDBSs) at selected Department of Defense (DoD) installations to ensure appropriate sample collection and analysis. Together with the Field Sampling Plan (FSP) presented in Section 1, this QAPP constitutes the project Sampling and Analysis Plan (SAP). Field activities will include installation and sampling of groundwater with PDBSs for analysis of volatile organic compounds (VOCs) (fixed-based laboratory analysis). Method SW8260B will be used for fixed-based analysis of VOCs. The target compound list and project reporting limits (PRLs) will be site-specific and therefore, listed in the site-specific work plans. The Base monitoring Contractor's QAPP will be adapted as a site-specific addendum to this PDBS QAPP, as appropriate.

This document outlines the objectives and quality assurance and quality control (QA/QC) activities necessary to achieve the desired data quality goals.

This QAPP has been prepared using the following documents as guidance:

- U.S. Environmental Protection Agency (EPA), 1999, EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5, Washington D.C. November 1999.
- EPA, 1994, Guidance for the Data Quality Objectives Process. EPA QA/G-4. Washington, D.C. September 1994.
- EPA. 1994 Contract Laboratory Program National Functional Guidelines for Organic Data Review.
- EPA. 1994 Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.
- EPA, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition, SW 846 (November 1986, 1995 update).
- American National Standards Institute/American Society of Quality Control (ANSI/ASQC E-4-1994), "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," July 1994, (Draft).

2.2 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) for the analyses specified in this QAPP are described in the EPA, 1994 Guidance for the Data Quality Objectives Process, EPA QA/G-4. An effective QA program addresses DQOs for field sampling, field screening, and laboratory analytical methods. The contractor's field QA efforts will focus on ensuring that collected samples are representative of the conditions in the various environmental media at the time of sampling, and that field screening analyses are conducted in accordance with the QAPP and this work plan. Fixed-based laboratory QA efforts will be aimed primarily at ensuring that analytical procedures provide sufficient accuracy and precision to reliably quantify contaminant levels in environmental samples. The contract laboratory will also ensure that analyzed portions are representative of each sample, and that the results obtained from analysis of each sample are comparable to those obtained from analysis of other similar samples.

2.2.1 Analytical Data Quality Levels

The analytical levels for this project's DQOs will conform to the EPA-defined data category defined below:

Definitive Data - Definitive data are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, and digital values) in the form of hard-copy printouts or computer-generated electronic files. Data may be generated at the site or at an offsite location, as long as the QA/QC requirements are satisfied. For the data to be definitive, QA/QC requirements must be met in either case. Results of fixed-based laboratory analyses of samples collected for this project will be considered definitive data.

2.2.2 Integration of DQOs

The overall QA objectives for the evaluation must be appropriate to meet the project DQOs. The QA/QC program will provide the basic guidelines for evaluating the analytical results and field data for the site. These QA objectives are qualitative summaries of qualitative and quantitative analyses requested for the project to ensure that the planned quality and quantity of data are sufficient to support comparison of the PDBS to conventional sampling methods. QA/QC is ensured through appropriate sample collection, preservation, and transport methods combined with an evaluation of laboratory analytical performance through the analysis of QC samples.

When analytical data fail to meet the required QA objectives, the technical report will discuss why the objectives were not met and any resultant effects on the project DQOs. Two major categories of noncompliance with QC requirements need to be considered:

- Requirements that are fully under the laboratory's control; and
- Requirements limited by the nature of the sample matrix.

Corrective action for noncompliance with QC standards that are fully under the laboratory's control (e.g., laboratory blanks, calibration standards, tuning, and laboratory check or control samples) will be addressed with a thorough reevaluation of the system and all calculations and, where practical, re-analysis of noncompliant samples. Corrective action for noncompliance with QC standards that are limited by the nature of the sample matrix (e.g., field blanks, matrix spikes, and duplicates) will be addressed with a thorough check of the system and all calculations, and the attachment of appropriate data qualifiers to noncompliant data.

An effective QA program addresses quality objectives for both sampling and laboratory methodologies. Parsons' field QA efforts are aimed primarily at assuring that samples are representative of the conditions in the various environmental media at the time of sampling. Laboratory QA efforts are aimed primarily at assuring that analytical procedures provide sufficient accuracy and precision to quantify contaminant levels in environmental samples. The laboratory will also ensure that analyzed portions are representative of each sample, and that the results obtained from analysis of each sample are comparable to those obtained from analysis of other similar samples.

2.3 QA OBJECTIVES FOR MEASUREMENTS

The QA objectives for all measurement data include considerations for precision, accuracy, completeness, representativeness and comparability (PARCC). These data quality assessment criteria will be used to evaluate the quality of the field sampling efforts, field-screening results, and fixed-based laboratory results for compliance with project DQOs. Procedures used to assess data accuracy and precision are in accordance with the respective analytical methods from the EPA's (1995) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW846.

2.3.1 Precision

Precision is the measure of variability among individual sample measurements under prescribed conditions. The relative percent difference (RPD) between primary and field duplicate samples, laboratory sample duplicate (SD) pairs, and matrix spike/matrix spike duplicate (MS/MSD) sample results demonstrate the precision of the sample matrix. During collection of samples, precision can be affected by the spatial variability of pollutant concentrations. Collection of the of field duplicate samples, sample duplicate pairs and MS/MSD pairs will enable a determination of variability due to sampling and laboratory analysis practices. Because the concentration of analytes may be below detection limits in many environmental samples, RPD data will be generated by preparing matrix spikes in duplicate. The precision of the analytical method will thus be measured by calculating the RPD between the duplicate spikes, rather than environmental samples. Levels of precision will vary according to the sample matrix, the specific analytical method, and the analytical concentration relative to the method detection limit (MDL). For sample duplicate samples, the target RPDs will be based on the lab-established limits based on laboratory control charts. For field duplicate samples, the target RPDs are 35 percent for water and soil samples.

When the laboratory control sample (LCS) results meet the accuracy criteria, results are also believed to be precise, and represent the precision of the laboratory independent from sample matrix. This is based on the LCS being within control limits in comparison to LCS results from previous analytical batches of similar methods and matrices.

Precision will be expressed in terms of RPD between the values resulting from primary and duplicate sample analyses. RPD is calculated as follows:

$$\text{RPD} = [(x1 - x2)/X][100]$$

where:

- x1 = analyte concentration in the primary sample,
- x2 = analyte concentration in the duplicate sample, and
- X = average analyte concentration in the primary and the duplicate sample.

Acceptable levels of precision will vary according to the sample matrix, the specific analytical method, and the analytical concentration relative to the MDL. For field duplicate samples, the target RPDs are = 35 percent for soil and water samples. Precision criteria for the laboratory QC samples must be defined by historical control limits developed through the use of control charts (Section 2.6.2.8). An RPD within the control limit indicates satisfactory precision in a measurement system.

2.3.2 Accuracy

Accuracy is a measure of the closeness of a reported concentration to the true value. Accuracy is expressed as a bias (high or low) and is determined by calculating percent recovery (%R) from specific QC samples. MS/MSD and surrogate spike recoveries indicate accuracy relevant to a unique sample matrix. LCS recoveries indicate accuracy relevant to an analytical batch lot, and are strictly a measure of analytical accuracy conditions independent of samples and matrices. The %R of an analyte, and the resulting degree of accuracy expected for the analysis of QC spiked samples, are dependent upon the sample matrix, method of analysis, and the compound or element being measured. The concentration of the analyte relative to the detection limit of the method is also a major factor in determining the accuracy of the measurement.

During field sampling and sample shipping, contamination may be introduced to the samples that could affect the accuracy of analysis results. Field and trip blanks will be used during sample collection and shipment to detect field contamination. Contamination affecting accuracy can also be introduced during laboratory analysis. Method blanks will be used during laboratory procedures to assess laboratory-introduced contamination. Laboratory results will be monitored, as they become available in order to identify potential sources of field or laboratory contamination, and eliminate them.

Accuracy expressed as %R is calculated as follows:

$$\%R = [(A-B)/C] \times 100$$

where:

- A = spiked sample concentration,
- B = measured sample concentration (without spike), and
- C = concentration of spike added.

Accuracy criteria for the laboratory must be defined by historical control limits developed through the use of control charts (Section 2.6.2.8).

2.3.3 Completeness

Completeness is defined as the percentage of laboratory measurements judged to be valid on a method-by-method basis. Valid data are defined as all data and/or qualified data that meet the DQOs for this project. Data completeness is expressed as percent complete (PC) and should equal 90 percent. The goal for meeting analytical holding times is 100 percent. At the end of each sampling event, the completeness of the data will be assessed. If any data omissions are apparent, the parameter in question will be resampled and/or reanalyzed, if feasible. The laboratory results will be monitored, as they become available to assess laboratory performance and its effect on data completeness requirements. When appropriate, additional samples will be collected to ensure that laboratory performance meets PC requirements.

PC is calculated as follows:

$$PC = \frac{N_A}{N_I} \times 100$$

Where:

- N_A = Actual number of valid analytical results obtained, and
- N_I = Theoretical number of results obtainable under ideal conditions.

2.3.4 Comparability

Comparability expresses the confidence with which data from one sample, sampling round, site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures.

Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, and standard reporting methods, including consistent units. For example, concentrations will be

reported in a manner consistent with general industry practice (e.g., soil data will be reported on a dry-weight basis).

In addition, to support the comparability of fixed-base laboratory analytical results with those obtained from previous or future testing, all samples will be analyzed by EPA-approved methods, where available. The EPA-recommended maximum permissible sample holding times for organic and inorganic parameters will not be exceeded. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with EPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared to analyses by other laboratories and/or to analyses for other sites addressed by this site investigation.

2.3.5 Representativeness

Representativeness expresses the extent to which collected data define site contamination. Where appropriate, sample results will be statistically characterized to determine the degree to which the data accurately and precisely represent a characteristic of a population, parameter variation at a sampling point, a process, or an environmental condition. Sample collection, handling, and analytical procedures are designed to obtain the most representative sample possible. Sample handling and analytical procedures also incorporate consideration of obtaining the most representative sample possible. Representative samples will be achieved by the following:

- Collection of samples from locations fully representing site conditions;
- Use of appropriate sampling procedures, including proper equipment and equipment decontamination;
- Use of appropriate analytical methods and project reporting limits for the required parameters; and
- Analysis of samples within the required holding times.

The portion of each sample chosen for analysis also affects sample representativeness. The laboratory will adequately homogenize all samples prior to taking aliquots for analysis to ensure that the reported results are representative of the sample received. Because many homogenization techniques may cause loss of contaminants through volatilization, homogenization will not be performed on samples for VOC analyses.

Sample representativeness will be preserved by using correct field sample collection and handling procedures, properly decontaminating sampling equipment, and using field QC samples, where appropriate. PDB sample collection and equipment decontamination procedures are discussed in Section 1. These procedures will be followed to collect samples that are representative of onsite environmental conditions.

2.3.6 Sensitivity

The concentration of any one target compound that can be detected and/or quantified is a measure of sensitivity for that compound. Sensitivity is instrument-, compound-,

method-, and matrix-specific. The definitions of terms relating to sensitivity and DQOs are presented in Section 2.6.3.

2.4 FIELD MEASUREMENTS

Measurement data for this project will include field data as well as laboratory analytical data. The field measurement data to be collected during groundwater sampling include water-level and total well depth measurements.

2.4.1 Calibration Procedures and Frequency for Field Test Equipment

Instruments and equipment used to gather generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. A summary of calibration, maintenance and decontamination procedures for field equipment is presented in Table 2.1. A summary of calibration frequencies and acceptance criteria for field instruments is presented in Table 2.2

2.4.2 Review of Field Records

All field records will be evaluated for the following QC parameters:

Completeness of field records. The check of field record completeness will ensure that all requirements for field activities in the site-specific work plan have been fulfilled, that complete records exist for each field activity, and that the procedures specified in the QAPP (or approved as field change requests) were implemented. Field documentation will ensure sample integrity and provide sufficient technical information to recreate each field event. The results of the completeness check will be documented, and environmental data affected by incomplete records will be identified in the technical report. The Project Manager will be responsible for ensuring that all scoped field analyses have been performed during the sampling activities at each site. The completeness check will be performed on a daily basis.

Identification of valid samples. The identification of valid samples involves interpretation and evaluation of the field records to detect problems affecting the representativeness of environmental samples. For example, field records can indicate if a well is properly constructed or if unanticipated environmental conditions were encountered during construction. Lithologic and geophysical logs may be consulted to determine if a well was screened only in the water-bearing zone of concern. Records also should note sample properties such as clarity, color, and odor. Photographs may show the presence or absence of obvious sources of potential contamination, such as combustion engines in operation near a well during sampling. Judgments of sample validity will be documented in the technical report, and environmental data associated with poor or incorrect fieldwork will be identified.

TABLE 2.1
INSTRUCTIONS FOR FIELD MEASUREMENT INSTRUMENTATION
CALIBRATION, MAINTENANCE, AND DECONTAMINATION

Parameter	Equipment	Calibration	Source of Calibration Standards	Equipment Maintenance	Equipment Decontamination
Water Level	Water-level indicator and extra batteries.	Calibrated by manufacturer. Periodically check using a tape measure.	Not applicable.	Keep tape clean and dry.	Triple-rinse probe with distilled water after each use. Scrub with Liquid-nox if necessary.

**TABLE 2.2
INSTRUCTIONS FOR FIELD MEASUREMENT INSTRUMENTATION
CONTROL PARAMETERS, CONTROL LIMITS, AND CORRECTIVE
ACTIONS**

Measurement Parameter	Control Checks	Control Limits	Corrective Actions (required if control limits are not achieved)
Water Level (water-level indicator)	Measure weekly against regular use.	± 0.02 foot.	Replace meter tape.

Correlation of data. The results of field tests obtained from similar areas will be correlated. For example, photo-ionization detector (PID) readings and VOC analysis results may be correlated. The findings of these correlations will be documented, and the significance of anomalous data will be discussed in the technical report.

Identification of anomalous field test data. Anomalous field data will be identified and explained to the extent possible. For example, a water temperature for one well that is significantly higher than any other well temperature in the same aquifer will be explained in the technical report.

Accuracy and precision of field data and measurements. The assessment of the quality of field measurements will be based on instrument calibration records and a review of any field corrective actions. The accuracy and precision of field measurements will be discussed. Field record review is an ongoing process. Field team leaders will be responsible for ensuring that proper recording is performed during sampling activities at each site.

2.5 DOCUMENTATION AND CHAIN-OF-CUSTODY PROCEDURES

A Standard Operating Procedure (SOP) providing descriptions of the sampling protocols for this PDBS evaluation is provided in Section 1 of this SAP. Field and laboratory chain-of-custody (COC) procedures are discussed below.

2.5.1 Site, Field, and Equipment Logbooks

Logbooks will be used to document field investigation activities. Parsons investigation personnel will maintain site and equipment logbooks. The site logbook is the master field investigation document that is a bound book with hard cover and sequentially numbered pages. Its primary purpose is to contain within one document the actual field data or references to other field documents that contain a specific description of every activity that has occurred in the field on any given day. Any administrative occurrences, conditions, or activities that have affected the fieldwork will also be recorded in this logbook.

All entries in the site logbook will be signed and dated. The following is a partial list of the types of information to be recorded in the site logbook:

- Name and title of author, date and time of entry, and physical/ environmental conditions during the field activity.
- Name and address of field contact.
- Names and titles of field crew.
- Names, titles, and firm or agency of all site visitors.
- Documentation of health and safety activities.
- Purpose of sampling activity.
- Type of sampled media (e.g., soil gas, soil, and groundwater).
- Sample collection method (e.g., split spoon, grab, composite, etc.).
- Number and volume of samples taken.
- Description of sampling points.
- Date and time of collection.
- Sample identification numbers.
- Sample distribution (e.g., laboratory).
- References for all maps and photographs of the sampling sites.
- Field observations.
- Any field measurements made, such as pH, temperature, water level, PID, etc.
- Decontamination procedures.
- Instrument calibration.
- Records of telephone conversations.
- Weather conditions.
- Project name and job number.
- Date and time of field activities.
- Observations, including descriptions of geologic units and any waste material encountered, staining (if any), presence of odors, etc.

- Sample number, times, and locations (including blind field dup references to parent environmental sample).
- Variations from Work Plan procedures.
- Names of all sampling personnel, subcontractors, and visitors.
- A daily summary of sampling activities.

The purpose of the field equipment logbook is to document the proper use, maintenance, and calibration of field testing equipment. All equipment will be inspected and approved by the field task manager before being used. A calibration log sheet will be maintained for each instrument used on site and will be kept in the field equipment logbook. The field equipment logbook will include:

- Name and identifying number of the instrument.
- Date calibrated.
- Calibration points.
- Identification of the calibrator.
- Manufacturer.
- Lot number.
- Expiration date of calibration standards.
- Results of the calibration.

In addition, field data forms will also be completed and maintained at the sampling site for all field activities.

Field documentation includes chain-of-custody reports used to track samples through the analytical process, analytical worksheets, boring logs, well construction diagrams, well development records, PPFs, and daily reports. These forms will be made part of the permanent record of the fieldwork.

2.5.2 Sample Containment, Preservation, and Labels

Section 1 of this SAP describes in detail the sample handling procedures for this project. The laboratory will provide sample containers, preservatives, labels, chain-of-custody (COC) forms, and shipping coolers to the project site. Properly cleaned sample containers must be used so that no target compound contamination occurs from contact with the sample container. The laboratory will provide documentation attesting to the cleanliness of the containers following their cleaning procedures. A certificate of cleanliness will be provided for any commercially purchased sample containers.

It is equally important to use preservative reagents that are free of target analytes or other contaminants. Preservatives will be added to sample containers by the laboratory

before shipment to the site or by the field sample collection team before containers are sent to the laboratory. The laboratory will provide documentation attesting to the purity and quality of the reagents being provided.

Table 2.3 lists the types of sample containers, sample volumes, methods of preservation, and holding times for each parameter. Field team members will ship laboratory samples directly to the fixed-base laboratory at the end of each sampling day, which will enable the laboratory to analyze the samples within the specified holding times.

Sample labels will be affixed to each container to identify the sample number, collector's name, date and time of collection, location of sampling point, analyses requested, and preservatives added.

TABLE 2.3
REQUIREMENTS FOR CONTAINERS, PRESERVATION TECHNIQUES,
SAMPLE VOLUMES, AND HOLDING TIMES

Name	Analytical Method	Container	Preservation	Minimum Sample Volume or Weight	Maximum Holding Time
Volatile Organics	SW8260B	G, Teflon®-lined septum	HCl to pH<2, 4°C, 0.008% Na ₂ S ₂ O ₃ ^{a/}	3 x 40 ml	14 days

a/ Preservation with 0.008 percent Na₂S₂O₃ is only required when residual chlorine is present.

Acronyms:

G – Glass

HCl – Hydrochloric acid

Na₂S₂O₃ – Sodium thiosulfate

2.5.3 Field Sample Identification

The establishment of a standard sample designation/labeling protocol is essential to ensure adequate QA/QC in regards to the traceability of samples and their associated analytical data. Proper labeling allows for the tracking of samples beginning from the time of sample collection, through analysis, and following project completion should future data correlation be deemed necessary. The proper labeling of samples is also critical in ensuring that samples are analyzed within the required sample holding times as specified by the appropriate analytical methods.

A sample numbering system will be used to identify each sample collected during field investigations, including all field QC samples. The numbering system will be a tracking mechanism to allow retrieval of information about a particular location and to ensure that each sample is uniquely numbered. The field team leader will maintain a listing of sample numbers.

2.5.4 Field Chain-of-Custody Procedures

Sample custody begins in the field at the time of collection and continues throughout the laboratory analytical process. Proper sample custody procedures are needed to ensure that samples have been obtained from the locations stated and that they have reached the laboratory without alteration. All sample bottles shall be maintained onsite in a locked storage area prior to use. Evidence of the sample traceability from collection to shipment, laboratory receipt, and laboratory custody must be documented. A sample is considered to be in a person's custody if the sample is:

- In a person's actual possession,
- In view after being in a person's possession,
- Locked so that no one can tamper with it after having been in physical custody, or
- In a secured area, restricted to authorized personnel.

For samples to be submitted to the fixed-base laboratory, COC forms will be prepared at the time of sample collection and will accompany the samples through the laboratory sample processing. COC forms will be completed **for each sample cooler** for tracking purposes and to provide a written record of all persons handling the samples. Samples analyzed in the field will not require COC forms. The following information will be documented on the COC form for each fixed-base laboratory sample:

- Unique sample identification;
- Date and time of sample collection;
- Source of sample (including name, location, and sample type);
- Designation of MS/MSD;
- Preservative used (traceable to the analytical method);
- Analyses required;
- Cooler number (if more than one);
- Trip blanks (with sample associations);
- Name(s) of collector(s);
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories; and
- Bill of lading or transporter tracking number (if applicable).

Shipments will be sent by common carrier for overnight delivery, and a bill of lading will be prepared. The shipping bill number will be recorded on the COC form. Bills of lading will be retained as part of the permanent project documentation and all sample shipments will be regulated by the USDOT as described in 49 CFR 171 through 177.

2.5.5 Laboratory Chain-of-Custody Procedures

To facilitate the documentation of sample custody, the laboratory will track the progress of sample preparation, analysis, and report preparation. When the laboratory receives the samples, custody information is checked against the samples received for

discrepancies. Laboratory receipt and handling procedures are presented in detail below. Within one day of receipt of samples from the contractor, the laboratory will send signed facsimile copies of all COCs and sample log-in receipt forms to the contractor. All discrepancies and/or potential problems (e.g., lack of sample volume) will be discussed immediately with the contractor's project manager.

The laboratory sample custodian will be required to provide a report to the contractor of any problems observed with any of the samples received. This report will also document the condition of samples, sample numbers received, corresponding laboratory numbers, and the estimated date for completion of analysis. The laboratory must receive written permission from the contractor before sending any samples (originally scheduled to be analyzed at their facility) to another laboratory. Analysis will not be performed on samples whose integrity has been compromised or is suspect.

2.5.5.1 Sample Receipt and Handling

Laboratory sample custody will be maintained using the following procedures:

1. The laboratory will designate a sample custodian responsible for maintaining custody of the samples and all associated paperwork documenting that custody.
2. Upon receipt of the samples, the sample custodian will sign the original COC form and compare the analyses requested with the label on each sample container.
3. A visual assessment of each sample container will be performed to note any anomalies such as broken or leaking bottles, lack of preservation (e.g., ice melted en route) or air bubbles in VOC sample bottles. VOC sample bottles should be shipped inverted. This assessment will be recorded as part of the incoming COC procedure.
4. If the COC and samples correlate, and there has been no tampering with the custody seals, the "received by laboratory" box on the COC form will be signed and dated.
5. Care will be exercised to document any labeling or descriptive errors. In the event of discrepancies, breakage, or conditions that could compromise the validity of analyses (i.e., cooler temperature), the laboratory project coordinator will immediately contact the laboratory PM as part of the corrective action process. If there is a discrepancy on the COC form, the laboratory will call for resolution. If the form requires changes, the laboratory will make changes by drawing a single line through the item requiring correction and initial and date it. If additional information is added to the form, the laboratory will initial and date the changes and note "as per Project Manager". If the cooler temperature is above 6°C, the Project Chemist will be notified and the impact to data quality assessed. Samples will be appropriately qualified during the data validation review.
6. Samples will be logged into the laboratory management computer system, which includes a tracking system for extraction and analysis dates. The laboratory will assign a laboratory work number to each sample for identification purposes. The sample custodian will log the laboratory work number and the field sample identification into a laboratory sample custody log. The laboratory sample custody

log may be either hard copy or computerized, depending on the laboratory's system.

