START

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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 191352

Proj. ECN

2. ECN Category (mark one) Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. D. B. Blumenkranz, 81353, H6-04, 2-1021	4. Date April 30, 1993
	5. Project Title/No./Work Order No. Integrated Test Plan for Demonstration of Cone Penetrometer Including Chemical Sensor Systems	6. Bldg./Sys./Fac. No. N/A
		7. Impact Level 3Q
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-EN-TP-023 Rev. 0	9. Related ECN No(s). none
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11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	N/A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

Add to document information concerning the Portable Fourier Transform Infrared Photoacoustic Spectrometer.

13a. Justification (mark one)	Criteria Change []	Design Improvement []	Environmental []
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13b. Justification Details

Instrument was included in the test after the issuance of WHC-SD-EN-TP-023.

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T. M. Brouns	K6-80	1
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DATE MAY 05 1993
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Engineering Change Notice

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15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
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[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]		[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
none		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer B. R. Cassem per telecon DB	5/2/93	PE	
Cog. Mgr. D. J. Moak per telecon DB	5/3/93	QA	
QA R. L. Hand [signature]	5/3/93	Safety	
Safety B. G. Tuttle		Design	
Security		Environ.	
Environ. D. B. Blumenkranz		Other	
Projects/Programs			
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6. Author

Name: D. B. Blumenkranz

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Signature

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7. Abstract

WHC, 1993, *Integrated Test Plan for Demonstration of Cone Penetrometer Including Chemical Sensor Systems*, WHC-SD-EN-TP-023, Rev. 1, by D. B. Blumenkranz, B. R. Cassem, and E. W. Papin, Westinghouse Hanford Company, Richland, Washington.

9. Impact Level 3Q

10. RELEASE STAMP

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RECORD OF REVISION	(1) Document Number WHC-SD-EN-TP-023	Page 1

(2) Title
Integrated Test Plan for Demonstration of Cone Penetrometer Including Chemical Sensor Systems.

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Original release via EDT 142085	B. R. Cassem	D. J. Moak
1 RS	Revision via ECN 191352 to incorporate additional information.	per telecon DB 5/2/93	per telecon DB 5/3/93

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CONTENTS

CONTENTS (Cont)

1.0 INTRODUCTION

1.1 SCOPE

This integrated test plan (ITP) describes continuing demonstration of the cone penetrometer (CPT) system as part of the Volatile Organic Compound-Arid Integrated Demonstration (VOC-Arid ID). This demonstration will focus on improvements to probes and rod for the CPT system, and the ability of the CPT system to implement and support additional characterization and monitoring activities.

Activities will include limited demonstration of four chemical sensor systems to be interfaced with the CPT. Sensor systems to be utilized during the test series include the HaloSnif spectrochemical total organic chloride (TOCl) sensor system developed by Pacific Northwest Laboratory (PNL), the Portable Acoustic Wave Sensor (PAWS) system developed by Sandia National Laboratory (SNL), a direct sampling ion trap mass spectrometer (DSITMS) developed by Oak Ridge National Laboratory (ORNL), and a commercially available, nondispersive, photo-acoustic infrared sensor manufactured by Brüel and Kjaer (B&K). The demonstra-tion of sensors will be performed in the PNL mobile laboratory directly adjacent to the Applied Research Associates (ARA), South Royalton, Vermont, CPT truck.

This demonstration is being conducted as a coordinated effort between the VOC-Arid ID and the 200 West Area carbon tetrachloride expedited response action (ERA). Results of this demonstration will be used to determine whether these technologies may become operable tools for the ERA and other environmental restoration programs at the Hanford Site and other U.S. Department of Energy (DOE) facilities.

1.2 BACKGROUND

1.2.1 CPT System

The CPT was used at the Hanford Site during 1991 (Rohay 1991b). During this demonstration, the CPT accomplished 13 pushes averaging 20.5 ft, with the deepest being 65.5 ft. Preliminary attempts showed that the CPT had promise, but needed improvements to function in the Hanford soils (ARA 1991).

In 1992, the CPT returned to the Hanford Site. Lessons learned from the 1991 demonstration were applied to a heavier, better balanced CPT truck. In July 1992, ARA brought this CPT truck back to the Hanford Site for another demonstration (Cassem 1992). The weight of this standard CPT truck was increased from 50,000 lb to approximately 68,000 lb using lead ballast. The 1.75-in. CPT was used exclusively over the 1.405-in. rod of 1991. Included in this testing effort were radiation probes, soil samplers, and varying cone tips (45- , 90-deg, and ogival).

The 1992 demonstration of the CPT proved to be a great improvement over the 1991 field demonstration. The CPT accomplished 37 pushes averaging 62.5 ft, with the deepest being 147 ft (WHC 1993). The CPT was used to identify, characterize, and obtain a soil sample of a hydrocarbon plume located in the 300 Area. The CPT was employed to monitor for VOC at over half of the pushes attempted during this demonstration. A radiation scintillator was used on five pushes in the 200 East Area and collected data at one site (Cassem 1992).

1.2.2 VOC-Arid ID

This demonstration is being conducted as part of the VOC-Arid ID. The VOC-Arid ID is one of several DOE integrated demonstrations designed to support the testing of emerging environmental management and restoration technologies. The purpose of the VOC-Arid ID is to identify, develop, and demonstrate new and innovative technologies for environmental restoration. These technologies may be used to characterize, remediate, and/or monitor arid or semiarid sites containing VOC (e.g., carbon tetrachloride) with or without associated metal and radionuclide contamination. Initially, the VOC-Arid