7. The samples will be stored in a secured area at a temperature of approximately 4 ± 2 degrees °C or cooler (as applicable) until analyses commence. The laboratory log should also contain the laboratory storage cooler number (if applicable) in which the sample will be stored while on the laboratory's premises. Samples will be logged when they are removed from and returned to storage for analysis. Samples must be stored in coolers separate from those used to store analytical standards, reagents, and/or QC samples.
8. The samples will be distributed to the appropriate analysts, with names of individuals who receive samples recorded in internal laboratory records.
9. The original COC form will accompany the laboratory report submittal to the contractor and will become a permanent part of the project records.
10. Data generated from the analysis of samples also will be kept under proper custody by the laboratory.

Upon analysis, a laboratory lot control number will be assigned to the sample. All samples within a given laboratory analysis group (e.g., samples sharing the same laboratory QC measurement samples) will have identical laboratory lot control numbers.

Disposal of sample containers and remaining sample material will be the responsibility of the laboratory. Samples should be disposed of appropriately when all analyses and related QA/QC work are completed.

2.5.5.2 Laboratory Sample Identification

The laboratory conducting the analysis of the samples will provide the data user with information on the laboratory sample identification system. With knowledge of this laboratory sample identification system, data generated at the laboratory can be tracked by both the laboratory and field sample identification systems.

Each sample will be logged into the laboratory system by assigning it a unique sample number. This laboratory number and the field sample identification number will be recorded on the laboratory report.

2.5.6 Documentation of Variance

In general, all documents will be completed in permanent black ink. Errors will be corrected by crossing out with a single line and then dating and initialing the correction. The use of correction fluid is not permissible. The documents used during the field investigation will remain on site during the entire effort. Forms used will be organized in a central file also located on site.

2.6 ANALYTICAL METHODS AND QUALITY CONTROL SAMPLES

Application of a specific analytical method depends on the sample matrix and the analytes to be identified. Methods for each of the parameters included in the analytical program are EPA-approved. Analytical procedures will follow the established EPA

methods wherever such methods exist for a specified analyte. The referenced methods are defined in EPA (1995) Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW846, 3rd Edition, Update III.

2.6.1 Field QC Samples (analyzed by fixed-based laboratory)

As a check on field sampling, QA/QC samples will be collected for all fixed-based laboratory analyses during each sampling event. Definitions of field QA/QC samples are presented below. In the event of a conflict with the site-specific QAPP already in use at a site, the site-specific QAPP will take precedence in determining the frequency of field QC samples collected.

2.6.1.1 Field Duplicates/Replicates

A field duplicate or replicate is defined as two or more water (or soil) samples collected independently at the same sampling location during a single act of sampling. Soil samples are divided into two equal parts (replicates) for analysis. Field duplicates will be indistinguishable from other samples by the laboratory. Each of the field duplicates/replicates will be uniquely identified with a coded identifier in the same format as other sample identifiers. Duplicate sample results are used to assess the precision of the sample collection process. During the collection of VOC samples, compositing should not be performed because of the potential for target compound loss. Ten percent of all field samples will be field duplicates.

2.6.1.2 Trip Blanks

The trip blank is used to indicate potential contamination by VOCs during sample shipping and handling. A trip blank consists of analyte-free laboratory reagent water ($\leq 18 \mu$ ohm-cm deionized water) in a 40-milliliter (ml) glass vial sealed with a Teflon® septum. The blank accompanies the empty sample bottles to the field and is placed in each shipping cooler containing VOC samples returning to the laboratory for analysis. The trip blank is not opened until the corresponding site samples are analyzed.

2.6.1.3 Temperature Blank

The temperature blank is used to indicate the temperature of the sample cooler upon receipt at the laboratory. A temperature blank consists of laboratory reagent in a 40-ml glass vial sealed with a Teflon® septum. Any cooler temperature exceeding the allowable 4 ± 2 degrees Celsius ($^{\circ}\text{C}$) must be noted and the project chemist notified prior to sample analyses. The impact to data quality assessed and a decision will be made to proceed with analysis or resample. If the laboratory proceeds with analysis, samples will be appropriately qualified during the data validation review.

2.6.1.4 Equipment Blank

Equipment blanks for the diffusion samplers will consist of $\leq 18 \mu$ ohm-cm deionized water (or equivalent) poured into the sampling bag. The blank will be transferred to a sample bottle appropriate for VOC analysis and transported to the laboratory. The

equipment blanks are analyzed for the same laboratory parameters as the site samples. Equipment blanks are used to measure contamination introduced to a sample set from improperly decontaminated sampling equipment. The equipment blank for this project will also be used as a source blank. One equipment blank will be collected for every site unless otherwise specified in the site-specific QAPP.

2.6.1.5 Source-Water Blank

The source-water blank will consist of distilled/deionized water poured directly from the source-water container into a sample bottle appropriate for VOC analysis and transported to the laboratory. The source-water blanks are analyzed for the same laboratory parameters as the site samples, and are used to measure contamination in the source water used to fill the PDBSs and decontaminate sampling equipment.

2.6.2 Laboratory QC Samples and Analytical Requirements

Laboratory QC samples are necessary to determine the precision and accuracy of the analyses, confirm matrix interferences, and demonstrate target compound contamination of sample results. QC samples will be analyzed routinely by the analytical laboratory as part of the laboratory QC procedures. Contract laboratories performing definitive data quality analyses require a more stringent QC program than those performing screening-level data quality analyses do. Definitions of QC samples and analytical requirements are presented below. Control limits for MS, MSD and LCS samples represent historically established limits determined by control charts by the analytical laboratory. These control limits will be requested from the laboratory.

2.6.2.1 Holding Time

Holding times for sample extraction and/or analysis as required by the methods will be met for all samples. The holding time is calculated from the date and time of sample collection to the time of sample preparation and/or analysis. All sample analyses to include dilutions and second-column confirmation will meet the required holding times. Table 2.3 defines applicable method-specific analytical holding times.

2.6.2.2 Method Blanks

Method blanks are designed to detect contamination of the field samples in the laboratory environment. Method blanks verify that interferences caused by contaminants in solvents, reagents, glassware, or in other sample processing hardware are known and minimized. The method blank will be (≤ 18 $\mu\text{ohm-cm}$ deionized water (or equivalent) for water samples, and a purified solid matrix (Ottawa sand or equivalent) for soil samples. The concentration of target compounds in the blanks must be less than the PRL. Exceptions are not made for common laboratory contaminants. If the blank contaminant concentration is not less than the specified limit, then the source of contamination will be identified, and corrective action will be taken. Sample quantitation limits (SQLs) and detection limits will not be raised because of blank contamination. Analytical data will not be corrected for the presence of analytes in blanks.

2.6.2.3 Laboratory Control Samples

LCSs are blank spikes made from clean laboratory-simulated matrices (reference method blank matrices) spiked with known concentrations of all target analytes of interest. The LCS is carried through the complete sample preparation and analysis procedure. LCSs are designed to check instrument and method accuracy. An LCS will be analyzed with every analytical batch. Failure of the LCS to meet %R criteria requires corrective action before any further analyses can continue. All sample results associated with the out-of-control LCS must be re-extracted and reanalyzed after control has been re-established. All re-extraction and reanalysis must be performed within the sample holding times.

2.6.2.4 Surrogate Spike Analyses

Surrogate spike analyses are used to determine the efficiency of analyte recovery in sample preparation and analysis in relation to sample matrix. Calculated %R of the spike is used to measure the accuracy of the analytical method for an individual sample matrix. A surrogate spike is prepared by adding to an environmental sample (before extraction) a known concentration of a compound similar in type to the target analytes (i.e., a surrogate compound) to be analyzed. Surrogate compounds, as specified in the methods, will be added to all samples analyzed, including method blanks, MS/MSDs, LCSs, field samples, and duplicate samples. Failure of the surrogate to meet %R criteria requires corrective action. All sample results associated with the out-of-control surrogates must be reanalyzed. If the reanalysis does not provide an in control surrogate %R, the sample must be re-extracted and reanalyzed. All re-extraction and reanalysis must be performed within the sample holding time.

2.6.2.5 Matrix Spikes/Matrix Spike Duplicates

MS samples are designed to check the accuracy of the sample matrix (matrix bias) with respect to analytical procedures by analyzing a field sample spiked in the laboratory with a known standard solution containing all the target analytes. An MSD is the second of a pair of laboratory MS samples. The MSDs are designed to check the precision of sample matrix with respect to analytical procedures.

One MS/MSD pair will be collected for every group of 20 project samples of similar matrix. Field blanks or duplicates are not to be used as MS/MSDs. If surrogate and/or target compound concentrations are out of control in the MS or MSD, the out-of-control MS or MSD must be reanalyzed. If the reanalysis does not provide an in-control %R, and evidence of matrix interference is not apparent the MS/MSD pair must be re-extracted and reanalyzed. All re-extraction and reanalysis must be performed within the sample holding time. In cases where the concentration of a target compound in the parent sample is greater than four times the spike concentration of the same compound in the MS/MSD, no re-extraction or reanalysis is required. The MS/MSD results are considered unusable.

2.6.2.6 Analytical Batches

Analytical batches will be designated in the laboratory at a minimum of one batch per sample delivery group (SDG). Each SDG will be composed of a maximum of 20 project samples of similar matrix collected within a 7-day period. Included in each SDG of 20 (or fewer) samples per analytical method will be an analytical batch identification number. This identification number will allow a reviewer to determine the association between field samples and QC samples. Analytical batches also will be inclusive of preparation lots (for methods with extraction processes) and calibration periods (for methods such as SW8260B where the extraction and analysis are simultaneous). The laboratory will, at a minimum, analyze internal QC samples at the frequency specified by the methods. The QC samples for each analytical batch include calibration standards and checks, blanks, an LCS, and a MS/MSD pair (SD and MS for inorganic analyses) per analytical batch.

2.6.2.7 Internal Standards

Internal standards (ISs) are compounds of known concentrations used to quantitate the concentrations of target detections in field and QC samples. ISs are added to all samples (analyzed for GC/MS methods only) after sample extraction or preparation. Because of this, ISs provide for the accurate quantitation of target detections by allowing for the effects of sample loss through extraction, purging, and/or matrix effects. ISs are used for any method requiring an IS calibration. Corrective action is required when ISs are out of control.

2.6.2.8 Control Limits

The acceptance criteria for the control limits associated with all methods will follow guidance established in the SW846 methods and the laboratory's historical data. The laboratory must specify historical accuracy and precision control limits for MS/MSDs, LCSs, and surrogate spikes for each analytical method. Each laboratory reviews and evaluates QC data through the use of method-specific control charts. At least 20 measurements are required before control limits can be established. Warning limits, when established, are set at two standard deviations above and below the mean standard recovery and are used by the laboratory as an indicator of potential impending analytical problems. Upper and lower control limits are defined as three standard deviations above or below the mean standard recovery, respectively, and are used to qualify data accordingly on the basis of out-of-control criteria. The control limits will be historic lab-established limits specific for that laboratory.

Control limits must be carefully reviewed by regulators and the contractor to ensure that the project DQOs will be met. Control limits established through the process described above can provide laboratory historical limits that will not satisfy project DQOs. For example, laboratory historical control limits with a low-end acceptability equivalent to the limit of detection (i.e., the MDL) are possible and not uncommon. Control limits at the limit of detection do not provide for acceptable data quality. In this instance, a re-evaluation of the control limits or an agreed minimum acceptable control limit may be required.

2.6.2.9 Calibration Requirements

Analytical instruments will be calibrated in accordance with the analytical methods and in accordance with the MDL as defined in Section 2.6.3.1. All analytes reported will be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in Table 2.4. The contract laboratory will maintain records of standard preparation and instrument calibration. Records will unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards will be traceable to standard materials.

Analyte concentrations are determined with either calibration curves (linear regression) or response factors (RFs). Calibration curves will be evaluated using a coefficient of determination (r^2), of greater than 0.990 or correlation coefficient (r) of greater than 0.995 acceptability. Calibration curves using the relative standard deviation (RSD) of RFs to determine linearity must meet the acceptability criteria specified within the method. For gas chromatography/mass spectrometer (GC/MS) methods, the average RF from the initial five-point calibration will be used to determine analyte concentrations. The continuing calibration (CCAL) will not be used to update the RFs from the initial five-point calibration. GC/MS methods also will meet all instrument performance and/or tuning criteria as specified by the methods.

2.6.2.9.1 Initial Calibration Verification

Initial calibration (ICAL) curves must be verified using a standard made from a source independent of the one used to make the ICAL standards. All target compounds must be included within the initial calibration verification (ICV), typically at a concentration around the midpoint of the calibration curve. Failure of the ICV requires corrective action as defined in Table 2.4.

2.6.2.9.2 Continuing Calibration and Verification

ICAL curves must be verified daily prior to sample analysis using a CCAL (or CCV). All target compounds must be included within the CCAL, typically at a concentration around the midpoint of the calibration curve. CCALs are required at the beginning and end of each analytical sequence and after every 10 samples analyzed (or as specified in each analytical method). Failure of the CCAL requires corrective action as defined in Table 2.4.

2.6.2.10 Standard Reference Materials

Standard materials used in calibration and to prepare samples will be traceable to National Institute of Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA), or other equivalent approved source, if available. The standard materials will be current, in accordance with the following expiration policy: The expiration dates for ampulated solutions will not exceed the manufacturer's expiration date or 1 year from the date of receipt, whichever occurs first. Expiration dates for laboratory-prepared stock and diluted standards will be no later than the expiration date of the stock solution or material, or the date calculated from the holding time allowed by the applicable analytical method, whichever occurs first. The laboratory will label standard and QC materials with expiration dates.

**TABLE 2.4
SUMMARY OF CALIBRATION AND QC PROCEDURES**

Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Volatile Organics SW8260B	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥ 0.30 (>0.10 for bromoform and >0.01 for chloromethane and 1,1-dichloroethane); and RSD for all calibration analytes $\leq 30\%$	Correct problem then repeat initial calibration
	Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration
	Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check
	Calibration verification	Daily, before sample analysis, every 12 hours of analysis time, and at end of analysis sequence	SPCCs average RF ≥ 0.30 , and CCCs $< 20\%$ drift; and all calibration analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration
	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria
	Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description	Retune instrument and verify

**TABLE 2.4 (Continued)
SUMMARY OF CALIBRATION AND QC PROCEDURES**

Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Volatile Organics	IS	Every sample, spiked sample, standard, and method blank	Retention time ± 30 seconds: EICP area within -50% to +100% of last calibration verification (12 hours) for each	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning
SW8260B	Method blank	One per analytical batch	No analytes detected > PRL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank
(Cont'd)	LCS for all analytes	One LCS per analytical batch	QC acceptance criteria	Correct problem then reprep and analyze the LCS and all samples in the affected analytical batch
	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria	Correct problem then reextract and analyze sample
	MS/MSD	One MS/MSD per every 20 project samples per matrix	QC acceptance criteria	Re-extract and re-analyze the MS and MSD sample within holding time
	MDL study	Once per year	Detection limits established shall meet QAPP-established criteria	Re-establish MDL
	Results reported between MDL and PRL	None	None	None

Note: All corrective actions associated with project work will be documented, and all records will be maintained by the laboratory.

2.6.3 Detection and Quantitation Limits

This section describes the terms, definitions, and formulas that will be used for detection and quantitation limits.

2.6.3.1 Method Detection Limit

The MDL is the lowest concentration at which a specific analyte in a matrix can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero. MDLs are experimentally determined and verified for each target analyte of the methods in the sampling program. The laboratory will determine MDLs for each analyte and matrix type prior to analysis of project samples. In addition, when multiple instruments are employed for the analysis of the same method, each individual instrument will maintain a current MDL study. MDLs are based on the results of seven matrix spikes at the estimated MDL, and are statistically calculated in accordance with the Title 40, Code of Federal Regulations Part 136 (40 CFR 136) Appendix B. The standard deviation of the seven replicates is determined and multiplied by 3.14 (i.e., the 99-percent confidence interval from the one-sided student t-test). If risk-based project objectives are developed, then where practicable, MDLs must be lower than the risk-based criteria determined for the project.

The MDLs to be used are intended to allow that both nondetected and detected target compound results will be usable to the fullest extent possible for the project. An MDL check sample (interference-free MS with all method target compounds) must be analyzed following the MDL study to determine if reasonable MDL concentrations have been achieved. The MDL check sample should be at a concentration of approximately two times the MDL. If any target compound is not recovered, the MDL study must be repeated. In this case, the repeated MDL should be performed with a higher concentration, based on the analyst's judgment, of the target compounds that failed in the MDL check sample. MDLs must be determined annually at a minimum, and verified quarterly by analyzing an MDL check sample.

2.6.3.2 Sample Quantitation Limit

SQLs are defined as the laboratory reporting limit multiplied by the dilution factor (DF) required to analyze the sample, and corrected for moisture or sample size. These adjustments may be due to matrix effects or to the high concentrations of some analytes. For example, if an analyte is present at a concentration that is greater than the linear range of the analytical method, the sample must be diluted for accurate quantitation. The DF raises the reporting limit, which then becomes the SQL. Because the reported SQLs take into account sample characteristics and analytical adjustments, they are the most relevant quantitation limits for evaluating nondetected chemicals.

2.6.3.3 Project Reporting Limit

PRLs for this project are site-specific and will be presented in the site-specific work plans. Laboratory reporting limits for each target compound are referred to as practical quantitation limits (PQLs). PQLs are laboratory-specific concentrations based on the

MDL for each target compound. The PQLs will be equivalent to the concentration of the lowest calibration standard for organic analyses. The lowest calibration standard for all target compounds will be at a concentration between three and ten times the MDL. The PQL, and therefore the lowest calibration standard, must not exceed regulatory action levels (where practicable) for any target compound.

All target compound detections will be reported at or above the MDL for each analyte. All results above the MDL, but below the PQL, will be qualified in the data deliverable from the laboratory with a “J” flag for organic compounds or “B” flag for inorganics (metals). The “J or B” flags will denote the sample result as below the PQL, and as an estimated quantitative value. Laboratories must verify the PQLs by analyzing a standard at or below the PQL on a weekly basis at a minimum.

2.6.4 Reporting Units

The prescribed reporting units for all analytical methods are as follow:

- Soil samples - organics: micrograms per kilogram ($\mu\text{g}/\text{kg}$), dry-weight basis;
- Soil samples - inorganics/metals: milligrams per kilogram (mg/kg), dry-weight basis;
- Water samples - inorganics/metals: milligrams per liter (mg/L);
- Water samples - organics: micrograms per liter ($\mu\text{g}/\text{L}$), and

All analytical results for soils (both non-detected and detected) will be reported on a dry-weight basis (i.e., corrected for moisture content). The moisture content for each soil sample will be reported. The equation for moisture content given for the Method SW3550 is as follows:

$$\frac{\text{Initial Weight} - \text{Dried Weight}}{\text{Initial Weight}} \times 100 = \% \text{ moisture}$$

The result for the sample on a dry-weight basis is as follows:

$$\frac{\text{Result of analysis on wet-weight basis}}{100 - \% \text{ Moisture}} = \text{Result of analysis on a dry-weight basis}$$

2.7 LABORATORY DATA REVIEW AND REPORTING

The following sections describe laboratory data review and reporting.

2.7.1 Review Procedures for Definitive Data

The laboratory review of definitive data is a four-step process involving an evaluation by the analyst, a peer review, an administrative review, and a QA review. A checklist to document each of the review processes will be required and must be included as part of the final data deliverable to the contractor. All steps are described below.

The analyst will review 100 percent of all definitive data prior to reporting. The establishment of detection and control limits will be verified. Any control limits outside of the acceptable ranges specified in the analytical methods will be identified. Any trends or problems with the data will be evaluated. The absence of records supporting the establishment of control criteria or detection limits will be noted. Analytical batch QC, calibration check samples, ICALs, CCVs, corrective action reports, the results of reanalysis, sample holding times, and sample preservations will be evaluated.

Samples associated with out-of-control QC data will be identified in the data package case narrative, and an assessment of the utility of such analytical results will be made. The check of laboratory data completeness must be documented and will ensure that:

- All samples and analyses specified in the COC have been processed;
- Complete records exist for each analysis and the associated QC samples; and
- Procedures specified in this QAPP have been implemented.

An analyst other than the original data processor will be responsible for performing a peer review of all steps of the data processing. A minimum of 25 percent of all data will be reviewed. All input parameters, calibrations, and transcriptions will be checked. All manually input, computer-processed data will be checked. Data review checklists will be used to document second level/peer review.

QC sample results (LCSs, MS/MSDs, surrogates, and ICAL and CCAL standards) are compared against stated criteria for accuracy and precision. QC data must meet acceptance levels prior to processing the analytical data. If QC standards are not met, the cause will be determined. If the cause can be corrected without affecting the integrity of the analytical data, processing of the data will proceed. If the resolution jeopardizes the integrity of the data, reanalysis will occur.

An administrative review will be performed by the laboratory project manager on each data deliverable package. The review will ensure that all requirements of the laboratory and the data deliverable have been met and are complete.

A review of at least 10 percent of all data deliverable packages from a laboratory QA officer must take place prior to the administrative review and final release of the data deliverable to the contractor. The data packages will be randomly selected for review.

Decisions to repeat sample collection and analyses may be made by the contractor project manager based on the extent of the deficiencies and their importance in the overall context of the project.

2.7.2 Laboratory Data Reporting Flags

The laboratory must use the following qualifiers when reporting sample results.

2.7.2.1 Laboratory Organic Data Reporting Qualifiers

The laboratory must use the following qualifiers when reporting results of organic analyses:

- Value-** If the result is a value greater than or equal to the PQL, the value is reported.
- U-** Indicates the compound was analyzed for but not detected. The number is the project reporting limit (e.g., the nondetect limit) for the sample.
- J-** Indicates an estimated value. This flag is used to estimate a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate identification criteria, but the result is less than the specified detection limit. This flag will also be used to identify values falling between the MDL and the PQL.
- C-** Applies to PCB parameters when the identification has been confirmed by GC/MS.
- B-** Used when the analyte is found in the blank, as well as a sample. It indicates possible/probable blank contamination and warns data user to take appropriate action.
- E-** Identifies compounds whose concentrations exceed the calibration range of the instruments for specific analysis.
- D-** Identifies all compounds analyzed at a secondary dilution.
- A-** Indicates that a tentatively identified compound (TIC) is a suspected aldol-condensation product.
- X-** Any other specific flags and footnotes that may be required to properly define the results.
- RE-** Analysis performed on a re-extracted sample.

2.7.2.2 Laboratory Inorganic Data Reporting Qualifiers

The laboratory must use the following qualifiers when reporting results of inorganic analyses.

Concentration Qualifiers:

- B-** The reported value was obtained from a reading that was less than the PQL, but greater than or equal to the MDL or instrument detection limit (IDL).
- U-** The analyte was analyzed for but not detected. The number is the project reporting limit (e.g., the nondetect limit) for the sample.

- Q-** Qualifier for specified entries:
- E-** The reported value is estimated due to the presence of interference(s).
- M-** Duplicate injection precision not met.
- N-** Spike sample recovery not within control limits.
- S-** The reported value was determined by the method of standard additions (MSA).
- W-** Post-digestion spike for GFAA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.
- *-** Duplicate analysis not within control limits.
- +-** Correlation coefficient for the MSA is less than 0.995.
- D-** Spike level under IDL with dilution.

(The use of "S", "W", or "+" is mutually exclusive. No combination of these qualifiers should appear in the same field for an analyte.)

Method Qualifiers:

- P-** ICP.
- A-** Flame atomic absorption (FAA).
- F-** Furnace AA.
- CV-** Manual cold-vapor AA.
- AV-** Automated cold-vapor AA.
- AS-** Semi-automated spectrophotometric.
- C-** Manual spectrophotometric.
- T-** Titrametric.
- NR-** Analyte not required to be analyzed.

2.7.3 Data Deliverables

The following deliverables will be required of the laboratory.

2.7.3.1 Hardcopy Data Deliverables

Data deliverables required for the analytical results include both a hard copy and an electronic copy. Hardcopy reporting of analytical results is defined in Table 2.5. The laboratory will be required to provide two copies of each hard copy data-reporting package.

2.7.3.2 Electronic Data Deliverables

To facilitate data handling and management, both field and laboratory data will be entered into a computerized format. All data entered into the electronic data files will correspond to the data contained in the original laboratory reports and other documents associated with sampling and the laboratory hard copy data deliverable packages. The subcontracting laboratories standard electronic data deliverable (EDD) will be used for electronic data reporting.

2.7.3.3 QA Reports

At monthly intervals beginning with the initiation of sampling activities, the laboratory will submit to the contractor's project task manager QA report that documents laboratory-related QA/QC issues. These reports will include discussions of any conditions adverse or potentially adverse to quality, such as:

- Responses to the findings of any internal or external systems or performance laboratory audits;
- Any laboratory or sample conditions that necessitate a departure from the methods or procedures specified in this QAPP;
- Any missed holding times or problems with laboratory QC acceptance criteria; and
- The associated corrective actions taken.

Submittal of QA reports will not preclude earlier contractor notification of such problems when timely notice can reduce the loss or potential loss of quality, time, effort, or expense. Appropriate steps will be taken to correct any QA/QC concerns as they are identified. The QA reports and a summary of the laboratory QA/QC program and results will be included in the final project report.

2.8 CONTRACTOR DATA REVIEW PROCESS

The data review process is performed in two phases. The initial phase, contract compliance screening (CCS), consists of inspecting the laboratory data deliverables to determine if the contract requirements were met. The second phase, data validation, includes a review of data results to assess data usability and application of data qualifiers to the analytical results based on adherence to method protocols and laboratory-specific QA/QC limits. Method SW8260B will undergo data validation.

**TABLE 2.5
REQUIRED HARDCOPY LABORATORY DELIVERABLES**

Method Requirements	Laboratory Deliverables (Definitive Data)
Requirements for all methods:	
Case narrative	Project identification
	Analytical method description and reference citation
	Discussion of unusual circumstances, problems, and nonconformances
Monthly quality assurance (QA) report	Any format to discuss issues which may affect data quality
Chain-of-custody (COC) form	Signed and dated when samples were received at laboratory
Dates of sample preparation and analysis (including first run and subsequent runs).	Specific deliverable depends upon type of analysis
Quantitation limits achieved.	Specific deliverable depends upon type of analysis
Dilution or concentration factors.	Specific deliverable depends upon type of analysis
Summary analytical batch report including analytical batch samples, method of analysis, matrix description, date of sample collection and receipt, laboratory identification number of each environmental sample plus identification number of each batch quality control (QC) sample (including matrix spike/matrix spike duplicate (MS/MSD), calibration check, etc.).	Any format
Method reporting limits	QC summary report
QC limits	QC summary report
Corrective action reports.	Any format
Laboratory data validation/review checklists	Any format
Percent moisture for all soil samples	Any format
Requirements for organic analytical methods:	
Sample data sheets	Summary information only ^{a/}
Surrogate recoveries	Summary information only
MS/MSD	Summary information only
Method blank analysis	Summary information only
Laboratory control spike (LCS)	Summary information only
Internal standard area and retention time summary data	Summary information only

**TABLE 2.5 (Continued)
REQUIRED HARDCOPY LABORATORY DELIVERABLES**

Method Requirements	Laboratory Deliverables (Definitive Data)
Requirements for organic analytical methods (Cont'd):	
Analysis run log	Any format
Requirements for inorganic analytical methods Metals:	
Sample data sheets	Summary information only *
Method blank, taken through sample preparation preparation.	Summary information only
Laboratory control spike/laboratory control spike duplicate	Summary information only
Matrix spike/matrix spike duplicate	Summary information only
Post-digestion spike sample recovery	Summary information only
Method of standard additions	Summary information only
Analysis run logs	Any format

- a) Summarized results can be in any format that provides the necessary data to completely validate that QC parameter. Example formats are the forms equivalent to those defined for the EPA Contract Laboratory Program or SW846 programs.

2.8.1 Contract Compliance Screening

CCS is the review of sample data deliverables for completeness and compliance with project requirements. Completeness is evaluated by ensuring that all required data deliverables are received in a legible format with all required information. The CCS process also includes a review of the COC forms, case narratives, and PRLs. Sample resubmission requests, documentation of nonconformances with respect to data deliverable completeness, and corrective actions often are initiated during the CCS review.

2.8.2 Data Validation

Following completion of the CCS process, an EPA Level III-type validation will be performed on 10 percent of all analytical results. Because this project does not involve regulatory compliance monitoring, 100% validation of the data is not necessary. The 10% validation will be selected from the first round of analyses so that potential problems can be identified early. The validation process includes a review of summary information to determine adherence to analytical holding times; results from analysis of field duplicates, method blanks, field blanks, surrogate spikes, MS/MSDs, LCSs, and sample temperatures during shipping and storage. The results of the CCS process are incorporated into the data validation process. Data qualifiers are applied to analytical results during the data validation process based on adherence to method protocols and laboratory-specific QA/QC limits.

The validation guidelines defined in Table 2.6 were developed in accordance with the National Functional Guidelines for Organic Data Review (EPA, 1994) as modified for the specific analytical method. Expanded criteria for the validation guidelines were developed where professional judgment is recommended within the EPA guidelines. QC guidelines are those specified in the analytical method protocols.

Data qualified as rejected will be assessed as to their critical importance. If required the samples will be recollected and reanalyzed.

2.8.3 Data Validation Qualifiers

The following definitions provide explanations of the EPA (1994b) qualifiers to be assigned to analytical results during data validation, in accordance with Table 2.6. The data qualifiers described are applied to both inorganic and organic results.

- U** - The analyte was analyzed for and is not present above the reported SQL.
- J** - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be considered as a basis for decision-making and are usable for many purposes.
- R** - The data are rejected as unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte was not verified. Resampling and reanalysis are necessary to confirm the presence or absence of the analyte.
- UJ**- The analyte was not present above the reported SQL. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in the sample.

2.8.4 Assessment of Data Usability

Data from QC samples will be assessed by the contractor using the procedures and criteria presented earlier in this section. In addition, the contractor will assess the usability of analytical data. Any limitations on data use will be expressed quantitatively to the extent practicable. This data usability review will include a review of the analytical methods, quantitation limits, and other factors important in determining the PARCC parameters. The outcome of this data review will be a data set appropriate to support project-specific DQOs. A data quality assessment (DQA) will be written and submitted by the contractor, if required, summarizing the findings of the review, and providing an assessment of overall data quality and usability.

TABLE 2.6
FLAGGING CONVENTIONS FOR DATA EVALUATION AND VALIDATION
OF ORGANIC METHODS

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for extraction or analysis by > 2 times	J detects R non-detects	Sample
	Holding time exceeded for extraction or analyses by < 2 times	J detects UJ non-detects	Sample
Sample Preservation	Sample not preserved	J detects UJ non-detects	Sample
Temperature Blank	>8°C	J detects UJ non-detects	All samples in same cooler
	>20°C (Volatile Compounds)	R all results.	All samples in same cooler
Tune	Ion abundance criteria	J detects UJ non-detect results	All associated samples in analysis batch
	Set critical ions as defined in SW846	R all detects R non-detects	All associated samples in analysis batch
ICAL	GC/MS: RRF <0.05	R non-detects J detects	Compound in all associated samples in analysis batch
	%RSD ≥30% and all initial calibration RRF ≥0.05	UJ non-detects J detects	Compound in all associated samples in analysis batch
	If %RSD >2X control criteria	R all detects R non-detects	Compound in all associated samples in analysis batch
CCAL	GC/MS: %D ≥25% and RRF≥0.05	J detects UJ non-detects	Compound in all associated samples in analysis batch
	If %D is >2X control criteria	R all detects R non-detects	Compound in all associated samples in analysis batch
	RRF <0.05	J detects R non-detects	Compound in all associated samples in analysis batch
LCS and LCSD	LCS or LCSD single compound: %R < ½ LCL or 30% (whichever is lower)	R all detects R non-detects	Spiked compound only in all associated samples.
	%R >UCL but < UCL + ½ UCL	J detects No qualification for non-detects	Spiked compound only in all associated samples.

TABLE 2.6 (Continued)
FLAGGING CONVENTIONS FOR DATA EVALUATION AND VALIDATION
OF ORGANIC METHODS

Quality Control Check	Evaluation	Flag	Samples Affected
	% R \geq 1/2 LCL or 30% (whichever is lower) but < LCL	J detects UJ non-detects	Spiked compound only in all associated samples.
	% R >UCL + 1/2 UCL	R all detects No qualification for non-detects	Spiked compound only in all associated samples.
	If \geq 50% of all LCS or LCSD spiked compounds are out of control	R all detects R non-detects	All detected spike compounds in all samples
	RPD >control limit	J detects	All detected spike compounds in all samples
Method Blank	Multiply value by 5, common lab contaminants multiply by 10 (common lab contaminants: methylene chloride, acetone, 2-butanone, and phthalates)	U flag reported results < calculated value	All samples in extraction batch
Equipment Blank	Convert to soil units, if applicable, multiply by 5, common lab contaminants multiply by 10 (common lab contaminants: methylene chloride, acetone, 2-butanone, and phthalates)	U flag reported results < calculated value	All associated samples
Trip Blank	Convert to soil units, if applicable, multiply by 5, common lab contaminants multiply by 10 (common lab contaminants: methylene chloride, acetone, 2-butanone, and phthalates)	U flag reported results < calculated value	All volatile samples shipped in the same cooler
MS/MSD	MS or MSD single compound: %R < 1/2 LCL or 10% (whichever is lower)	R all detects R non-detects	Affected compound in native sample MS/MSD
	%R >UCL but < UCL + 1/2 UCL	J detects No qualification for non-detects	Affected compound in native sample MS/MSD
	% R \geq 1/2 LCL or 10% (whichever is lower) but < LCL	J detects UJ non-detects	Affected compound in native sample MS/MSD
	% R >UCL + 1/2 UCL	R all detects No qualification for non-detects	Affected compound in native sample MS/MSD
	If \geq 50% of all MS or MSD spiked compounds are out of control:	R all detects R non-detects	All compounds in native sample

TABLE 2.6 (Continued)
FLAGGING CONVENTIONS FOR DATA EVALUATION AND VALIDATION
OF ORGANIC METHODS

Quality Control Check	Evaluation	Flag	Samples Affected
	When sample conc. is >4X spike conc.	No evaluation required	None
	RPD > control limit	J detects	Affected compound in native sample MS/MSD
Surrogates GC/MS VOCs	%R > UCL	J detects	All compounds in associated sample
	%R < LCL and $\geq 10\%$	J detects UJ non-detects	All compounds in associated sample
	%R < 10%	J detects R non-detects	All compounds in associated sample
Internal Standards (IS) (GC/MS)	RT change > UCL from daily CCAL	R all detects R non-detects	All associated compounds in sample
	IS extracted ion area counts < -50% to +100% of last CCAL	J detects UJ non-detects	All associated compounds in sample
	IS extracted ion area counts > +100% of last CCAL	J detects No qualification for non-detects	All associated compounds in sample
	IS extracted ion area counts < 10% of last CCAL	R all detects R non-detects	All associated compounds in sample
Retention Time Windows (RTW)	Analyte peak not within RTW	Report detects as non-detect, (professional judgment should be used prior to eliminating detections)	All affected compounds
Field Duplicates	RPD > 35% water or soil	Discuss impacts in data quality assessment report	Field duplicate pair

Acronyms:

- %D - Percent difference.
- %R - Percent recovery.
- CCAL - Continuing calibration
- GC/MS - Gas chromatograph/mass spectroscopy
- HPLC - High performance liquid chromatography
- ICAL - Initial Calibration
- LCL - Lower control limit
- LCS - Laboratory control sample
- LCSD - Laboratory control sample duplicate
- MS/MSD - Matrix spike/matrix spike duplicate
- NFG - National Functional Guidelines
- PCB - Polychlorinated biphenyl
- RPD - Relative percent difference
- RRF - Relative response factor

RT	- Retention time
RSD	- Relative standard deviation
SVOC	- Semivolatile organic compounds
UCL	- Upper control limit
VOCs	- Volatile organic compounds

2.9 CORRECTIVE ACTION

The following procedures have been established to ensure that conditions adverse to data quality are promptly investigated, evaluated, and corrected. Adverse conditions may include malfunctions, deficiencies, deviations, and errors. When a significant condition adverse to data quality is noted at the laboratory or in the field, the cause of the condition will be determined and corrective action will be taken to prevent repetition. Condition identification, cause, reference documents, and corrective action planned will be documented and reported to the contractor project QA officer by the laboratory QA officer. Following implementation of corrective action, the laboratory QA officer will report the actions taken and their results to the contractor Project Manager and QA Officer. A record of the action taken and results will be attached to the data report package. If samples are reanalyzed, the assessment procedures will be repeated, and the control limits will be reevaluated to ascertain if corrective actions have been successful.

Implementation of corrective action is verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to identify, report, and solicit approval of corrective actions for conditions adverse to data quality.

Corrective actions will be initiated in the following instances:

- When predetermined acceptance criteria are not attained (objectives for precision, accuracy, and completeness);
- When the prescribed procedure or any data compiled are faulty;
- When equipment or instrumentation is determined to be faulty;
- When the traceability of samples, standards, or analysis results is questionable;
- When QA requirements have been violated;
- When designated approvals have been circumvented;
- As a result of systems or performance audits;
- As a result of regular management assessments;
- As a result of intralaboratory or interlaboratory comparison studies; and
- At any other instance of conditions significantly adverse to quality.

Laboratory project management and staff, such as QA auditors, document and sample control personnel, and laboratory groups, will monitor work performance in the normal course of daily responsibilities.

The Laboratory QA Officer or designated alternate will audit work at the laboratory. Items, activities, or documents ascertained to be compliant with QA requirements will be documented, and corrective actions will be mandated in the audit report. The contractor Project QA Officer and Laboratory QA Officer will log, maintain, and control the audit findings.

The contractor Project QA Officer and Laboratory QA Officer are responsible for documenting all out-of-control events and nonconformances with QA protocols. The QC checks, their frequency, acceptance criteria, and corrective actions for out-of-control data are summarized in Table 2.4 for each analytical method. A nonconformance report will summarize each nonconformance condition. No specific format for the nonconformance report is required. The report should state the problem and address the laboratory's process for corrective action. The laboratory will notify the contractor Project Manager or QA Officer of any laboratory QA/QC nonconformance upon discovery. Copies of all field change requests and corrective action forms will be maintained in the project files. The contractor may initiate a stop-work order if corrective actions are insufficient.

2.10 FINAL SAMPLE DISPOSITION

Upon completion of all required analyses and acceptance of the data reported to the contractor, the laboratory will be responsible for proper disposal of any remaining samples, sample containers, shipping containers, and Styrofoam™ or plastic packing materials in accordance with sound environmental practice, based on the sample analytical results. Unused samples and containers found to be non-hazardous will be disposed of after 60 days following completion of the analysis unless the contractor requests the storage of the sample. However, the laboratory will give prior notification to and receive the approval of the contractor before disposing of any remaining samples. The laboratory will maintain proper records of waste disposal methods, and will have disposal company contracts on file for inspection.

2.11 SUBCONTRACT LABORATORY SERVICES OTHER THAN THE PRIME LABORATORY

The laboratory will assume responsibility for providing all analytical services specified in the laboratory agreement. Should it be agreed in writing that the laboratory may use an additional subcontract laboratory facility, the primary laboratory will supply to the contractor the SOPs, MDL studies, verification of certifications, and QA plans for the other laboratories that are used. The laboratory will be responsible for communicating all analytical guidelines and QC requirements of the project to these laboratories. The QA Officers from both the primary laboratory and the contractor will monitor the data from subcontract laboratories and correct any QC nonconformance.

SECTION 3

REFERENCES

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- EPA. 1999. EPA Requirements for Quality Assurance Project Plans. EPAQA/R-5. Washington D.C. November

APPENDIX C – PROJECT HEALTH AND SAFETY PLAN

**PROGRAM HEALTH AND SAFETY PLAN FOR
REMEDIAL PROCESS OPTIMIZATION SUPPORT AND
DEMONSTRATION OF PASSIVE DIFFUSION BAG SAMPLING
TECHNOLOGY
AT SEVERAL DEPARTMENT OF DEFENSE INSTALLATIONS**

Prepared for:

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February 2002

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
ANSI	American National Standards Institute
APR	Air Purifying Respirator
BEI	Biological exposure index
°C	Degrees Celsius
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	Cardiopulmonary resuscitation
dB	Decibels
DCE	Dichloroethene
DO	Delivery Order
DoD	Department of Defense
ECT	Equivalent chill temperature
eV	Electron volt
°F	Degrees Fahrenheit
GC	Gas chromatograph
HEPA	High efficiency particulate air
IDLH	Immediately dangerous to life or health
LEL	Lower explosive limit
mA	Milliamp
MPH	Miles per hour
MSDS	Material safety data sheet
mu	Meter units
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
Parsons	Parsons Engineering Science, Inc.
PCE	Perchloroethene
PDBS	Passive Diffusion Bag Sampler
P.E.	Professional Engineer
P.G.	Professional Geologist
PEL	Permissible exposure limit
PID	Photoionization detector
POV	Personally-owned vehicle
PPE	Personal protection equipment
ppmv	Parts per million, volume per volume
QAE	Quality Assurance Evaluator
QA/QC	Quality assurance/quality control

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SAR	Supplied air respirator
SCBA	Self-contained breathing apparatus
SHSO	Site health and safety officer
TCE	Trichloroethene
TLV	Threshold limit value
TWA	Time-weighted average
USACE	US Department of the Army, Corps of Engineers
V	Volt

SECTION 1

PURPOSE AND POLICY

The purpose of this program health and safety plan is to establish protection standards and mandatory safety practices for all Parsons Engineering Science, Inc. (Parsons) and subcontractor personnel involved in field activities to support Remedial Process Optimization (RPO) evaluations; and to demonstrate the effectiveness of Passive Diffusion Bag Samplers (PDBSs) at selected US Air Force (USAF) and other Department of Defense (DoD) installations. The goal of this safety program is to conduct the entire project with **zero accidents**. All task activities shall be designed for zero accidents. This plan provides guidance for safe operations on remediation study sites and provides for contingencies that may arise during field operations. Site-specific information is not included in this plan and will be addressed in the formal health and safety plan addenda for each installation. All Parsons field team members and subcontractors are responsible for reading and conforming to this plan and the associated addenda. All personnel will be required to sign the Plan Acceptance Form located in Appendix B. No employee will perform a project activity that he or she believes may endanger his or her health and safety or the health and safety of others.

All personnel must share responsibility in performing all work in such a manner and under such conditions to preclude or minimize the possibility of damage to property or injury to themselves or others. Carelessness or disregard of accepted safety, health, and fire protection standards will not be tolerated. Any field team member who does not comply with established safety procedures may be subject to immediate dismissal from the site.

A project description and scope of work summary for the project are provided in Section 2. Section 3 presents the project team organization, personnel responsibilities, and lines of authority. Training and medical monitoring requirements are contained in Section 4. Section 5 presents a safety and health risk analysis. Section 6 contains the program emergency response plan. Program requirements for levels of protection are included in Section 7, and air-monitoring procedures are provided in Section 8. Site control measures, including designation of site work zones, are contained in Section 9, and Section 10 provides decontamination procedures. Section 11 contains information on the use and calibration of air monitoring equipment. Appendix A contains an example of an Emergency Contacts Form to be used in each formal health and safety plan addendum prepared for all investigation sites. Appendix B contains a Plan Acceptance Form, Site-Specific Training Record Form, Field Experience Documentation Form, Air Monitoring Data Forms, Accident Report Form, Near-Miss Incident Form, Shipping Paper, and Respirator Use Forms. Appendix C contains job safety analyses for project activities.

SECTION 2

PROJECT DESCRIPTION AND SCOPE OF WORK

2.1 PROJECT DESCRIPTION

Under this Delivery Order (DO), Parsons will provide services to the US Department of the Army, Corps of Engineers (USACE) and the Air Force Base Conversion Agency (AFBCA) to conduct extensive evaluations of existing remediation systems, and to evaluate the use of PDBSs in existing groundwater monitoring programs at selected USAF and other DoD installations. The PDBS evaluation will be performed using existing groundwater monitoring wells at the installations.

2.2 SCOPE OF WORK

RPO field activities may include soil and groundwater sampling with the use of a hollow-stem auger drilling rig, a Geoprobe[®] direct-push rig, or a cone penetrometer rig.

PDBS site activities will involve the placement of a water-filled diffusive membrane capsule in a well installation device at a specified depth in a groundwater monitoring well. After a specified period of time, the water in the sampler is transferred to a sample container and submitted for laboratory analysis. No drilling or ground-intrusive activities are anticipated under the current scope of PDBS work.

SECTION 3

PROGRAM TEAM ORGANIZATION

The project team assigned to the RPO and PDBS evaluations, their responsibilities, and lines of authority are outlined below.

<u>Name</u>	<u>Task Assigned</u>
Mr. Ed Bishop, P.E.	Program Manager
Mr. Peter Guest, P.E.	Project Manager/RPO Task Manager
Mr. Doug Downey, P.E.	Technical Director
Mr. John Hicks, P.G	PDBS Task Manager
Mr. Timothy Mustard, C.I.H.	Program Health and Safety Manager
To Be Assigned	Site Managers
To Be Assigned	Site Health and Safety Officers
To Be Assigned	Alternate Health and Safety Officers
Mr. Mark Mercier	USACE Project Manager
Mr. Rafael Vazquez	AFCEE Point of Contact (POC)
Mr. David Becker	USACE POC
Mr. Mario Ierardi	AFBCA POC

The RPO/PDBS team will operate under the leadership of the program manager, Mr. Ed Bishop, and the project manager, Mr. Peter Guest.

The project manager, Mr. Peter Guest, will coordinate all activities to meet the requirements of the scope of work and ensure technical review of all deliverables. The activities will include meetings, document reviews, monthly reporting, and project management activities. He will be responsible for coordinating with the USACE project manager, Mr. Mark Mercier, and the AFCEE, USACE, and AFBCA POCs, Rafael

Vazquez, David Becker, and Mario Ierardi, respectively. As RPO task manager, Mr. Guest will be responsible for the execution of all phases of RPO work on this project.

The technical director, Mr. Doug Downey, is responsible for conduct and review of all technical work on this project to ensure technical accuracy and adequacy. He will provide advice to the project manager and project personnel on technical issues.

The PDBS task manager, Mr. John Hicks, is directly responsible for the execution of all phases of PDBS work on this project. He is responsible for planning, staffing, assuring adequate planning for health and safety and quality assurance/quality control (QA/QC), execution of each phase, coordination with AFCEE, and interpretation of data and reporting. The PDBS task manager will also coordinate with the site managers to obtain permission for site access, coordination of activities with appropriate officials, and serve as the liaison with base officials. The PDBS task manager will also ensure that quality work is accomplished on schedule.

The program health and safety manager, Mr. Timothy Mustard, CIH, will ensure that all field activities are performed with strict adherence to OSHA requirements and this program health and safety plan. He will be responsible for updating and revising the program health and safety plan, as needed, and for ensuring that all field team members meet health and safety training and medical monitoring requirements.

The site health and safety officer (SHSO) along with the project manager is responsible for ensuring that day-to-day project activities are performed in strict conformance with the program health and safety plan. Through action and example, the SHSO will instill a sincere attitude toward the zero accident philosophy for this program, and will help field personnel develop a better understanding of accident prevention and loss control. The SHSO, project manager, and program health and safety manager have the authority to stop work if actions or conditions are judged to be unsafe or not in conformance with the program health and safety plan.

The site manager will support the project manager for the specific work the team will accomplish at each site and will be responsible for scheduling and coordinating the testing activities at the respective sites. The site manager will assist the project manager in the day-to-day organization and execution of the various project tasks. The site manager will also apply the zero accident philosophy in designing field tasks. He will use any downtime in the field for safety training and educational purposes, to the extent possible.

SECTION 4

SITE-SPECIFIC EMPLOYEE TRAINING AND MEDICAL MONITORING REQUIREMENTS

The Parsons corporate health and safety manual, incorporated by reference, presents general requirements for Parsons employee training and medical monitoring. All field team members will have completed the 40-hour basic health and safety training as specified by the Occupational Safety and Health Administration (OSHA) in Title 29, Code of Federal Regulations, Part 1910.120, paragraph (e) (29 CFR 1910.120[e]) and the 8-hour annual refresher training thereafter. All supervisory personnel onsite will be required to have completed an 8-hour supervisor course as required in 29 CFR 1910.120(e).

In addition to the 40-hour course, all field employees will be required to have completed a minimum of 3 days onsite training under the supervision of a trained and experienced supervisor, not necessarily at one of the current investigation sites. If this training is received during a current study, the training will be documented on the Field Experience Documentation Form provided in Appendix B. Employees will not participate in field activities until they have been trained to the level required by their job function and responsibility. In addition, at least one person on every Parsons field crew will have current certification in Red Cross or equivalent first-aid and cardiopulmonary resuscitation (CPR). All training documentation for Parsons personnel will be verified by the SHSO and maintained by the health and safety manager.

All Parsons field team members will be on current medical monitoring programs in accordance with federal OSHA requirements (29 CFR 1910.120) and Parsons corporate

policies. Listed below are additional health and safety training and medical monitoring requirements for this project.

4.1 ADDITIONAL SAFETY TRAINING REQUIREMENTS

If Level B (self-contained breathing apparatus [SCBA]) respiratory protection is used, additional training may be required for those personnel involved. This training will be conducted onsite as necessary by a qualified, Level B-experienced supervisor. Employees will also be trained in use, care, maintenance, limitations, and disposal of personal protective equipment (PPE) in accordance with 29 CFR 1910.132. All field team members must have site-specific training as discussed in the following subsection.

4.1.1 Site-Specific Safety Training

Site-specific safety and health training will be conducted by the Parsons SHSO for all personnel who will engage in any fieldwork under this contract. Site-specific safety training will address the activities, procedures, monitoring, and equipment applicable to the site operations, as well as site or facility layout, potential hazards, and emergency response services at the site. Additional topics that will be addressed at the safety briefings will include:

- Names of responsible health and safety personnel;
- Zero accident performance philosophy
- Identification of site hazards and measures for eliminating or reducing hazard risk;
- Site contingencies and emergency procedures;
- Exposure risk;
- Symptoms of exposure and exposure treatment for chemical contaminants;
- Use, care, maintenance, and limitations of PPE;

- Decontamination procedures to be followed;
- Location of safety equipment;
- Review of planned activities and specialized training necessary for personnel to perform their work with zero accidents;
- Defined safety procedures to be followed during field activities; and
- Emergency and evacuation procedures.

4.1.2 Daily Safety Briefings

Daily safety briefings will also be conducted prior to commencement of field activities. Discussion and coordination of field team activities, discussion of hazards faced that day, and discussion of hazard mitigation procedures will be held with all field team members. Documentation of training and briefings, including agenda and signatures of attending personnel, will be maintained onsite. Site-specific training forms are provided in Appendix B.

4.2 MEDICAL MONITORING REQUIREMENTS

Prior to being assigned to the field activities, each Parsons employee will receive a preassignment or baseline physical examination. Preassignment screening has two major functions: 1) determination of an individual's fitness for duty, including the ability to perform work while wearing PPE; and 2) provision of baseline data for comparison with future medical data. Medical qualification/certification documentation will be maintained by the program health and safety manager. All medical examinations and procedures will be performed by or under the supervision of a licensed physician, preferably an occupational physician. The examination content will be determined by the examining physician in accordance with 29 CFR 1910.120(f).

SECTION 5

SAFETY AND HEALTH RISK ANALYSIS AND HAZARD MITIGATION

5.1 CHEMICAL HAZARDS

The chemicals of primary concern occurring at the installation sites typically include diesel fuel; gasoline; jet fuel; and the associated petroleum hydrocarbon constituents benzene, toluene, ethylbenzene, and xylenes (BTEX); and various chlorinated solvents, including perchloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride.

Table 5.1 summarizes the health hazards and properties of the aforementioned BTEX compounds. Chlorinated solvents will be addressed in the site-specific addenda. An example of a site-specific addendum is located in Appendix F of the workplan containing this HASP. The pertinent information about these and any other compounds of concern will be provided in Table 5.1 of the site-specific addenda. The health hazards or other physical/chemical hazards (e.g., corrosiveness, flammability) of the compounds will then be communicated to the onsite employees.

Hazardous substances of primary concern identified are those potentially occurring in contaminated groundwater, soils, or air.

5.2 PHYSICAL HAZARDS

In addition to the hazardous substances potentially present at the sites, other physical hazards or hazardous conditions may be expected at the sites during the course of field activities. These hazards include possible risks from injury while working around motor vehicles, stationary or moving equipment, fire or explosion hazards, slip, trip, and fall

TABLE 5.1 HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL ^{a/} (ppm)	TLV ^{b/} (ppm)	IDLH ^{c/} (ppm)	Odor Threshold ^{d/} (ppm)	Ionization Potential ^{e/} (eV)	Physical Description/Health Effects/Symptoms
Benzene	1 (29 CFR 1910.1028) ^{f/}	0.5 (skin) ^{g/}	500	4.7	9.24	Colorless to light-yellow liquid (solid<42°F) with an aromatic odor. Eye, nose, skin, and respiratory system irritant. Causes giddiness, headaches, nausea, staggered gait, fatigue, anorexia, exhaustion, dermatitis, bone marrow depression, and leukemia. Mutagen, experimental teratogen, and carcinogen.
Ethylbenzene	100	100	800 (10% LEL) ^{h/}	0.25-200	8.76	Colorless liquid with an aromatic odor. Irritates eyes, skin, and mucous membranes. Causes dermatitis, headaches, narcosis, and coma. Mutagen and experimental teratogen.
Toluene	100	50 (skin)	500	0.2-40 ^{i/}	8.82	Colorless liquid with sweet, pungent, benzene-like odor. Irritates eyes and nose. Causes fatigue, weakness, dizziness, headaches, hallucinations or distorted perceptions, confusion, euphoria, dilated pupils, nervousness, tearing, muscle fatigue, insomnia, skin tingling, dermatitis, bone marrow changes, and liver and kidney damage. Mutagen and experimental teratogen.
Xylene (o-, m-, and p-isomers)	100	100	900	0.05-200 ^{i/}	8.56 8.44 (p)	Colorless liquid with aromatic odor. P-isomer is a solid <56°F. Irritates eyes, skin, nose, and throat. Causes dizziness, drowsiness, staggered gait, incoordination, irritability, excitement, corneal irregularities, conjunctivitis, dermatitis, anorexia, nausea, vomiting, abdominal pain, and olfactory and pulmonary changes. Also targets blood, liver, and kidneys. Mutagen and experimental teratogen.

- a/ PEL = Permissible Exposure Limit. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm. Expressed as parts per million (ppm) unless noted otherwise. PELs are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997. Some states (such as California) may have more restrictive PELs. Check state regulations.
- b/ TLV = Threshold Limit Value - Time-Weighted Average. Average air concentration (same definition as PEL, above) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), 2001 *TLVs® and BEIs®*.
- c/ IDLH = Immediately Dangerous to Life or Health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise. IDLH values are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997.
- d/ When a range is given, use the highest concentration.
- e/ Ionization Potential, measured in electron volts (eV), used to determine if field air monitoring equipment can detect substance. Values are published in the *NIOSH Pocket Guide to Chemical Hazards*, June 1997.
- f/ Refer to expanded rules for this compound.
- g/ (skin) = Refers to the potential contribution to the overall exposure by the cutaneous route.
- h/ Indicates that the IDLH value was based on 10% of the lower explosive limit for safety considerations, even though relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations (*NIOSH Pocket Guide to Chemical Hazards*, 1997).
- i/ Olfactory fatigue has been reported for the compound and odor may not serve as an adequate warning property.

hazards; and excessive noise conditions. Additional physical hazards may include heat stress and cold-related exposures.

The guidelines presented in this section are applicable to all types of equipment that may be used during field activities at the installations. Individual equipment types or certain specialized equipment may require additional safety considerations or specialized training prior to its use. Should any specialized equipment be required during the performance of a task, the program health and safety manager will ensure that operators receive appropriate training. The program health and safety manager is also responsible for ensuring that all equipment is routinely inspected and that any piece of equipment considered unsafe is not used until the unsafe conditions are corrected or repaired.

5.2.1 Support Vehicles

Contractor/subcontractor personnel shall wear seat belts and obey posted speed limits. Personnel shall comply with applicable state, local, and installation traffic regulations. Current or anticipated hazardous road conditions (i.e., ice, construction) will be addressed at the daily safety briefings. No personnel shall ride in the bed of pickup trucks or standing on the side or riding on the fenders of heavy equipment.

Personnel will conduct a "walk-around" inspection of the vehicle before moving it to ensure they do not drive over personnel or equipment.

No personally-owned vehicles (POVs) will be driven into contaminated areas, nor will contaminated equipment, personnel, or material be transported in POVs. POVs must be left in support zones on-site. Stunt driving, racing, and horseplay are prohibited and will be subject to disciplinary action, including dismissal.

5.2.2 Heavy Equipment and Drilling Rigs

Working with large motor vehicles could be a major hazard at these sites. Injuries can result from equipment dislodging and striking unsuspecting personnel, and impacts from flying objects or overturning of vehicles. Vehicles and heavy equipment design and

operation will be in accordance with 29 CFR, Subpart O, 1926.600 through 1926.602. In particular, the following precautions will be used to help prevent injuries and accidents:

- Daily vehicle inspections will be conducted and documented.
- Do not back up large motor vehicles unless the vehicle has backup warning lights and a reverse signal alarm audible above the surrounding noise level, or an observer signals it is safe to do so.
- No riders other than the driver are permitted on heavy equipment.
- Motor vehicle cabs will be kept free of all nonessential items and all loose items will be secured.
- Drilling rig masts will be lowered to the ground and parking brakes will be set before shutting off the vehicle.
- Drilling rig brakes, cables, kill switches, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be inspected daily.
- All personnel working at and around the drilling rig must be informed of the locations of the kill switches.
- Only qualified operators will be allowed to operate heavy equipment.
- When heavy equipment is left unattended, loads must be lowered, controls neutralized, power shut off, and brakes set. Wheels must be chocked if a vehicle is parked on an incline.

When working near a drill rig, personnel shall be aware of snag hazards from rotating tools and pinch and crush hazards from suspended tools. No loose, dangling clothing will be allowed. Personnel will also be aware of falling object hazards and wear hard hats at all times. Personnel will be aware of slip, trip, and fall hazards from drilling equipment,

tools, and well construction materials that may be lying on the ground in the vicinity of the drill rig. To reduce the threat of slip, trip, and fall hazards, the area immediately around the drill rig will be kept clear of equipment and supplies. Use of a downhole hammer will require the use of an air compressor. The compressor air hoses will be checked daily prior to startup for cracks or other defects that could result in injuries. Refer to Section 5.2.7 for noise associated with drill rig, downhole hammer, and air compressor.

5.2.3 Hazards Associated with the Geoprobe[®] Unit

The Geoprobe[®] unit consists of a hydraulically-driven press mounted on the bed of a pick-up truck, with power supplied to the cylinder via a power-take-off on the truck. A list of safety instructions provided by the Geoprobe[®] manufacturer is provided below, and will be followed by all Parsons and subcontractor personnel.

- Never operate the controls without proper training.
- Orient operator cross-wind to minimize exposure to contaminants and vehicle exhaust.
- Always take the vehicle out of gear and set the emergency brake before engaging the remote ignition.
- If the vehicle is parked on a loose or soft surface, do not fully raise the rear of the vehicle with the probe foot, as the vehicle may fall or move, causing injury.
- Always extend the probe unit out from the vehicle, and deploy the foot to clear the vehicle roof line before folding the probe unit out.
- Operators must wear approved steel-toed shoes, and keep feet clear of the probe foot.
- Wear safety glasses, hard hat, and hand protection at all times during the operation of this machine.

- Wear ear muffs or disposable foam earplugs when in the vicinity of the operation of equipment, aircraft noise or other sources of high intensity noise.
- Only one person should operate the probe. Additional personnel may be necessary to assemble/disassemble the probe rods and accessories.
- Never place hands on top of a rod while it is under the machine.
- Turn off the hydraulic system while changing rods, inserting the hammer anvil or attaching accessories.
- While operating the controls, the operator must stand to the control side of the probe, clear of the probe foot and mast.
- Never exert down pressure on the probe rod so as to lift the probe foot over six inches off the ground.
- Be aware of height limitations in parking structures and around utility lines.
- Make sure utility clearances have been obtained.
- Use only approved equipment, tools, and accessories for the Geoprobe.

5.2.4 Slip, Trip, and Fall Hazards

Existing site conditions may pose a number of slip, trip, and fall hazards, such as:

- Open excavations, pits, or trenches;
- Slippery surfaces;
- Steep or uneven grades;
- Surface obstructions; and
- Construction materials or debris.

All field team members will be instructed to be cognizant of potential safety hazards and immediately inform the SHSO or the site manager about any new hazards. If the hazard cannot be immediately removed, actions must be taken to warn site workers about the hazard. The site will be kept in a neat, organized, and orderly fashion. Rubbish, trash, or debris generated by the project team shall be picked up and properly disposed of on a daily basis. Items such as tools, equipment, and hoses will be properly stored when not in use.

5.2.5 Fire or Explosion Hazards

Fuels and solvents may have been released into the soils at the installations and vapors from these fuels may be flammable or explosive. Therefore, precautions will be taken when performing field activities to ensure that combustible or explosive vapors have not accumulated, or that an ignition source is not introduced into a flammable atmosphere.

OSHA standards for fire protection and prevention are included in 29 CFR Subpart F, 1926.150 through 1926.154. Of particular concern on these sites are:

- Proper storage of flammables;
- Adequate numbers of 20 lb A:B:C type fire extinguishers;
- Use of intrinsically safe (explosion-proof) equipment where appropriate; and
- Monitoring for development of an explosive atmosphere.

5.2.6 Effects and Prevention of Heat Stress

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury. These conditions are discussed further below.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur. They can range from mild symptoms such as fatigue; irritability; anxiety; and decreased concentration,

dexterity, or movement; to death. Medical help must be obtained for the more serious cases of heat stress. One or more of the following actions will help reduce heat stress:

- Provide plenty of liquids. To replace body fluids (water and electrolytes) lost due to perspiration, each employee must drink 1 to 1.5 gallons of water or commercial electrolyte mix per day. Workers are encouraged to frequently drink small amounts, i.e. one cup every 15-20 minutes.
- Field personnel are cautioned to minimize alcohol intake during off-duty hours.
- Provide cooling devices (e.g., water jackets or ice vests) to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker mobility.
- Wear long cotton underwear, which acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Install portable emergency showers and/or hose-down facilities to reduce body temperature and to cool protective clothing.
- In extremely hot weather, conduct nonemergency response operations in the early morning or evening.
- Ensure that adequate shelter is available to protect personnel against sun, heat, or other adverse weather conditions which decrease physical efficiency and increase the probability of accidents.
- In hot weather, rotate workers wearing protective clothing.
- Maintain good hygienic standards by frequent changing of clothing and daily showering. Clothing should be permitted to dry during rest periods. Workers who notice skin problems should immediately consult the SHSO.

5.2.6.1 Heat-Related Problems

- Heat rash: Caused by continuous exposure to heat and humid air, and aggravated by chafing clothes. Decreases ability to tolerate heat and is a nuisance.
- Heat cramps: Caused by profuse perspiration with inadequate fluid intake and chemical replacement, especially salts. Signs include muscle spasms and pain in the extremities and abdomen.
- Heat exhaustion: Caused by increased stress on various organs to meet increased demands to cool the body. Signs include shortness of breath; increased pulse rate (120-200 beats per minute); pale, cool, moist skin; profuse sweating; and dizziness and exhaustion.
- Heat stroke: The most severe form of heat stress. Body must be cooled immediately to prevent severe injury and/or death. Signs include red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and possibly coma. Medical help must be obtained immediately.

5.2.6.2 Heat-Stress Monitoring

Monitoring of personnel wearing impermeable clothing will begin when the ambient temperature is 70°F (21°C) or above. Table 5.2 presents the suggested frequency for such monitoring. Monitoring frequency will increase as the ambient temperature increases or as slow recovery rates are observed. Heat-stress monitoring will be performed by a person with current first-aid certification who is trained to recognize heat-stress symptoms. For monitoring the body's recuperative capabilities in response to excess heat, one or more of the techniques listed below will be used. Other methods of heat-stress monitoring may also be used, such as the wet-bulb globe temperature index from the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) Booklet (current edition).

To monitor the worker, measure:

- Heart rate: Count the radial pulse during a 30-second period as early as possible during the rest period.
 - If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by one-third and the rest period will remain the same.
 - If the heart rate still exceeds 110 beats per minute at the next rest period, the following work cycle will be reduced by one-third.
- Oral temperature: Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
 - If oral temperature exceeds 99.6° (37.6°C), the next work cycle will be reduced by one-third without changing the rest period.
 - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, the following work cycle will be reduced by one-third.

No worker will be permitted to wear a semipermeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

5.2.7 Cold Exposure

It is possible that work on this project may be extended to colder climates and fieldwork may be conducted during the winter months. Therefore, injury due to cold exposure may become a problem for field personnel. Cold exposure symptoms, including hypothermia and frostbite, will be monitored when personnel are exposed to low temperatures for extended periods of time.

Persons working outdoors in temperatures at or below freezing may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause

TABLE 5.2
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT
AND ACCLIMATIZED WORKERS^{a/}

Adjusted Temperature ^{b/}	Normal Work Ensemble ^{c/}	Impermeable Ensemble ^{d/}
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° - 90°F (30.8° - 32.2° C)	After each 60 minutes of work	After each 30 minutes of work
82.5° -87.5° F (28.1° - 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° -82.5° F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° -77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

^{a/} For work levels of 250 kilocalories/per hour.

^{b/} Calculate the adjusted air temperature (ta adj) by using this equation: $ta\ adj = ta\ ^\circ F + (13 \times \text{sunshine multiplier})$ [i.e., 50 percent sunshine equals a .5 multiplier). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate the sunshine multiplier by judging what percent of time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine - no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows).

^{c/} A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and trousers.

^{d/} Saranex[®], Poly-Coated Tyvek[®], Etc.

severe injury by freezing exposed body surfaces (frostbite), or may result in profound generalized cooling (hypothermia), possibly causing death. Areas of the body which have high surface area-to-volume ratios such as fingers, toes, and ears are the most susceptible to frostbite.

Two factors influence the development of a cold injury: ambient temperature and wind velocity. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For example, 14°F with a wind speed of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. Cold exposure is particularly a threat to site workers if the body cools suddenly when chemical-protective equipment is removed, and the clothing underneath is perspiration-soaked. The presence of wind greatly increases the rate of cooling.

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: characterized by suddenly blanching or whitening of skin.
- Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite: tissues are cold, pale, and solid; an extremely serious injury.

Systemic hypothermia, or lowering of the core body temperature, is caused by exposure to freezing or rapidly dropping temperatures. Symptoms are usually exhibited in five stages:

- Shivering and uncoordination;
- Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F (35°C);

- Unconsciousness, glassy stare, slow pulse, and slow respiratory rate;
- Freezing of the extremities; and
- Death.

5.2.7.1 Evaluation and Control

TLVs recommended for properly clothed workers for periods of work at temperatures below freezing are shown in Table 5.3. For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill temperature of -32°C (-25.6°F). Superficial or deep local tissue freezing will occur only at temperatures below -1°C (30.3°F) regardless of wind speed.

Special protection of the hands is required to maintain manual dexterity for the prevention of accidents. If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 16°C (60.8°F), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be used. At temperatures below -1°C (30.2°F), metal handles of tools and control bars should be covered by thermal insulating material.

To prevent contact frostbite, workers should wear gloves. When cold surfaces below -7°C (19.4°F) are within reach, a warning will be given to the workers by the supervisor or SHSO to prevent inadvertent contact with bare skin. If the air temperature is -17.5°C (0°F) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

Provisions for additional total body protection are required if work is performed in an environment at or below 4°C (39.2°F). The workers will wear cold protective clothing appropriate for the level of cold and physical activity. If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable

**Table 5.3
Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift**

Air Temperature – Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm. Breaks)	1	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-Emergency work	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-Emergency work		should cease	
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-Emergency work		should cease			
-40° to -42°	-40° to -44°	30 min	5	Non-Emergency work		should cease					
-43° & below	-45° & below	Non-Emergency work should cease		should cease							
				↓		↓		↓		↓	

Notes for Table 5.3

- Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work (limited physical movement); apply the schedule one step lower. For example, a -35 °C (-30 °F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).
- The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph; light flag moves; 10 mph; light flag fully extended; 15 mph; raises newspaper sheet; 20 mph; blowing and drifting snow.
- In general the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.
- TLVs apply only for workers in dry clothing.

windbreak garment. If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work will be modified or suspended until adequate clothing is made available or until weather conditions improve.

5.2.7.2 Work-Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) below -7°C (19.4°F), heated warming shelters (tents, cabins, rest rooms) will be made available nearby. The workers will be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onsets of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation, or a change of dry work clothing should be provided. A change of dry work clothing may be necessary to prevent workers from returning to work with wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of the diuretic and circulatory effects.

For work practices at or below -12°C (10.4°F) ECT, the following should apply:

- The workers will be under constant protective observation (buddy system or supervision).
- The work rate should not be so high as to cause heavy sweating that will result in wet clothing; if heavy work must be done, rest periods will be taken in unheated shelters, and the opportunity for changing into dry clothing should be provided.

- New employees should not be required to work full-time in the cold during the first days of employment until they become accustomed to the working conditions and required protective clothing.
- The weight and bulkiness of clothing should be included in estimating the required work performances and weights to be lifted by the worker.
- The work should be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats will not be used. The worker should be protected from drafts to the greatest extent possible.
- The workers will be instructed in safety and health procedures relative to cold exposures.

5.3 BIOLOGICAL HAZARDS

Various biological hazards may be encountered at the Air Force or DoD installations. These hazards include snakes; scorpions; pathogenic organisms or diseases such as Hantavirus, Bubonic Plague, Equine Encephalitis, and Lyme Disease. Other biological hazards include insects, spiders, and cactuses or other harmful plants (such as poison ivy). Sturdy work clothes and shoes will be worn by field personnel to help prevent injuries.

5.3.1 Venomous Snakes

The prairie rattlesnake is a venomous snake that may be encountered at some sites. . It is brownish or greenish brown with blotches of variable shape bordered with white along their backs. It ranges in length from three to five feet. These snakes are not particularly aggressive and inhabit fields, pine habitats, sandy areas, cultivated land, forests, rocky slopes, and along streams. They are active at night on or near paved roads.

Some rattlesnakes, such as the eastern diamondback rattlesnake do not always rattle before striking. These snakes are up to six feet long with brown, black, and beige diamond marks on their backs. They typically live in old animal burrows in forests near palmetto bushes, but can also live near fresh or salt water.

Rattlesnakes often seek cover under rocks, shrubs, and logs. Personnel should check carefully before sitting down in these types of areas, and never place hands or feet where they are not easily seen.

The cottonmouth or water moccasin has a thick body, typically two to four feet long. It is light brown with black and olive patterns when young, and all black when older. It has no rattle, is aggressive, and may strike several times. It typically lives near fresh-water swamps, lakes, streams, and ditches.

Coral snakes are skinny and approximately two feet long, and have black noses and distinguishing rings of red, yellow, and black along their bodies. They do not have long fangs, and actually chew on a person to inject venom. While other snakes make look like coral snakes, the coral snakes have red and yellow colorations touching, while the non-poisonous snakes have red and black colorations touching.

The bite of a venomous snake is extremely painful and swells rapidly. It is usually marked by one or more puncture marks created by the fangs. Skin discoloration may occur within hours. Also common are weakness, sweating, faintness, nausea, tender lymph nodes, and tingling or numbness of the tongue, mouth, or scalp. The victim should be transported to the hospital as quickly as possible. First aid should consist of keeping the victim as calm and immobile as possible, preferably lying down, and immobilizing the bitten extremity, keeping it at or below heart level to slow the spread of any poison through the body. Do not cut the wound, apply a tourniquet, or use a snakebite kit. Cold therapy is not recommended, nor is alcohol, sedatives, aspirin, or any medicine containing aspirin. Transport the victim to the hospital as soon as possible. If possible (without undo risks to personnel), obtain the snake for identification purposes.

5.3.2 Insect/Arachnid Bites and Stings

Poisonous insects and insect-like creatures at some sites may include red fire ants, bees (honeybees, bumble bees, wasps, and hornets), mosquitoes, spiders, and scorpions.

Red fire ants may be observed, especially in the vicinity of existing monitoring wells. Do not stand on, place equipment on, or otherwise disturb the anthills. It is also advisable to place a four-foot square piece of plywood where personnel need to stand. An insect repellent may be used if it does not interfere with the desired sampling analyses. Tyvek® suits can be worn or latex booties can be taped at the top to the pants of field personnel. Frequent self-checks for crawling ants should also be performed.

Mild insect stings and bites should be treated by applying a baking soda paste or ice wrapped in a wet cloth. Do not pull out stingers with tweezers or your fingers. Stingers should be gently scraped from the skin, working from the side of the sting, using your fingernail, the edge of a credit card, a dull knife blade, or other straightedge object.

Equine encephalitis, an inflammation of the brain, can be carried by mosquitoes. Symptoms range from none to mild, flu-like symptoms (fever, headache, sore throat) to rare infection of the central nervous system with sudden fever and severe headaches followed quickly by seizures and coma. In the more severe variety, the mortality rate is up to 60%, with permanent brain damage in many of the survivors. Field personnel must wear long-sleeved clothing and/or use DEET-containing insect repellents if they are working in areas of mosquito infestations.

The two poisonous spiders likely to be encountered are the Brown Recluse and the Black Widow. They are usually found in buildings, utility box or monitoring well covers, or piles of debris, rocks, wood, or leaves. These spiders are typically non-aggressive, and bite only when disturbed. The Brown Recluse is up to one inch long with a violin or “fiddle” shaped mark on the top of the head. It is generally brown, but more poisonous varieties may be pale-brown, reddish-brown, orange, or gray. The Black Widow is a smaller, bulbous black spider with a red or yellow hourglass-shaped mark on the underside. It weaves shapeless diffuse webs in undisturbed areas.

Persons who are believed to have been bitten by a Brown Recluse or Black Widow spider should be immediately transported to a hospital. The spider should be collected for confirmation of the species.

Reactions to a Brown Recluse spider bite may be nothing, immediate, or delayed, depending upon the sensitivity of the person bitten and the amount of venom injected. A small white blister often occurs at the bite site surrounded by a swollen area. Within 24 to 36 hours, the victim may experience fever, chills, restlessness, weakness, nausea, and joint pain. Within 24 hours, the bite site can erupt into a “volcanic lesion”, which produces a hole in the flesh due to damaged gangrenous tissue. The open wound may range in size from an adult thumbnail to the span of a hand, with recovery taking months, and sometimes requiring plastic surgery and skin grafts.

Reactions to a Black Widow spider include intense pain at the site of the bite after approximately 15 to 60 minutes, followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils, and generalized swelling of face and extremities. Death may occur due to complications, but usually not from the bite itself.

Contrary to popular belief, the tarantula is harmless to humans, with a bite similar to a bee sting, producing mild to moderate pain and slight swelling. It is tan or brown to black in color, and is typically nocturnal.

There are several types of scorpions native to the United States. Scorpions may be brown to yellowish in color, and range from 1/2 inch to 8 inches in length. Their bodies are divided into two parts: a short, thick upper body, and a long abdomen with a six-segment tail. A scorpion has six pairs of jointed appendages: one pair of small pincers, one pair of large claws, and four pairs of jointed legs. They are most active at night. A scorpion sting is very painful, but usually will not result in death.

If insect/arachnid stings or bites become red or inflamed or symptoms such as nausea, dizziness, shortness of breath, appear, medical care will be sought. Immediate care is

needed if a person is allergic to insect bites/stings. Personnel with insect allergies should inform the Project Manager, Site Manager, Project Health and Safety Officer, and Site Safety and Health Officer (SSHO). If an allergic person receives a spider bite or insect bite/sting, seek immediate medical attention, keep the victim calm, and check vital signs frequently. Rescue breathing should be given if necessary to supply oxygen to the victim. The victim may experience swelling of the breathing passageways. If this occurs, the person providing the rescue breathing may have to slightly increase the air pressure to ensure that the victim receives an adequate supply of air.

5.3.3 Ticks

The primary hazards associated with ticks are Lyme disease and Rocky Mountain Spotted Fever. In the southeastern United States, Lyme disease is transmitted by the Deer Tick. This tick is very small (about the size of this asterisk: *), is red in color, and has black legs. Transmission of Lyme disease is most likely in late spring, summer, and early fall.

There are three stages of Lyme disease, although not everyone will proceed through all the stages or experience all the symptoms. The initial symptoms may include a red rash that is circular and blotchy and expands around the tick bite, and flu-like symptoms such as fatigue, headaches, fever, swollen glands, and stiffness and pain in muscles and joints. The next stage can occur from a few days to a few weeks after the initial stage. Symptoms of this phase may include irregular heartbeat, facial paralysis, joint pain, irritability, headaches, dizziness, poor coordination, weakness, severe fatigue, and memory loss. The third stage may occur weeks to years after the second stage. Arthritis, often in the knees, is the most common symptom of this stage. The arthritis may disappear and recur many times, and chronic arthritis may develop.

People get Rocky Mountain spotted fever from the bite of an infected tick or by contamination of the skin with the contents of an attached tick when it is removed from the skin. Rocky Mountain spotted fever is spread from person to person, except rarely by blood transfusion. People with Rocky Mountain spotted fever get a sudden fever (which

can last for 2 or 3 weeks), severe headache, tiredness, deep muscle pain, chills, nausea, and a characteristic rash. The rash might begin on the legs or arms, can include the soles of the feet or palms of the hands, and can spread rapidly to the trunk or the rest of the body. Symptoms usually begin 3 to 12 days after a tick bite.

If found crawling on a person, ticks should be removed and burned or smashed between two rocks. Do not smash ticks with fingers. If a tick is found to be holding onto the skin, the tick should be covered with Vaseline until it can no longer breathe and backs out of the skin. At that time, all parts of the tick should be removed with tweezers. Areas of the skin where the tick may have crawled, as well as bite area will be scrubbed with soap and water. Hot showers are to be taken as soon as possible after site departure to wash away all ticks that have not adhered to the skin. Prompt medical treatment with antibiotics is usually successful in preventing further complications from Lyme disease. Lyme disease becomes more difficult to treat the longer treatment is delayed. .

To prevent tick bites, it is recommended that DEET (vapor-active repellent) be applied to any exposed skin surface (except lips and eyes), and apply permethrin repellent spray to field clothing. It should be noted that the permethrin repellent should be allowed to dry on the clothing before putting the clothing onto the body. This combination of deet and permethrin provides the maximum protection from ticks. Long-sleeved shirts with snug collar and cuffs, pants tucked into socks, and personal protective equipment will offer some protection. Personnel should perform self-checks for ticks at the end of each workday

5.3.4 Fleas

Bubonic plague is a bacterial disease that is spread to humans by fleas that have bitten an infected animal. Bubonic plague displays symptoms rapidly. Chills and fever are soon accompanied by swelling of the lymph nodes, usually on one side of the body. These painful swellings are usually dark blue to black, hence the other common name for this disease, “black death.” The disease is treatable with antibiotics. Field personnel

must wear Tyvek® suits with leg seams taped to boots or boot covers to minimize contact with fleas while working in prairie dog towns.

5.3.5 Rodents

Hantavirus has been reported from the “Four Corners” area of the southwestern U.S. The Four Corners strain of Hantavirus has had a 60 percent mortality rate. Deer mice are the primary reservoir for the virus. The virus is excreted in mouse feces, urine, and saliva. People become infected when the virus is inhaled, through breaks in the skin, by ingesting contaminated food or water, or by being bitten by an infected rodent.

The incubation period for Hantavirus may be three days to six weeks. Symptoms include fever, chills, headache, dizziness, muscle aches, dry cough, nausea, vomiting, abdominal cramps, diarrhea, and shortness of breath. Progression of the disease leads to fluid in the lungs, heart irregularities, and kidney failure. Personnel will use HEPA-equipped air-purifying respirators when working in rodent-infested areas or when entering sheds of buildings containing mice infestations.

Small rodents, called nutria, have also been observed at some sites. Resembling beavers with round tails, these animals have created an abundance of burrows that provide a tripping hazard for field personnel. Care must be taken when walking in grassy areas to avoid tripping or twisting of ankles and knees.

5.3.6 Poisonous/Spiny Plants

The majority of skin reactions following contact with offending plants is allergic in nature and is characterized by general symptoms of headache and fever, itching, redness, and a rash.

Some of the most common and severe allergic reactions result from contact with plants of the poison ivy group, including poison oak and poison sumac. Such plants produce a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

The most distinctive features of poison ivy, poison oak, and poison sumac are their leaves. Poison ivy is a woody vine whose leaves are divided into three leaflets. Poison oak is a low branching shrub with leaflets also in threes. Poison sumac is a shrub or small tree occurring in swamps. Poison sumac has 7 to 13 leaflets that resemble those of green ash trees. In certain seasons, all three plants also have greenish-white flowers and berries that grow in clusters.

A person experiencing symptoms of poison ivy or poison oak should remove contaminated clothing; wash all exposed areas thoroughly with soap and water. Apply calamine or other poison ivy/oak/sumac lotion if the rash is mild. Seek medical advice if a severe reaction occurs, or if there is a known history of previous sensitivity. Oak/ivy/sumac cleanser can be used after site work or after potential exposure to reduce chances of irritation. Personnel must wear Tyvek® suits or other protective clothing when working in areas containing these plant species.

The star thistle plant is a gray-green to blue-green plant with yellow or pale purple thistle-like flowers with sharp spines, and grows to heights varying from six inches to five feet. The blooming period is typically from May to June. The star thistle is poisonous to horses when ingested, but is harmless to humans except for the spiny nature of the plants, which can result in scratches and lacerations. Personnel are advised to wear sturdy work clothes including long-sleeved shirts and heavy work gloves as necessary.

Cactuses and other non-poisonous spiny or thorny plants may also be common at the various installations. Personnel are advised to wear sturdy work clothes, including long-sleeved shirts and heavy work gloves as necessary to protect against skin punctures.

SECTION 6

EMERGENCY RESPONSE PLAN

All hazardous waste site activities will present a degree of risk to onsite personnel. During routine operations, risk is minimized by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated. The sections below establish procedures and guidelines for emergencies.

6.1 GUIDELINES FOR PRE-EMERGENCY PLANNING AND TRAINING

Employees must read this program health and safety plan and the appropriate site-specific addendum to this plan, and familiarize themselves with the information provided. Prior to project initiation, the SHSO will conduct a meeting with the field team members to review the provisions of this program health and safety plan and the addendum, and to review the emergency response plan. Employees are required to have a copy of the emergency contacts and telephone numbers immediately accessible onsite and know the route to the nearest emergency medical services. The emergency contacts, telephone numbers, and routes to the hospital will be provided in the site-specific health and safety plan addendum prepared for each RPO or PDDBS evaluation site. Appendix A provides a guideline for preparing this information.

6.2 EMERGENCY RECOGNITION AND PREVENTION

Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while onsite.

- A condition is discovered that suggests the existence of a situation more hazardous than anticipated (e.g. flammable atmospheres).
- Concentrations of combustible vapors reach or exceed 10 percent of the lower explosive limit (LEL).
- A fire or explosion hazard exists.
- Concentrations of organic vapors measured in the worker breathing zone by a photoionization detector (PID) are above background air concentrations greater than an amount equal to the lowest permissible exposure limit (PEL) of a contaminant of concern onsite.
- A vehicle accident occurs.

Preventive measures are listed below.

- Site workers must maintain visual contact and should remain close together to assist each other during emergencies. (Use the buddy system.)
- During continual operations, onsite workers act as safety backup to each other. Offsite personnel provide emergency assistance.
- All field crewmembers should make use of all of their senses to alert themselves to potentially dangerous situations to avoid (e.g., presence of strong and irritating or nauseating odors).
- Personnel will practice unfamiliar operations prior to performing them in the field.
- Field crew members will be familiar with the physical characteristics of investigations and field demonstrations, including:
 - Wind direction in relation to contamination zones;
 - Accessibility to co-workers, equipment, vehicles and communication devices;

- Communication signals and devices;
 - Hot zone locations (areas of known or suspected contamination);
 - Site access; and
 - Nearest water sources.
- Personnel and equipment in the designated work area should be minimized, consistent with effective site operations.

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, will result in the reevaluation of the hazard and the level of protection required, and may result in a temporary evacuation of the field team from the immediate work area. Such conditions may include an adverse effect or symptom of exposure experienced by a field team member, or the exceedance of the action levels for organic vapors and/or combustible vapors. If the action levels for organic vapors and/or combustibles are exceeded, procedures will be followed as stated in Section 7 of this health and safety plan.

In the event of an accident, the SHSO or site manager will complete the Accident Report Form provided in Appendix B. Copies of the completed forms will be maintained by the program health and safety manager in the health and safety file of the affected employee. Follow-up action should be taken to correct the situation that caused the accident.

Near-miss incidents will also be documented using the form provided in Appendix B, and filed with the onsite health and safety records, as well as with the program health and safety manager. Near-miss incidents are defined as any incident which could have led to injury or property damage, but for whatever reason, did not. The assessment of near-miss incidents provides a better measure of safety program effectiveness than simply tracking accidents, since near misses tend to occur at much higher frequencies than actual accidents.

In the event of an emergency such as an injury to Parsons employees or contractor personnel, damage to facilities or operations, or threats against personnel or operations, Parsons personnel will contact the Parsons Emergency Contact Service. This hotline provides live telephone call support in English and Spanish 24-hours a day, 7 days a week, and 365 days a year for immediate guidance and response when local management is not available. The telephone number for this service is located along with the other emergency numbers in Appendix A and in the site-specific addenda.

6.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION PROCEDURES DURING AN EMERGENCY

When an emergency occurs, decisive action is required. Rapidly made choices may have far-reaching, long-term consequences. Delays of minutes can create or exacerbate life-threatening situations. Personnel must be ready to respond to emergency situations immediately. All personnel will know their own responsibilities during an emergency, know who is in charge during an emergency, and the extent of that person's authority. This section outlines personnel roles, lines of authority, and communication procedures during emergencies.

In the event of an emergency situation at the site, the site manager will assume total control and will be responsible for onsite decision-making. The designated alternate for the site manager will be the SHSO. These individuals have the authority to resolve all disputes about health and safety requirements and precautions. They will also be responsible for coordinating all activities until emergency response teams (ambulance, fire department, etc.) arrive onsite.

The site manager and/or SHSO will ensure that the necessary Base personnel, Parsons personnel, and agencies are contacted as soon as possible after the emergency occurs. All onsite personnel must know the location of the nearest phone and the location of the emergency phone number list.

6.4 EVACUATION ROUTES AND PROCEDURES, SAFE DISTANCES, AND PLACES OF REFUGE

In the event of emergency conditions, decontaminated employees will evacuate the area as instructed, transport decontaminated injured personnel, or take other measures to ameliorate the situation. Evacuation routes and safe distances will be decided upon and posted by the field team prior to initiating work. Evacuation routes will be oriented upwind of the exclusion zone. Wind direction will be monitored through the use of windsocks, surveyors flagging or other appropriate measures.

6.5 DECONTAMINATION OF PERSONNEL DURING AN EMERGENCY

Procedures for leaving a contaminated area must be planned and implemented prior to going onsite. Decontamination areas and procedures will be established based on anticipated site conditions. If a member of the field crew is exposed to chemicals, the emergency procedures outlined below will be followed:

- Another team member (buddy) will assist or remove the individual from the immediate area of contamination to an upwind location.
- Precautions will be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing will be removed if it is safe to do so.
- Administer first aid and transport the victim to the nearest medical facility, if necessary.

If uninjured employees are required to evacuate a contaminated area in an emergency situation, emergency decontamination procedures will be followed. At a minimum, these would involve moving into a safe area and removing protective equipment. Care will be taken to minimize contamination of the safe area and personnel. Contaminated clothing will be placed in plastic garbage bags or other suitable containers. Employees will wash or shower as soon as possible.

6.6 EMERGENCY SITE SECURITY AND CONTROL

For this project, the site manager (or designated representative) must know who is onsite and who is in the work area. Personnel access into the work area will be controlled. In an emergency situation, only necessary rescue and response personnel will be allowed into the exclusion zone.

6.7 PROCEDURES FOR EMERGENCY MEDICAL TREATMENT AND FIRST AID

The following general procedures will be implemented in the event of an emergency. Site-specific addenda will incorporate specific emergency procedures, emergency contact names and telephone numbers and a map detailing the route to the local hospital.

6.7.1 Chemical Exposure

In the event of chemical exposure (skin contact, inhalation, ingestion) the following procedures will be implemented:

- Another team member (buddy) will assist or remove the individual from the immediate area of contamination to an upwind location.
- Precautions will be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing will be removed if it is safe to do so.
- If the chemical has contacted the skin, the skin will be washed with copious amounts of water, preferably under a shower.
- In case of eye contact, an emergency eyewash will be used. Eyes will be washed for at least 15 minutes. Emergency eyewashes will comply with ANSI Z-358.1 and filled with tempered water maintained no cooler than 60°F and no warmer than 95°F. Eyewashes will be capable of delivering 0.4 to 0.8 gallons of water to both eyes for a minimum of 15 minutes. Each jobsite will have at least one emergency

eyewash station. Each crew will have, at a minimum, an ANSI-approved personal eyewash suitable for initial eye flushing while the injured person is moved to an emergency eyewash station or medical facility.

- If necessary, the victim will be transported to the nearest hospital or medical center. If necessary, an ambulance will be called to transport the victim.

6.7.2 Personal Injury

In the event of personal injury:

- Field team members trained in first aid can administer treatment to an injured worker.
- The victim will be transported to the nearest hospital or medical center. If necessary, an ambulance will be called to transport the victim.
- The SHSO or site manager is responsible for the completion of the appropriate accident report form.

6.7.3 Fire or Explosion

In the event of fire or explosion, personnel will evacuate the area immediately. Administer necessary first aid to injured employees. Personnel will proceed to a safe area and telephone the emergency support services designated in the appropriate sit-specific addendum. Upon contacting the emergency support services, state your name, nature of the hazard (fire, high combustible vapor levels), the location of the incident, and whether there were any physical injuries requiring an ambulance. Do not hang up until the emergency support services personnel have all of the additional information they may require.

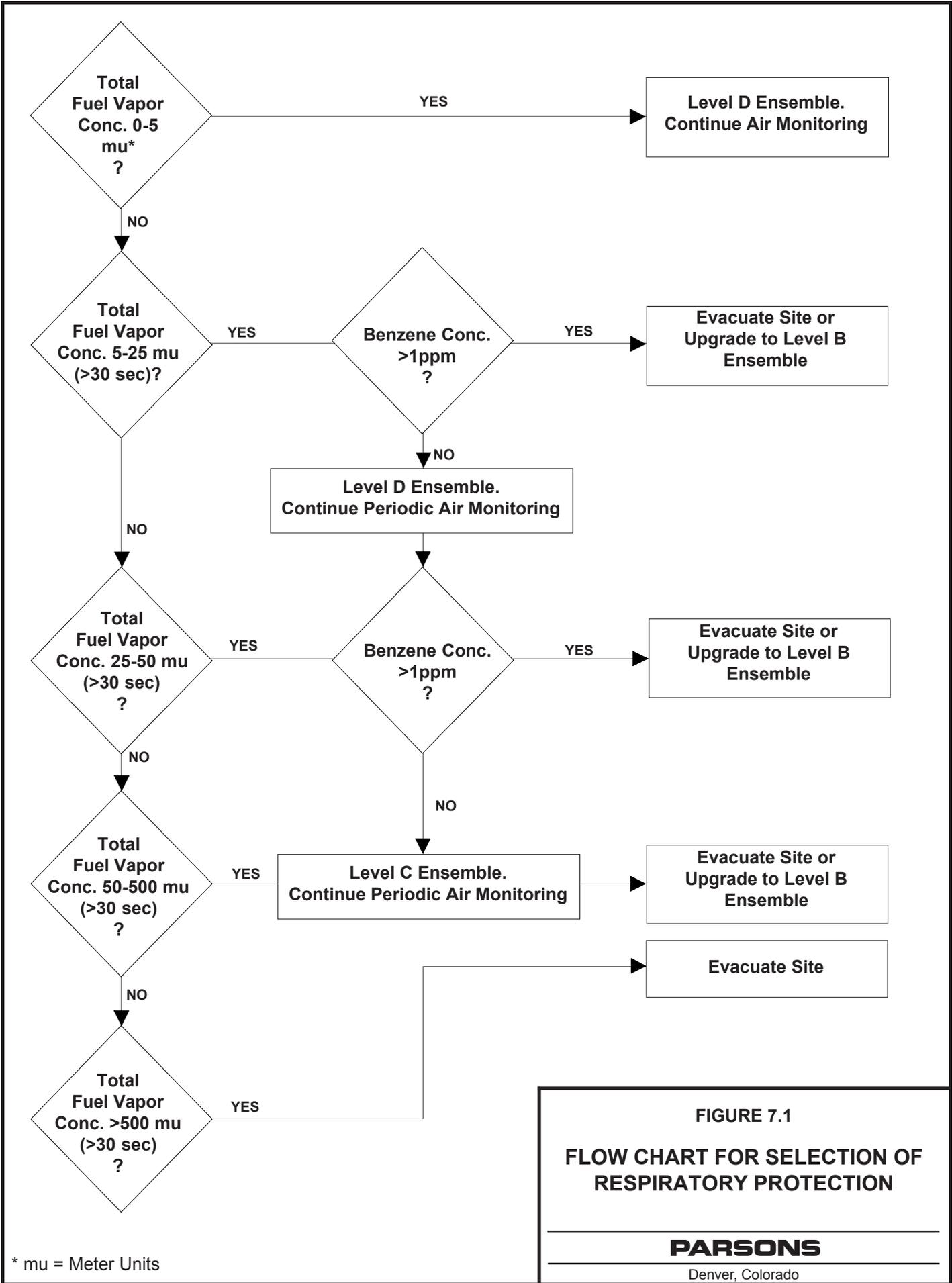
SECTION 7

LEVELS OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT REQUIRED FOR SITE ACTIVITIES

7.1 PERSONAL PROTECTIVE EQUIPMENT

The personal protection level prescribed for the RPO and PDBS evaluations is OSHA Level D (no respiratory or chemical protective clothing), with a contingency for the use of OSHA Level C or B as site conditions require (Figure 7.1). Unless certain compounds are ruled out through use of appropriate air monitoring techniques such as Dräger[®] tubes, portable sampling pumps, or an onsite gas chromatograph (GC), Level C respiratory protection (air-purifying respirator [APR]) cannot be used. Level C protection may only be used on this project when vapors in air are adequately identified and quantified and Level C respirator-use criteria are met. Level B (supplied air) respiratory protection must be used on this project in the presence of unknown vapor constituents or if benzene is detected at or above 1 part per million, volume per volume (ppmv). This is based on the toxicity and warning properties (high odor threshold) for benzene. Air monitoring must be conducted in the worker-breathing zone when the potential occurrence of these compounds exists.

Ambient air monitoring of organic gases/vapors (using photoionization detectors such as an HNU[®] or Photovac[®] MicroTIP[®], or by colorimetric analysis with Dräger[®] tubes) will be used to select the appropriate level of personal protection. The flow chart presented in Figure 7.1 will be used to select respiratory protection against volatile hydrocarbon constituents. If the portable air monitoring equipment indicates organic vapor concentrations of 0-5 meter units (mu), site workers will continue air monitoring in a Level D ensemble. If organic vapors reach 5-25 mu for more than 30 seconds, and benzene concentrations exceed 1 ppmv, site workers will evacuate the



* mu = Meter Units

FIGURE 7.1
FLOW CHART FOR SELECTION OF RESPIRATORY PROTECTION

PARSONS

Denver, Colorado

area or upgrade to Level B ensemble, if trained to do so. If benzene concentrations are less than 1 ppmv in the breathing zone, and vapors are in the range of 5-25 mu, the site crews may continue in Level D ensembles with periodic air monitoring. If organic vapor concentrations reach 25-50 mu for more than 30 seconds and benzene concentrations exceed 1 ppmv in the worker breathing zone, site crews will evacuate the area or upgrade to Level B ensembles. If benzene concentrations are less than 1 ppmv, and vapors are in the range of 25-50 mu, site workers will don full facepiece APRs equipped with organic vapor cartridges (National Institute for Occupational Safety and Health [NIOSH]-approved), and continue periodic monitoring. If organic vapor concentrations reach 50-500 mu for more than 30 seconds, site crews will evacuate the site or upgrade to Level B ensembles. If organic vapor concentrations exceed 500 mu for more than 30 seconds, site crews will evacuate the site.

Before work can be performed in Level B respiratory protection, the project manager must be notified. He will initiate the change order process with the Air Force or decide to halt activities at that site. (Level B operations also require approval from Parsons corporate health and safety.) The SHSO will determine whether it is safe to continue activities without respiratory protection or assign an upgrade to Level C protection.

The use of PPE will be required when handling contaminated samples and working with potentially contaminated materials. The SHSO must ensure that all field personnel are properly trained in use, maintenance, limitations (including breakthrough time), and disposal of PPE assigned to them, in accordance with federal OSHA regulations in 29 CFR 1910.132. Disposable PPE will be used whenever possible to simplify decontamination, to reduce generation of contaminated wash water, and to avoid potential problems with chemical permeation (breakthrough). Single-use PPE (such as Tyvek®) will be disposed of whenever personnel go through decontamination. At most, a single item of disposable PPE (including respirator cartridges) will be used for no more than one day and will then be disposed of. Double layers of gloves will be used when personnel are handling contaminated soil or water, or equipment to minimize breakthrough. If personnel note chemical odors on their hands, clothing or skin after wearing PPE, or

develop skin irritation or rashes, consult with the SHSO and decide on alternate actions and/or seek medical attention.

Respirator and other PPE selection will be determined for each of the sites individually and variations from what is specified in this plan will be presented in the site-specific addenda. The criteria will be based on previously collected data indicating the contaminants of concern and their concentrations. Respiratory protection against chlorinated solvents will be discussed in the site-specific addenda. Hard hats will be worn in all areas where a head impact hazard exists. Steel-toed, steel-shank leather work boots will be worn by all field personnel.

The following personal protective ensemble is required only when handling contaminated samples or equipment.

Mandatory Equipment

- Vinyl or latex inner gloves
- 4H or SilverShield® outer gloves

Optional Equipment

- Air-purifying respirator (equipped with organic vapor/high-efficiency particulate air [HEPA] cartridges)
- Self-contained breathing apparatus or airline respirator in pressure-demand mode
- Rubber safety boots
- Disposable Tyvek® coveralls
- Outer disposable boot covers
- Saranex® suits
- Chemical goggles

7.2 EQUIPMENT NEEDS

Each field team will have the following items readily available:

- Copy of this program health and safety plan, site-specific addendum, and a separate list of emergency contacts;
- First aid kit which includes PPE for bloodborne pathogens;
- Eyewash station;
- Paper towels;
- Duct tape;
- Water (for drinking and washing);
- Plastic garbage bags;
- Fire extinguisher; and
- Earplugs.

7.3 EQUIPMENT DISPOSAL

All reusable PPE (such as hard hats and respirators), if contaminated, will be decontaminated in accordance with procedures specified in Section 10 of this health and safety plan. Contaminated single-use PPE (such as Tyvek® suits and protective gloves) will be properly disposed of according to installation requirements.

SECTION 8

FREQUENCY AND TYPES OF AIR MONITORING

Air monitoring will be used to identify and quantify airborne levels of hazardous substances. Periodic monitoring is required during on site activities. The types of monitoring and equipment to be used are as follows:

<u>Type of Equipment</u>	<u>Minimum Calibration Frequency</u>	<u>Parameter(s) to be Measured</u>	<u>Minimum Sampling Frequency</u>	<u>Sampling Locations</u>
Photoionization Detector	1/day	Benzene Organic Vapors	2/hour for general site activities	Breathing Zone
Sensidyne® or Dräger® Tubes	None (check manufacturer's requirements)	Benzene Organic Vapors	When PID exceeds lowest PEL of the contaminants of concern	Breathing Zone
Dosimeter Badges	None	Benzene Organic Vapors	As needed on workers with greatest exposure to contamination initially detected by Dräger® tubes	Breathing Zone
Portable Air Sampling Pumps	Prior to and after each use	Benzene Organic Vapors	As needed on workers with greatest exposure to contamination initially detected by Dräger® tubes	Breathing Zone

During field activities, a photoionization detector (such as an HNU® or MicroTIP®) will be used to measure ambient air concentrations in the worker-breathing zone. The size of the PID lamp will be determined for each site individually, based on the ionization

potential of the contaminants. This information will be presented in the site-specific addenda.

Evacuation may be necessary if the lowest PEL of a contaminant of concern is exceeded above background in the breathing zone of the site workers. This evacuation will be necessary until the area is well ventilated or the respiratory protection is upgraded, if possible. Any detectable concentration above background concentrations in the breathing zone will necessitate following the respiratory protection flowchart (Figure 7.1).

Worker exposure monitoring will be conducted to document any exposures of Parsons site personnel to organic vapors. Portable air sampling pumps or dosimeter badges will be used for personal exposure monitoring, if necessary. The following general protocols will be followed if badges or pumps are used.

Passive Dosimeter Badges

An organic vapor monitoring badge will be attached in the worker's breathing zone for an eight-hour period when the potential for exposure exists. The exposed badges and a blank will be sent to the laboratory for analysis. These personal dosimeter badges work by means of diffusion eliminating the need for a pump, calibration or batteries.

Portable Sampling Pumps

- The portable pump will be calibrated to the required flow rate (in liters per minute) following the manufacturer's calibration procedures.
- The pump will be equipped with the appropriate sorbent tube for the particular organic compounds to be monitored (e.g., charcoal for volatile organics).
- A personal air monitoring data sheet (provided in Appendix B) listing pump flow rates, start and stop times, sorbent tube used, etc. will be completed.
- The pump will undergo a post calibration to determine final flow rates.

- The laboratory analytical results will be disclosed to the employee(s) monitored.
- The analytical results will be placed in the employee's permanent medical file for documentation of any exposures received.

SECTION 9

SITE CONTROL MEASURES

The following site control measures will be followed to minimize potential contamination of workers, protect the public from potential site hazards, and control access to the sites. Site control involves the physical arrangement and control of the operation zones and the methods for removing contaminants from workers and equipment. The first aspect, site organization, is discussed in this section. The second aspect, decontamination, is considered in the next section.

9.1 SITE ORGANIZATION-OPERATION ZONES

The following organization-operation zones will be established on the site or around a particular site feature:

- Exclusion Zone (Contamination Zone),
- Contamination Reduction Zone, and
- Support Zone.

The site manager and/or SHSO will be responsible for establishing the size and distance between zones at the site or around the site feature. Considerable judgment is required to ensure safe working distances for each zone are balanced against practical work considerations.

9.1.1 Exclusion Zone (Contamination Zone)

The exclusion zone includes the areas where active investigation or cleanup operations take place. Within the exclusion zone, prescribed levels of PPE must be worn by all

personnel. The hotline, or exclusion zone boundary, is initially established based upon the presence of actual wastes or apparent spilled material, or through air monitoring, and is placed around all physical indicators of hazardous substances. For drilling operations, the hotline will be located at a distance equal to the drilling rig boom height or 25 feet, whichever is greater, from the drill rig. The hotline generally consists of an easily identifiable physical boundary (e.g., bright orange or yellow flagging attached to stakes, and may be readjusted based upon subsequent observations and measurements. This boundary will be physically secured and posted or well defined by physical and geographic boundaries.

Under some circumstances, the exclusion zone may be subdivided into zones based upon environmental measurements or expected onsite work conditions.

9.1.2 Contamination Reduction Zone

If decontamination is required, a contamination reduction zone will be established between the exclusion zone and the support zone. The contamination reduction zone will be located upwind of the exclusion zone. This zone provides an area to prevent or reduce the transfer of hazardous materials which may have been picked up by personnel or equipment leaving the exclusion area. All decontamination activities occur in this area. The organization of the contamination reduction zone and the control of decontamination operations, are described in Section 10.

9.1.3 Support Zone

The support zone is the outermost area of the site and is considered a noncontaminated or clean area. The support zone contains the command post for field operations, first-aid stations, and other investigation and cleanup support. Normal work clothes are appropriate apparel within this zone; potentially contaminated personnel, clothing or equipment are not permitted.

9.2 SITE SECURITY

Site security is necessary to prevent exposure of unauthorized, unprotected individuals in the work area. The areas immediately surrounding the work area will be clearly marked through use of warning signs, traffic cones, barrier tape, rope, or other suitable means.

Site security will be enforced by the SHSO or a designated alternate who will ensure that only authorized personnel are allowed in the work area and that entry personnel have the required level of PPE, are trained under the requirements of 29 CFR 1910.120, and are on a current medical monitoring program.

9.3 SITE COMMUNICATION

Internal site communication is necessary to alert field team members in the exclusion and contamination reduction zones to:

- Emergency conditions;
- To convey safety information; and
- Communicate changes or clarification in the work to be performed.

For internal site communication, the field team members will use prearranged hand signals (and responses). Radios and/or compressed air horns may also be used for communication.

External site communication is necessary to coordinate emergency response teams and to maintain contact with essential offsite personnel. A telephone will be available for use in external site communication. A list of emergency contact telephone numbers will be provided in subsequent addenda.

9.4 SAFE WORK PRACTICES

To ensure a strong safety-awareness program during field operations, field personnel will be adequately trained for their particular tasks. In addition, standing work orders will

be developed and communicated to all field personnel, as will the provisions of this program health and safety plan and the appropriate addenda. Sample standing work orders for personnel entering the contamination reduction zone and exclusion zone are as follows:

- No horseplay at any time;
- No smoking, eating, drinking or chewing of tobacco or gum;
- Alcoholic beverage intake and illegal drug use is prohibited during the work shift and will result in immediate dismissal from the site;
- No matches or lighters;
- No personal vehicles;
- Check in/check out at access control points;
- Use the buddy system;
- Wear appropriate PPE;
- Avoid walking through puddles or stained soil;
- Upon discovery of unusual or unexpected conditions, immediately evacuate and reassess the site conditions and health and safety practices;
- Conduct safety briefings prior to onsite work;
- Conduct daily safety meetings; and
- Take precautions to reduce injuries resulting from heavy equipment and other tools.

SECTION 10

DECONTAMINATION PROCEDURES

10.1 PERSONNEL DECONTAMINATION PROCEDURES

An exclusion zone, contamination reduction zone, and support zone will be established whenever field personnel are using PPE. Decontamination station layout will be made on a site-specific basis and will be based on the level of PPE used, the types of chemical hazards encountered, and the site conditions, including topography, wind direction, and traffic patterns. Defined site access and egress points will be established and personnel will enter and exit only through these points. As a general rule, persons assisting in the decontamination station may be in one level lower of respiratory protection than required in the work zone.

A guideline for personnel decontamination is presented in Figure 10.1. This procedure may be modified by the SHSO if necessary.

If personnel are in Level D-modified protection (no respirator but using protective gloves and/or suits and other equipment), a portable decontamination station will be set up at the site. The decontamination station will include provisions for collecting disposable PPE (e.g., garbage bags); washing boots, gloves, vinyl rain suits, field instruments and tools; and washing hands, face, and other exposed body parts. Onsite personnel will shower at the end of the workday. Refuse from decontamination will be properly disposed of in accordance with US Army installation protocols.

Decontamination equipment will include:

- Plastic buckets and pails;

EXCLUSION ZONE

3
REMOVE OUTER
GLOVES AND
BOOT COVERS

2
WASH AND RINSE
OUTER GLOVES
AND BOOT COVERS

1
SEGREGATED
EQUIPMENT DROP

4
FILTER CHANGE
(SKIP IF PROCEEDING
THROUGH DECONTAMINATION)

5
REMOVE
DISPOSABLE
TYVEK SUIT

6
WASH INNER GLOVES,
REMOVE RESPIRATOR
FACE PIECE

7
WASH/RINSE
RESPIRATOR

8
REMOVE
INNER GLOVES

EQUIPMENT
DECONTAMINATION
CORRIDOR

CONTAMINATION REDUCTION ZONE

SUPPORT ZONE

9
FIELD WASH

FIGURE 10.1
DECONTAMINATION
STATION LAYOUT
LEVEL C PROTECTION

PARSONS

Denver, Colorado

- Scrub brushes and long-handle brushes;
- Detergent;
- Containers of water;
- Paper towels;
- Plastic garbage bags;
- Plastic or steel 55-gallon barrels;
- Distilled water; and
- An eyewash station.

10.2 DECONTAMINATION OF EQUIPMENT

All sampling equipment will be decontaminated prior to use, between samples, and between sampling locations. PPE will consist of splash protective clothing, eye protection, gloves, and boot covers, as necessary.

SECTION 11

AIR MONITORING EQUIPMENT USE AND CALIBRATION PROCEDURES

11.1 PHOTOVAC MICROTIP® AIR ANALYZER

The MicroTIP® is a direct-reading instrument used in conjunction with the span gas kit. To calibrate the MicroTIP®, press the power switch. Allow the MicroTIP® to warm up; the display will read “Ready.” Press the calibration switch; the display will read “Connect zero gas then press enter.” Connect the bag of zero gas to the MicroTIP® inlet (or allow the MicroTIP® to sample clean air) and press enter; the display will read “Calibrating now please wait.” The display will then read "Span Conc.?" Enter the span concentration (usually 100 ppmv isobutylene). Connect the bag of span gas to the tip inlet and press enter; the display will read “Connect span gas then press enter.” The MicroTIP® will then calibrate. When the display reads “Ready,” the MicroTIP® has completed the calibration and is ready for use. Repeat the calibration daily.

To use the MicroTIP®, press the power switch and wait for the instrument to display the date, time, event number, current detected concentrations, and instrument status “ready.” The minimum, maximum, and average concentrations measured in each 15-second period are automatically recorded in memory. The keyboard also allows for direct numeric entry.

Since a calibration gas (i.e., isobutylene) is used which typically differs from the contaminants of concern, it may be necessary to combine the instrument reading with a response factor to more closely approximate the concentration of the contaminants of

concern. MSDSs for all chemicals (including calibration gases such as isobutylene) used in the field will be maintained by the field team.

Relative response factors are found in Table 11.1 for MicroTIP® models MP-100 and HL-200 with a 10.6 eV lamp. For these instruments, a more accurate concentration may be obtained by dividing the instrument reading by the appropriate relative response factor from Table 11.1 for the contaminant of concern.

For MicroTIP® instrument models MP-1000, HL-2000, IS-3000, and EX-4000 with a 10.6 eV lamp, the instrument reading is multiplied by the appropriate response factor from Table 11.2 for the contaminant of concern.

11.2 HNU® PHOTOIONIZATION DETECTOR

To calibrate the HNU®, turn the function switch to the “standby” mode and use the zero control to zero the instrument. Connect a bag of span gas (usually 100 ppmv isobutylene). Turn the function switch to the 0-200-range position and adjust the span control setting to read the ppmv concentration of the standard. Recheck the zero setting as previously described. If readjustment is needed, repeat the calibration step. This provides a two-point calibration to zero and the gas-standard point. Repeat the calibration daily. If the span setting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned.

To use the HNU® connect the probe to the instrument by matching the alignment slot in the probe connector to the key in the 12-pin connector on the control panel. Twist the probe connector until a distinct snap and lock is felt. Turn the function switch to battery check position. The needle should read within or above the green battery arc on the scale plate. If the needle is in the lower position of the battery arc, the instrument should be recharged before use. If the red light comes on, the battery should be recharged. Next, turn the functions switch to the on position, and the instrument is ready to take direct air readings.

TABLE 11.1
MICROTIP® RELATIVE RESPONSE FACTORS (10.6 EV LAMP)
INSTRUMENT MODELS MP-100 & HL-200

Compound	Relative Response Factor	Compound	Relative Response Factor
Acetaldehyde	0.17	Hydrogen Sulfide	0.25
Acetic Acid	0.09	Isobutyl Acetate	0.52
Acetone	0.86	Isobutyraldehyde	1.02
Acetone Cyanohydrin	0.93	Isopentane	0.12
Acrolein	0.28	Isoprene	2.12
Allyl Chloride	0.26	Isopropyl Acetate	0.43
Ammonia	0.10	Isopropyl Alcohol	0.23
Benzene	1.78	Methyl Bromide	0.45
1,3-Butadiene	1.43	Methyl tert-Butyl Ether	1.22
n-Butanol	0.27	Methyl Ethyl Ketone	1.10
see-Butanol	0.36	Methyl Isobutyl Ketone	0.87
n-Butyl Acetate	0.35	Methyl Mercaptan	1.60
n-Butyl Acrylate	0.53	Methyl Methacrylate	0.67
n-Butyl Mercaptan	1.36	Monoethylamine	1.25
n-Butylaldehyde	0.65	Monomethylamine	1.06
Carbon Disulfide	0.65	n-Octane	0.39
Chlorobenzene	2.24	n-Pentane	0.09
Cyclohexane	0.53	Perchloroethylene	1.40
Cyclohexanone	1.11	n-Propyl Acetate	0.31
1,2-Dichlorobenzene (ortho)	2.25	n-Propyl Alcohol	0.18
cis-1,2-Dichloroethylene	1.20	Propionaldehyde	0.56
trans-1,2-Dichloroethylene	2.21	Propylene	0.87
Diisobutylene	2.10	Propylene Oxide	0.13
1,4-Dioxane	0.83	Styrene	2.20
Epichlorohydrin	0.11	Tetrahydrofuran	0.65
Ethyl Alcohol	0.13	Toluene	1.91
Ethyl Acetate	0.25	Trichloroethylene	1.61
Ethyl Acrylate	0.30	Trimethylamine	1.35
Ethylene	0.09	Vinyl Acetate	0.84
Ethyl Mercaptan	1.82	Vinyl Bromide	2.24
Furfuryl Alcohol	1.43	Vinyl Chloride	0.51
n-Heptane	0.27	Vinylidene Chloride (1,1-DCE)	1.16
n-Hexane	0.20		

Note: Concentration = $\frac{\text{Instrument Reading}}{\text{Relative Response Factor}}$

TABLE 11.2
MICROTIP® RESPONSE FACTORS (10.6 EV LAMP)
INSTRUMENT MODELS MP-1000, HL-2000, IS-3000 & EX-4000

Compound	Response Factor	Compound	Response Factor
Acetaldehyde	6.6	n-Hexane	5.6
Acetic Acid	18.9	Hydrogen Sulfide	3.7
Acetone	1.2	Isobutyl Acetate	2.3
Acetone Cyanohydrin	1.2	Isobutyraldehyde	1.1
Acrolein	3.7	Isopentane	7.8
Allyl Chloride	4.3	Isoprene	0.6
Ammonia	10.1	Isopropyl Acetate	2.4
Benzene	0.6	Isopropyl Alcohol	4.5
1,3-Butadiene	0.7	Methyl Bromide	2.3
n-Butanol	4.6	Methyl tert-Butyl Ether	0.8
see-Butanol	3.0	Methyl Ethyl Ketone	0.9
n-Butyl Acetate	2.9	Methyl Isobutyl Ketone	1.1
n-Butyl Acrylate	1.9	Methyl Mercaptan	0.6
n-Butyl Mercaptan	0.7	Methyl Methacrylate	1.5
n-Butylaldehyde	1.9	Monoethylamine	0.8
Carbon Disulfide	1.4	Monomethylamine	1.0
Chlorobenzene	0.4	n-Octane	2.6
Cyclohexane	1.9	n-Pentane	10.8
Cyclohexanone	0.9	Perchloroethylene	0.7
1,2-Dichlorobenzene (ortho)	0.4	n-Propyl Acetate	3.5
cis-1,2-Dichloroethylene	0.8	n-Propyl Alcohol	6.3
trans-1,2-Dichloroethylene	0.4	Propionaldehyde	1.9
Diisobutylene	0.6	Propylene Oxide	7.1
Dimethylamine	1.5	Styrene	0.5
Di-n-propylamine	0.5	Tetrahydrofuran	1.5
1,4-Dioxane	1.2	Toluene	0.5
Epichlorohydrin	10.3	Trichloroethylene	0.6
Ethanol	11.1	Trimethylamine	0.9
Ethyl Acetate	4.2	Vinyl Acetate	1.2
Ethyl Acrylate	3.3	Vinyl Bromide	0.4
Ethylene	10.0	Vinyl Chloride	2.0
Ethyl Mercaptan	0.6	Vinylidene Chloride (1,1-DCE)	0.9
n-Heptane	3.7		

Note: Concentration = Instrument Reading x Response Factor

11.3 EXPLOSIVITY METER

An explosivity meter is used to measure oxygen and combustible gas levels. The instrument provides characteristic warning signals when deficient oxygen conditions or unacceptable levels of combustible gas are detected.

To use the explosivity meter, turn the unit on and wait a few seconds for the readings to stabilize. Check the battery charge and the alarms before using the instrument. Set the LEL indicator to zero and the oxygen indicator to 20.9 percent.

To calibrate the instrument, attach a bag, bulb or balloon of span gas and wait for the readings to stabilize. Adjust the instrument to read the LEL percent of the calibration gas. Remove the span gas and allow the instrument to exhaust. The combustible sensor will read 000-percent LEL in clean air.

11.4 SENSIDYNE® OR DRÄGER® COLORIMETRIC GAS ANALYSIS TUBES

Colorimetric tubes can be used to give an instantaneous reading of various organic compounds. Their aim is to determine very small concentrations of a compound in the shortest amount of time. To sample with a colorimetric tube use the Dräger® or Sensidyne® bellows pump and select the appropriate tube (for example, a tube marked benzene to look for benzene). Break off both ends on the pump's break-off plate. Insert the tube into the pump head (the tube should be inserted with the arrow pointing towards the pump). There are a specific number of suction strokes for each tube/compound. Each box of tubes will have instructions for how many suction strokes are required for that compound.

APPENDIX A

EMERGENCY CONTACTS

EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from a list similar to this which will be prepared in the health and safety plan addenda. For emergency situations, telephone or radio contact should be made with the site point of contact or site emergency personnel who will then contact the appropriate response teams.

<u>Contingency Contacts</u>	<u>Telephone Number</u>
Nearest phone located at the work site	_____
Site Fire Department	_____
Site Contact	_____
Site Emergency Telephone Number	_____
Site Security/Police	_____
<u>Medical Emergency</u>	
Hospital Name	_____
Hospital Address	_____
Hospital Telephone Number	_____
Ambulance Service	_____
Airlift Helicopter	_____

Directions and/or Map to the Hospital

Parsons Contacts

Peter Guest Project Manager/RPO Task Manager	(303) 831-8100 or 764-1913(w)
John Hicks PDBS Task Manager	(303) 831-8100 or 764-1941(w) (303) 279-3698 (h)
Timothy Mustard, CIH (Denver) Program Health and Safety Manager	(303) 831-8100 or 764-8810(w) (303) 450-9778 (h)
Edward Grunwald, CIH (Atlanta) Corporate Health and Safety Manager	(678) 969-2394 (w) (404) 299-9970 (h)
Judy Blakemore (Denver) Assistant Program Health and Safety Manager	(303) 831-8100 or 764-8861(w) (303) 828-4028 (h) (303) 817-9743 (m)
Parsons 24-Hour Emergency Contact Service	(866) 727-1411 (toll free)

USACE Contact

Mark Mercier (Project Manager)	(402) 221-7664
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APPENDIX B

PROJECT HEALTH AND SAFETY FORMS

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

Instructions: This form is to be completed by each person to work on the subject project work site and returned to the safety manager.

I have read and agree to abide by the contents of the Health and Safety Plan for the following project:

Signed

Date

RETURN TO:

Office Health and
Safety Representative
Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, CO 80290

SITE SPECIFIC TRAINING RECORD

Project: _____
Project No.: _____
Date: _____
Trainer: _____

On this date, the following individuals were provided site-specific training in accordance with OSHA regulations contained in 29CFR1910.120(e):

<u>Name (Print)</u>	<u>Employee No.</u>	<u>Employee Signature</u>
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Forward this form to:

Office Health and Safety Representative
Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290

PARSONS ENGINEERING SCIENCE, INC.
FIELD EXPERIENCE
DOCUMENTATION FORM

OSHA requires (29CFR1910.120(e)) that personnel involved in hazardous waste operations have 40-hours of initial training and a minimum of three days field experience working under the direction of a trained and experienced supervisor. This form serves to document the three days of additional field training/experience.

Employee Name: _____

Employee Number (or Social Security No.): _____

Project Name(s): _____

Project Number(s): _____

Dates of Field Training: _____

Summary of Activities Performed: _____

Levels of Respiratory Protection Used: _____

Comments:

Field Supervisor Signature: _____

Date: _____

Return this form to the Office Health and Safety Representative

“NEAR MISS” INCIDENT INVESTIGATION REPORT FORM

- 1) Project name and number: _____
- 2) “Near miss” location: _____
- 3) Incident date and time: _____
- 4) Personnel present (optional): _____
- 5) Describe incident: _____

- 6) What action or condition contributed to incident? _____

- 7) What action was taken or suggested to prevent reoccurrence? _____

- 8) Comments _____

- 9) Date of report _____ Prepared by _____
- 10) Office health and safety representative review:

Signature

Date

**PARSONS ENGINEERING SCIENCE, INC.
DAILY VEHICLE INSPECTION REPORT**

= OK

= Adjustment Made

= Repair Needed

Date: _____ Time: _____ License Plate Number: _____

Vehicle Make and Type: _____ Rental Agency _____

General Vehicle Inspection:

- | | | | |
|---------------------|--------------------------|------------------------|--------------------------|
| 1. Windshield | <input type="checkbox"/> | 3. Vehicle Interior | <input type="checkbox"/> |
| 2. Vehicle Exterior | <input type="checkbox"/> | 4. Leaks under Vehicle | <input type="checkbox"/> |

Check that the following are in proper working order:

1. Lights:
 - a. Headlights
 - b. Taillights
 - c. Turn Signals
 - d. Brake Lights
 - e. Back-up Lights
 - f. Interior Lights
2. Brakes
3. Horn
4. Tires properly inflated (refer to sticker on door or vehicle manual)
5. Spare tire present and properly inflated
6. Windshield wipers
7. Windshield washers
8. Defrosters/Defoggers
9. Battery terminals free of corrosion
10. Cooling system hoses
11. Belts
12. Fluid levels: (Circle approximate level)

a. Oil: Full	1 Quart low	Does not register
b. Coolant: Full cool	Needs some coolant	Does not register
c. Transmission: Full	1 Pint low	Does not register
(NOTE: Check transmission fluid while vehicle is running!)		
d. Fuel:	E 1/4 1/2 3/4 F	

Please note any problems, unusual conditions, repairs made or fluids added (except fuel):

PERSONAL AIR MONITORING DATA FORM

PROJECT NAME _____

PROJECT NUMBER: _____

Person Sampling	Person(s) Sampled/Location	Date	Time	PID/BG** (PPM)	Dräger (PPM)	LEL/BG (%)	O ₂ /BG (%)	Other	Notes

PID

Explosimeter

Other

Model _____
 Serial # _____
 Cal.* Gas _____
 Cal. Reading _____
 BG Reading _____

Model _____
 Serial # _____
 Cal Gas _____
 Cal. Reading _____
 BG Reading _____

Model _____
 Serial # _____
 Cal Gas _____
 Cal. Reading _____
 BG Reading _____

Cal

=

Calibration

*
 **BG = Background

15. ES WITNESS TO ACCIDENT
- | | | |
|--------|---------------|-------------|
| _____ | _____ | _____ |
| (Name) | (Affiliation) | (Phone No.) |
| _____ | _____ | _____ |
| (Name) | (Affiliation) | (Phone No.) |
| _____ | _____ | _____ |
| (Name) | (Affiliation) | (Phone No.) |

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe injury or illness in detail; indicate part of body affected:
- _____
- _____
17. Name the object or substance that directly injured the employee. (for example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.).
- _____
- _____
18. Date of injury or initial diagnosis of occupational illness: _____
(date)
19. Did the accident result in employee fatality? Yes () No ()
20. Number of lost days ____/restricted workdays ____ resulting from injury or illness?

OTHER

21. Name and address of physician: _____
(No. and Street) (City or Town) (State and Zip)
22. If hospitalized, name and address: _____
(No. and Street) (City or Town) (State and Zip)
- Date of report: _____ Prepared by: _____
- Official position: _____

APPENDIX C

JOB SAFETY ANALYSES

**PARSONS ENGINEERING SCIENCE, INC.
JOB SAFETY ANALYSIS**

ACTIVITY: Water Sampling with Diffusion Sampler

Potential Hazards	Recommended Controls
Slip, Trip, Fall, Loss of Balance	Site safety briefing Stay alert Maintain firm footing Use "buddy" system Watch for obstacles and tripping hazards in the work area
Heat/Cold Stress	Wear appropriate clothing Monitor for heat/cold stress as recommended in the HASP Provide adequate drinking water (minimum 1.5 gallons/person) Carry communication equipment
Chemical Hazards	Conduct daily site safety briefing Conduct air monitoring as described in the HASP and use the appropriate PPE level Avoid contact with contaminated soil and groundwater Be aware of possible exposure symptoms (e.g., headache, nausea, dizziness, etc.) Immediately report any exposure symptoms to the Site Health and Safety Officer
Fire Hazards	Have approved fire protection devices available (see HASP) Equipment will be shut down prior to fueling Use good housekeeping procedures
Noise/Eye Hazards	Use hearing protection when appropriate Use approved safety glasses
Sharp Objects	Wear boots with steel toes and shanks Use care when cutting rope with knife or scissors Have a current tetanus booster as recommended by occupational physician Be extra cautious in areas containing sharp objects
Biohazard	Biohazard training Tap well casing with tool prior to opening and listen for buzzing of bees or wasps Stay alert for snakes, spiders (inside well casing), insects, and animals Wear high-top safety boots
Physical Exertion	Follow work/rest regime Use "buddy" system Use proper lifting technique, size up the load, never twist or turn when lifting

**PARSONS ENGINEERING SCIENCE, INC.
JOB SAFETY ANALYSIS**

ACTIVITY: General Field Vehicle Operations

Page 1 of 1

Potential Hazards	Recommended Controls
Speeding	Observe posted speed limits Keep vehicle under control Operate at lesser speeds consistent with conditions
Backing up	Visual check around and behind vehicle Backup alarm or use observer to guide you Notify bystanders that vehicle is backing up (verbally or sound horn)
Unsafe Equipment	Perform vehicle inspection prior to shift Repair or replace defective equipment
Unfamiliar Area	Obtain map and/or detailed directions Lock doors
Unfamiliar Vehicle (e.g., rental car)	Familiarize yourself with controls Adjust seat, mirrors, etc. prior to putting vehicle in motion Set radio stations prior to putting vehicle in motion

**JOB SAFETY ANALYSIS
FOR GEOPROBE® SOIL/GROUNDWATER SAMPLING**

Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Monitoring Devices
Geoprobe® Soil/Groundwater Sampling	Failure of Equipment	<ul style="list-style-type: none"> • Proper site-specific safety training for operator and crew • Daily inspection to include: <ul style="list-style-type: none"> ▪ Vehicle/equipment condition ▪ Properly block and level machine ▪ Proper equipment storage ▪ Condition of all fittings, drive rods, and hydraulic lines ▪ Presence and check first aid kit and fire extinguisher 		
	Inhalation and Contact with Hazardous Substances or Vehicle Exhaust	<ul style="list-style-type: none"> • Provide workers proper skin, eye, and respiratory protection based on the exposure hazards and vehicle exhaust present • Review hazardous properties of site contaminants and vehicle exhaust with workers before sampling operations begin • Orient operator cross-wind • Keep all sampling supplies and bottles upwind or cross-wind 	Tyvek coveralls, nitrile gloves, latex or neoprene boots	FID/PID, LEL/O ₂
	Contact with Utilities	<ul style="list-style-type: none"> • Use Underground Utility Avoidance procedures: <ul style="list-style-type: none"> ▪ Check site blueprints ▪ Use locator to mark utilities (One Call, etc.) ▪ Have emergency telephone number available ▪ Mark known utilities • Maintain safe distance from overhead electrical lines (See Table below) 		
	Struck by/Against	<ul style="list-style-type: none"> • Wear hard hats, safety glasses with side shields and steel- 	Hard Hat, safety	

**JOB SAFETY ANALYSIS
FOR GEOPROBE® SOIL/GROUNDWATER SAMPLING**

Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Monitoring Devices
	Flying Particles, Protruding Objects, Liquid Splash	<p>toed safety boot at all times.</p> <ul style="list-style-type: none"> • Keep hands clear of rod prior to it being driven • Wear splash shields and safety goggles when cleaning, decontaminating drilling equipment 	glasses, safety boots	
	High Noise Levels	<ul style="list-style-type: none"> • Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • The need to raise your voice at 1 foot or shout at 3 feet is a sign hear protection is required 	Ear plugs/muffs	Sound level meter
	Musculoskeletal Disorders (MSD)	<ul style="list-style-type: none"> • Observe proper lifting techniques • Obey sensible lifting limits (60 lb. Maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) or more than one person to move large, awkward loads. 		
	Sharp Objects	<ul style="list-style-type: none"> • Use Geoprobe® tool or hook bladed utility knife to cut acetate sleeves • Maintain all tools in a safe condition • Keep guards in place during use • Always cut away from body and hands 	Leather gloves and proper cutting tool (Geoprobe® knife or hook blade utility knife)	
	Caught In/Between Moving Parts	<ul style="list-style-type: none"> • Identify and understand parts of equipment which may cause crushing, pinching, rotating, or similar injuries • Assure guards are in place to protect from these parts of equipment during operation • Provide and use proper work glove when the possibility of pinching, or other injury may be caused by moving/handling large or heavy objects 		

**JOB SAFETY ANALYSIS
FOR GEOPROBE® SOIL/GROUNDWATER SAMPLING**

Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Monitoring Devices
		<ul style="list-style-type: none"> • Maintain all equipment in safe condition • Keep all guards in place during use • De-energize and lock-out machinery before maintenance or service 		
	Flammable, Explosive Atmospheres	<ul style="list-style-type: none"> • Test probe stem head atmospheres for flammable/toxic vapors • Turn engine off before refueling • Eliminate sources of ignition from the work area • Prohibit smoking in well drilling area • Provide ABC (or equivalent) fire extinguishers • Store flammable liquids in well ventilated areas • Prohibit storage of flammable liquids in plastic containers • Store combustible materials away from flammables • Separate flammables and oxidizers by 20 feet minimum 		LEL/O ₂ , FID/PID
	Heat / Cold Stress	<ul style="list-style-type: none"> • Monitor for heat/cold stress in accordance with health and safety procedures • Provide fluids to prevent work dehydration • Give frequent breaks 		Wet Bulb Globe Thermometer OR Oral thermometer and pulse

<i>Minimum Clearance from Energized Overhead Electrical Line</i>	
Nominal System Voltage	Minimum Required Clearance
0 - 50 kV	10 feet
51 - 200 kV	15 feet
201 - 300 kV	20 feet
301 - 500 kV	25 feet
501 - 750 kV	35 feet
751 - 1000 kV	45 feet

PARSONS ENGINEERING SCIENCE, INC.
JOB SAFETY ANALYSIS

ACTIVITY: General Health and Safety

Potential Hazards	Recommended Controls
Slip, Trip, Fall, Loss of Balance	Site safety briefing Stay alert Maintain firm footing Use "buddy" system Watch for obstacles
Heat/Cold Stress	Wear appropriate clothing Monitor for heat/cold stress as recommended in the HASP Provide adequate drinking water (minimum 1.5 gallons/person) Carry communication equipment
Fire Hazards	Have approved fire protection devices available (see HASP) Equipment will be shut down prior to fueling Use good housekeeping procedures
Noise/Eye Hazards	Use hearing protection when appropriate Use approved safety glasses
Sharp Objects	Wear boots with steel toes and shanks Have a current tetanus booster as recommended by occupational physician Be extra cautious in areas containing sharp objects
Biohazard	Biohazard training Stay alert for snakes, insects, and animals Wear high-top safety boots
Physical Exertion	Follow work/rest regime Use "buddy" system Use proper lifting technique, size up the load, never twist or turn when lifting
Construction Hazards	Wear hard-hat, safety glasses, steel-toe/shank boots, and hearing protection when working near heavy equipment Never enter excavations Stay alert Maintain eye contact/communication with equipment operator when working in vicinity

PARSONS ENGINEERING SCIENCE, INC.
JOB SAFETY ANALYSIS

ACTIVITY: Drill Rig Operations

Potential Hazards	Recommended Controls
Operations Hazards Faulty/Damaged Equipment Hand/Power tools Falling Objects Pinch/Contact Points Fire Hazards	Wear hardhat and steel-toe/shank boots and proper PPE (see HASP) Stay alert, watch for pinch/contact points (sliding platforms, rotary equipment, etc.) Maintain eye contact/communication with equipment operator when working in vicinity Equipment will be operated by trained/experienced personnel only Equipment will be inspected upon arrival and at the beginning of each shift (e.g., frayed cables, worn fittings, etc.) Equipment found to be unsafe will be tagged and locked out Keep feet and hands clear of moving/suspended materials and equipment Machine guards shall remain in place Use long-handled shovels to remove auger cuttings Carry fire extinguisher on board vehicle Be aware of locations of kill switches
Chemical Hazards	Conduct daily site safety briefing Conduct air monitoring as described in Section 8 of the HASP and use the appropriate PPE level Avoid contact with contaminated soil and groundwater Avoid breathing dust by using dust suppression, if necessary Be aware of possible exposure symptoms (e.g., headache, nausea, dizziness, sleepiness, etc.) Immediately report any exposure symptoms to the Site Health and Safety Officer
Physical Exertion	Follow work/rest regime Use "buddy" system Use proper lifting technique, size up the load, never twist or turn when lifting
Noise/Eye Protection	Use hearing protection when appropriate Use approved safety glasses
Slip, Trip, Fall, Loss of Balance	Site safety briefing Stay alert Maintain firm footing Watch for obstacles

PARSONS ENGINEERING SCIENCE, INC.
JOB SAFETY ANALYSIS

ACTIVITY: Drill Rig Operations

Potential Hazards	Recommended Controls
Biohazard	Biohazard training Stay alert for snakes, insects, and animals Wear high-top safety boots
Heat/Cold Stress	Wear appropriate clothing Monitor for heat/cold stress as recommended in the HASP Carry drinking water (minimum 1.5 gallons per person) Carry communication equipment
Fire Hazards	Have approved fire protection devices available (see HASP) Equipment will be shut down prior to fueling Use good housekeeping procedures
Sharps/Metal Fragments	Wear boots with steel toes and shanks Have a current tetanus booster as recommended by occupational physician

Equipment to be used	Inspection Requirements	Training Requirements
Communications Equipment Air Monitoring Instruments Drill Rig	Function Test: Communications Equipment Air Monitoring Instruments Inspect Drill Rig Daily	Site-specific training Biohazard training 40-hr OSHA hazardous waste operations training Read and comply with the HASP

**PARSONS ENGINEERING SCIENCE, INC.
JOB SAFETY ANALYSIS**

ACTIVITY:

Page 1 of 1

Potential Hazards	Recommended Controls

**APPENDIX D - EXAMPLE SITE-SPECIFIC HEALTH AND SAFETY
PLAN ADDENDUM**

**ADDENDUM TO THE PROGRAM HEALTH AND SAFETY PLAN FOR
REMEDIAL PROCESS OPTIMIZATION SUPPORT AND
DEMONSTRATION OF PASSIVE DIFFUSION BAG SAMPLING
TECHNOLOGY
AT SEVERAL DEPARTMENT OF DEFENSE INSTALLATIONS**

AT

**SITE ST-04
(CAR CARE CENTER, BUILDING 41)**

AND

**SITE SS-05
(HANGAR 2 APRON)**

**BOLLING AIR FORCE BASE
WASHINGTON, DC**

MARCH 2002

Prepared By:

**Parsons
1700 Broadway, Suite 900
Denver, Colorado 80290**

Reviewed and Approved By:

Name

Date

Project Manager
Office Health and Safety
Representative

1.0 INTRODUCTION

This addendum modifies the existing program health and safety plan (HASP) entitled *Program Health and Safety Plan for Remedial Process Optimization Support and Demonstration of Passive Diffusion Bag Sampling Technology at Several Department of Defense Installations* (Parsons Engineering Science, Inc., [Parsons] 2002) for remedial process optimization (RPO) evaluations and the demonstration of the effectiveness of passive diffusion bag samplers (PDBSs) in existing groundwater monitoring programs at selected US Air Force (USAF) and other Department of Defense (DoD) installations across the United States. This work is being performed under contract number F44650-99-D-005 Delivery Order DK01, US Department of the Army, Corps of Engineers (USACE), Omaha District, and Air Force Base Conversion Agency (AFBCA).

This addendum to the program HASP was prepared to address the upcoming tasks at the Car Care Center (site ST-04) and the Hangar 2 Apron (site SS-05), at Bolling Air Force Base (AFB), Washington, DC. Included or referenced in this addendum are the scope of services, site-specific description and history, project team organization, hazard evaluation of physical hazards and of known or suspected chemicals, and emergency response information. All other applicable portions of the program health and safety plan remain in effect.

2.0 SCOPE OF SERVICES

RPO activities will include soil sampling and groundwater monitoring well installation with the use of a hollow-stem auger drilling rig.

PDBS activities will involve the placement of water-filled diffusive membrane capsules at specific depths in existing groundwater monitoring wells. The wells are located in various areas throughout the base. After a specified period of time, the water in the sampler is transferred to a sample container and submitted for laboratory analysis. No drilling or ground-intrusive activities are anticipated under the current scope of PDBS work.

3.0 SITE-SPECIFIC DESCRIPTION HISTORY

The descriptions, history, and maps for the site are contained in the work plan entitled *Work Plan for Remedial Process Optimization Evaluations and the Passive Diffusion Bag Sampler Demonstration at Bolling AFB, Washington, DC* (Parsons, 2002).

4.0 PROJECT TEAM ORGANIZATION

The project team assigned to the RPO/PDBS demonstration activities at Bolling AFB is identified in the program HASP. The following personnel will also be involved in this project.

Ms. Linda Murray	Project Manager
Mr. John Hicks	Task Manager
Mr. John Tunks	Assistant Task Manager
Mr. John Ledbetter	Site Manager

Mr. Jason Gross
Mr. Modupe Babalola

Site Health and Safety Officer
Bolling AFB Site Contact

5.0 HAZARD EVALUATION

5.1 Chemical Hazards

The primary contaminants of concern at site ST-04 are the volatile hydrocarbon constituents benzene, toluene, ethylbenzene, and xylenes (BTEX). The primary contaminants of concern at site SS-05 are chlorinated solvents and the BTEX compounds. Health hazard qualities for these and other compounds are presented in Table 5.1A for site ST-04 and Table 5.1B for site SS-05 at the end of this addendum. If other contaminants are found to exist at the site, this addendum will be modified to include the necessary information that will then be communicated to the onsite personnel.

5.2 Physical Hazards

Potential physical hazards at Bolling AFB include hazards associated with motor vehicles and drilling rigs; slip, trip, and fall hazards; noise; and heat and cold exposure. These hazards are discussed in the program HASP (Parsons, 2002).

6.0 EMERGENCY RESPONSE PLAN

6.1 Emergency Contacts

In the event of any emergency situation or unplanned occurrence requiring assistance, the appropriate contacts should be made from the list below. A list of emergency contacts must be posted at the site. **DO NOT USE 911 WHILE AT BOLLING AFB.**

Contingency Contacts

Telephone Number

Bolling AFB Fire Department	(202) 767-5777
Bolling AFB Police Department	(202) 767-4357 or -5000
Site Contact: Modupe Babalola 370 Brookley Avenue Bolling AFB, Washington, DC	(202) 767-1159

Medical Emergency (On-Base):

Hospital Name	Bolling AFB Clinic
Address	Building 1300 corner of Brookley and Angell Bolling AFB
Hours	0700-1600
Telephone Number	(202) 767-5234
Ambulance	(202) 767-5233 (available 24 hours)

Directions to the Base Hospital:

For site ST-04, travel south on Brookley Avenue approximately 0.5 mile to Angell Street. From site SS-05, turn right on Brookley Avenue and travel south approximately 0.3 mile to Angell Street.

Medical Emergency (Off-Base):

Hospital Name	Hadley Memorial Hospital
Address	4601 Martin Luther King Jr. Avenue Washington, DC 20032
Telephone Number	(202) 574-5700
Ambulance	911 if off-base, (202) 767-5233 if on-base

Directions to the Off-Base Hospital:

Exit the base from MacDill Boulevard and proceed to South Capitol Street. Turn right (south) and continue for approximately 3500 feet. Bear right onto Martin Luther King Jr. Avenue. Continue for approximately one mile to the hospital.

Parsons ES Contacts

Telephone Number

Linda Murray Project Manager	(303) 831-8100 or 764-1904 (Work) (303) 279-9129 (Home)
John Hicks Task Manager	(303) 831-8100 or 764-1941 (Work) (303) 279-3698 (Home)
John Tunks Assistant Task Manager	(303) 831-8100 or 764-8740 (Work) (303) 833-1454 (Home)
Tim Mustard, CIH Program Health and Safety Manager	(303) 831-8100 or 764-8810 (Work) (303) 450-9778 (Home)
Ed Grunwald, CIH Corporate Health and Safety Manager	(678) 969-2394 (Work) (404) 299-9970 (Home)
Judy Blakemore Assistant Program Health and Safety Manager	(303) 831-8100 or 764-8861 (Work) (303) 828-4028 (Home) (303) 817-9743 (Mobile)
Parsons 24-Hour Emergency Contact Service	(866) 727-1411

**7.0 LEVELS OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT
REQUIRED FOR SITE ACTIVITIES**

The personal protection level prescribed for field activities at Bolling AFB is Occupational Safety and Health Administration (OSHA) Level D with a contingency for the use of OSHA Level C or B, as site conditions require. The flow chart presented in Figure 7.1 of the program HASP plan along with the related text will be used to select respiratory protection at site ST-04. For site SS-05, the following information will be

used to select respiratory protection in combination with the Figure 7.1 flow chart and related text in the program HASP.

Although there is a Dräger® tube that can be used for the detection of vinyl chloride, there is no Dräger® tube for 1,1-DCE or 1,1,2,2-tetrachloroethane. Therefore, the following procedures will be followed. If sustained air monitoring readings in the worker breathing zone indicate vapor concentrations greater than or equal to 1 part per million (ppm) above background for 30 seconds or longer, the field crew will be forced to evacuate and ventilate the area until readings are less than 1 ppm in the worker breathing zone. If ventilation is inadequate, air samples will be taken to confirm or deny the existence of the contaminants of concern and/or the crew will upgrade to Level B respiratory protection. These air samples will be sent to a lab to be analyzed by US Environmental Protection Agency (USEPA) Compendium Method TO-14 or equivalent. Method TO-14 can also be used to analyze for the other volatile contaminants of concern at the site as listed in Table 5.1 of this addendum.

If vinyl chloride, 1,1-DCE, and/or 1,1,2,2-tetrachloroethane are/is found to exist in the worker-breathing zone at concentrations greater than 1 ppm above background, additional work must be performed in OSHA Level B personal protective equipment (PPE) due to the inadequate warning properties of these compounds.

If these compounds do not exist in the worker-breathing zone at concentrations greater than 1 ppm above background, a reading of 2 ppm above background in the worker-breathing zone will require the use of Dräger® tubes or the equivalent to determine if chloroform and/or carbon tetrachloride is/are present. Level B protection must also be used if the concentration of chloroform and/or carbon tetrachloride equals or exceeds 2 ppm above background in the worker-breathing zone.

A reading of of 4 ppm above background in the worker-breathing zone will require the use of a Dräger® tube or the equivalent to determine if carbon disulfide is present. Level B protection must also be used if concentrations of carbon disulfide meet or exceed 4 ppm above background in the worker-breathing zone.

If the above compounds are not present, and field activities continue with Level D protection, a reading of 5 ppm above background in the worker-breathing zone will require the use of a Dräger® tube or the equivalent to determine if benzene is present at a concentration greater than or equal to the PEL of 1 ppm. The flow chart presented in Figure 7.1 and appropriate text in the Program HASP then will be used to select respiratory protection for volatile hydrocarbon constituents.

If sustained air-monitoring readings in the worker-breathing zone persist at or above 25 ppm, Dräger® tubes or the equivalent must be used to confirm or deny the presence of tetrachloroethene (PCE). Due to the inadequate warning properties of PCE, Level B protection must be used if concentrations of PCE are greater than or equal to 25 ppm above background in the worker-breathing zone.

If PCE is not present, continue to monitor the air in the worker-breathing zone. If concentrations in the worker-breathing zone persist above 25 ppm above background, periodic use of the PCE and/or methylene chloride Dräger® tubes must be used to confirm the absence of the compounds.

Section 7 of the Program HASP contains guidelines for selection of PPE. PPE will be required when handling contaminated samples and when working with potentially contaminated materials.

8.0 FREQUENCY AND TYPES OF AIR MONITORING

A photoionization detector (PID) with an 11.7 electron volts (eV) (HNU®) or equivalent lamp will be used for air monitoring during this project since the ionization potentials of the contaminants of concern are below 11.7 eV.

TABLE 5.1A HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL ^{a/} (ppm)	TLV ^{b/} (ppm)	IDLH ^{c/} (ppm)	Odor Threshold ^{d/} (ppm)	Ionization Potential ^{e/} (eV)	Physical Description/Health Effects/Symptoms
Benzene	1 (29 CFR 1910.1028) ^{f/}	0.5 (skin) ^{g/}	500	4.7	9.24	Colorless to light-yellow liquid (solid <42°F) with an aromatic odor. Eye, nose, skin, and respiratory system irritant. Causes giddiness, headaches, nausea, staggered gait, fatigue, anorexia, exhaustion, dermatitis, bone marrow depression, and leukemia. Mutagen, experimental teratogen, and carcinogen.
Ethylbenzene	100	100	800 (10% LEL) ^{h/}	0.25-200	8.76	Colorless liquid with an aromatic odor. Irritates eyes, skin, and mucous membranes. Causes dermatitis, headaches, narcosis, and coma. Mutagen and experimental teratogen.
Toluene	100	50 (skin)	500	0.2-40 ^{i/}	8.82	Colorless liquid with sweet, pungent, benzene-like odor. Irritates eyes and nose. Causes fatigue, weakness, dizziness, headaches, hallucinations or distorted perceptions, confusion, euphoria, dilated pupils, nervousness, tearing, muscle fatigue, insomnia, skin tingling, dermatitis, bone marrow changes, and liver and kidney damage. Mutagen and experimental teratogen.
Xylene (o-, m-, and p-isomers)	100	100	900	0.05-200 ^{i/}	8.56 8.44 (p)	Colorless liquid with aromatic odor. P-isomer is a solid <56°F. Irritates eyes, skin, nose, and throat. Causes dizziness, drowsiness, staggered gait, incoordination, irritability, excitement, corneal irregularities, conjunctivitis, dermatitis, anorexia, nausea, vomiting, abdominal pain, and olfactory and pulmonary changes. Also targets blood, liver, and kidneys. Mutagen and experimental teratogen.

a/ PEL = Permissible Exposure Limit. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm. Expressed as parts per million (ppm) unless noted otherwise. PELs are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997. Some states (such as California) may have more restrictive PELs. Check state regulations.

b/ TLV = Threshold Limit Value - Time-Weighted Average. Average air concentration (same definition as PEL, above) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), 2001 *TLVs® and BEIs®*.

c/ IDLH = Immediately Dangerous to Life or Health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise. IDLH values are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997.

d/ When a range is given, use the highest concentration.

e/ Ionization Potential, measured in electron volts (eV), used to determine if field air monitoring equipment can detect substance. Values are published in the *NIOSH Pocket Guide to Chemical Hazards*, June 1997.

f/ Refer to expanded rules for this compound.

g/ (skin) = Refers to the potential contribution to the overall exposure by the cutaneous route.

h/ Indicates that the IDLH value was based on 10% of the lower explosive limit for safety considerations, even though relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations (*NIOSH Pocket Guide to Chemical Hazards*, 1997).

i/ Olfactory fatigue has been reported for the compound and odor may not serve as an adequate warning property.

TABLE 5.1B HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL ^{a/} (ppm)	TLV ^{b/} (ppm)	IDLH ^{c/} (ppm)	Odor Threshold ^{d/} (ppm)	Ionization Potential ^{e/} (eV)	Physical Description/Health Effects/Symptoms
Acetone	750	500	2,500 (10% LEL) ^{f/}	100	9.69	Colorless liquid with mint-like odor. Irritates nose, eyes, and throat. Causes headaches, dizziness, central nervous system (CNS) depression, and dermatitis.
Benzene	1 (29 CFR 1910.1028) ^{g/}	0.5 (skin) ^{h/}	500	4.7	9.24	Colorless to light-yellow liquid (solid<42°F) with an aromatic odor. Eye, nose, skin, and respiratory system irritant. Causes giddiness, headaches, nausea, staggered gait, fatigue, anorexia, exhaustion, dermatitis, bone marrow depression, and leukemia. Mutagen, experimental teratogen, and carcinogen.
Carbon Disulfide	4 (skin)	10 (skin)	500	0.0011-7.7	10.08	Colorless to faint-yellow liquid with sweet ether or foul (reagent grade) odor. Irritating to eyes, skin, and mucous membranes on contact. Causes dizziness, headaches, poor sleep, fatigue, nervousness, low-weight, psychosis, nervous system degeneration, Parkinson-like syndrome, ocular changes, heart disease, gastritis, dermatitis, eye and skin burns, liver and kidney damage, and reproductive effects. Mutagen and experimental teratogen.
Carbon Tetrachloride	2	5 (skin)	200	21.4-200	11.47	Colorless liquid with characteristic, ether-like odor. Irritates eyes and skin. Causes CNS depression, nausea, vomiting, liver/kidney damage, drowsiness, dizziness, and incoordination. In animals, causes liver cancer. Mutagen, experimental teratogen, and carcinogen.
Chloroform (Trichloromethane)	2	10	500	205 ^{i/}	11.42	Colorless, heavy liquid with pleasant odor. Irritates eyes and skin. Anaesthetic. Causes dizziness, mental dullness, nausea, confusion, headache, fatigue, anesthesia, and enlarged liver. Also attacks kidneys and heart. In animals, causes liver and kidney cancer. Mutagen, experimental teratogen, and carcinogen.
Chloromethane (Methyl Chloride)	50	50 (skin)	2,000	10-100	11.28	Colorless gas with a sweet taste and a faint, sweet odor not noticeable at dangerous concentrations. Causes dizziness, nausea, vomiting, visual disturbances, staggering, slurred speech, convulsions, coma, frostbite (liquid), reproductive and teratogenic effects, and CNS, liver, and kidney damage. In animals, causes lung, kidney, and forestomach tumors. Mutagen, experimental teratogen, and carcinogen.

TABLE 5.1B HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL ^{a/} (ppm)	TLV ^{b/} (ppm)	IDLH ^{c/} (ppm)	Odor Threshold ^{d/} (ppm)	Ionization Potential ^{e/} (eV)	Physical Description/Health Effects/Symptoms
1,1-Dichloroethene (DCE) (Vinylidene Chloride)	1	5	NA ^{j/}	NA	10.00	Colorless liquid or gas (>89°F) with a mild, sweet, chloroform-like odor. Irritates eyes, skin, and throat. Causes dizziness, headaches, nausea, shortness of breath, liver and kidney dysfunctions, and lung inflammation. Mutagen and carcinogen.
1,2-Dichloroethene (DCE) (cis- and trans-isomers)	200	200	1,000	0.085-500	9.65	Colorless liquid (usually a mixture of cis- and trans- isomers), with a slightly acrid, chloroform-like odor. Irritates eyes and respiratory system. CNS depressant. Cis- isomer is a mutagen.
Ethylbenzene	100	100	800 (10% LEL) ^{k/}	0.25-200	8.76	Colorless liquid with an aromatic odor. Irritates eyes, skin, and mucous membranes. Causes dermatitis, headaches, narcosis, and coma. Mutagen and experimental teratogen.
Styrene	50	20 (skin)	700	0.047-200	8.40	Colorless to yellow, oily liquid with sweet floral odor. Irritates eyes, nose, and respiratory system. Causes tearing, violent itching of the eyes, headaches, fatigue, dizziness, confusion, vague discomfort, drowsiness, weakness, unsteady gait, narcosis, defatting dermatitis, and possible liver injury and reproductive effects. Mutagen, experimental teratogen, and suspected carcinogen.
1,1,2,2-Tetrachloroethane	1 (skin)	1 (skin)	100	3-5	11.10	Heavy, colorless to pale-yellow liquid with pungent, chloroform-like odor. Powerful narcotic and liver poison. Strong irritant to eyes and mucous membranes. Causes nausea, vomiting, abdominal pain, finger tremors, jaundice, hepatitis, liver tenderness, dermatitis, blood disorders, sleepiness, hallucinations, distorted perceptions, tearing, salivation, restlessness, dizziness, convulsions, coma, death, and kidney damage. In animals, causes liver tumors. Mutagen and carcinogen.
Tetrachloroethene (PCE) (Perchlorethylene)	25 ^{l/}	25	150	5-50	9.32	Colorless liquid with a mild chloroform odor. Eye, nose, skin and throat irritant. Causes nausea, flushed face and neck, vertigo, dizziness, headaches, hallucinations, incoordination, drowsiness, coma, pulmonary changes, and skin redness. Cumulative liver, kidney, and CNS damage. In animals, causes liver tumors. Mutagen, experimental teratogen, and carcinogen.

TABLE 5.1B HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL ^{a/} (ppm)	TLV ^{b/} (ppm) (skin)	IDLH ^{c/} (ppm)	Odor Threshold ^{d/} (ppm)	Ionization Potential ^{e/} (eV)	Physical Description/Health Effects/Symptoms
Toluene	100	50 (skin)	500	0.2-40 ^{i/}	8.82	Colorless liquid with sweet, pungent, benzene-like odor. Irritates eyes and nose. Causes fatigue, weakness, dizziness, headaches, hallucinations or distorted perceptions, confusion, euphoria, dilated pupils, nervousness, tearing, muscle fatigue, insomnia, skin tingling, dermatitis, bone marrow changes, and liver and kidney damage. Mutagen and experimental teratogen.
1,1,1-Trichloroethane (TCA) (Methyl Chloroform)	350	350	700	20-500	11.00	Colorless liquid with a mild chloroform-like odor. Irritates eyes and skin. Causes headaches, exhaustion, CNS depression, poor equilibrium, dermatitis, liver damage, cardiac arrhythmia, hallucinations or distorted perceptions, motor activity changes, aggression, diarrhea, and nausea or vomiting. Mutagen, experimental teratogen, and questionable carcinogen.
Trichloroethene (TCE)	50	50	1,000	21.4-400	9.45	Clear, colorless or blue liquid with chloroform-like odor. Irritates skin and eyes. Causes fatigue, giddiness, headaches, vertigo, visual disturbances, tremors, nausea, vomiting, drowsiness, dermatitis, skin tingling, cardiac arrhythmia, and liver injury. In animals, causes liver and kidney cancer. Mutagen, experimental teratogen, and carcinogen.
Vinyl Chloride	1 (29 CFR 1910.1017) ^{f/}	1	NA	260	9.99	Colorless gas (liquid <7°F) with a pleasant odor at high concentrations. Severe irritant to skin, eyes, and mucous membranes. Causes weakness, abdominal pain, gastrointestinal bleeding, enlarged liver, pallor or blue skin on the extremities, liver cancer, and frostbite (liquid). Also attacks lymphatic system. Mutagen, experimental teratogen, and carcinogen.
Xylene (o-, m-, and p-isomers)	100	100	900	0.05-200 ^{i/}	8.56 8.44 (p)	Colorless liquid with aromatic odor. P-isomer is a solid <56°F. Irritates eyes, skin, nose, and throat. Causes dizziness, drowsiness, staggered gait, incoordination, irritability, excitement, corneal irregularities, conjunctivitis, dermatitis, anorexia, nausea, vomiting, abdominal pain, and olfactory and pulmonary changes. Also targets blood, liver, and kidneys. Mutagen and experimental teratogen.

a/ PEL = Permissible Exposure Limit. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm. Expressed as parts per million (ppm) unless noted otherwise. PELs are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997. Some states (such as California) may have more restrictive PELs. Check state regulations.

TABLE 5.1B HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL ^{a/} (ppm)	TLV ^{b/} (ppm)	IDLH ^{c/} (ppm)	Odor Threshold ^{d/} (ppm)	Ionization Potential ^{e/} (eV)	Physical Description/Health Effects/Symptoms
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b/ TLV = Threshold Limit Value - Time-Weighted Average. Average air concentration (same definition as PEL, above) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), 2001 *TVLs® and BEIs®*.

c/ IDLH = Immediately Dangerous to Life or Health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise. IDLH values are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997.

d/ When a range is given, use the highest concentration.

e/ Ionization Potential, measured in electron volts (eV), used to determine if field air monitoring equipment can detect substance. Values are published in the *NIOSH Pocket Guide to Chemical Hazards*, June 1997.

f/ Indicates that the IDLH value was based on 10% of the lower explosive limit for safety considerations, even though relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations (*NIOSH Pocket Guide to Chemical Hazards*, 1997).

g/ Refer to expanded rules for this compound.

h/ (skin) = Refers to the potential contribution to the overall exposure by the cutaneous route.

i/ Olfactory fatigue has been reported for the compound and odor may not serve as an adequate warning property.

j/ NA = Not available.

k/ NIOSH recommends reducing exposure to the lowest feasible concentration, and limiting the number of workers exposed.

APPENDIX E - EXAMPLE SITE-SPECIFIC WORK PLAN OUTLINE

SITE-SPECIFIC PDBS WORK PLAN

LIST OF ACRONYMS AND ABBREVIATIONS

1.0 INTRODUCTION

1.1 Project Description

1.2 Objective

1.3 Scope

1.4 Document Organization

2.0 SITE DESCRIPTION

2.1 Location and Description of (*site name*)

2.2 Environmental Setting

2.2.1 Geology

2.2.2 Hydrogeology

2.3 Chemicals of Concern

2.4 Current Groundwater Monitoring Program

3.0 SCOPE OF PDBS DEMONSTRATION

3.1 Field Activities

3.2 Waste Management

3.3 Analytical Results Comparison/Evaluation

4.0 PROJECT ORGANIZATION

5.0 SCHEDULE

6.0 REPORTING

7.0 REFERENCES

Appendix A. Health and Safety Plan Addendum

**APPENDIX F – EXAMPLE SITE-SPECIFIC RESULTS REPORT
OUTLINE**

SITE-SPECIFIC PDBS RESULTS REPORT

LIST OF ACRONYMS AND ABBREVIATIONS

SECTION 1. INTRODUCTION

1.1 Objectives and Scope of Demonstration

1.2 Document Organization

SECTION 2. FIELD ACTIVITIES

2.1 Deployment Mobilization

2.2 Retrieval Mobilization

SECTION 3. SAMPLING RESULTS AND COMPARISON

3.1 Data Presentation

3.2 Data Validation

3.3 Sampling Results Comparison

3.3.1 Comparison Procedure

3.3.2 Comparison of PDBS and Conventional Sampling Results

3.3.3 Discussion of Low Correlations

SECTION 4. COST ANALYSIS

4.1 Estimate of Implementation Costs

4.2 PDB and Conventional Sampling Cost Comparison

4.2.1 Long-Term PDBS Costs

4.2.2 Long-Term Conventional Sampling Costs

4.3 Sampling Cost Avoidance

4.4 Return on Investment

SECTION 5. CONCLUSIONS

SECTION 6. REFERENCES

Appendix A. Field Data

Appendix B. Laboratory Data

Appendix C. Data Validation Summary Report

Appendix D. Data Comparison Tables

Appendix E. Well-Specific Analytical Results Graphics

Appendix F. Monitoring Well Network Optimization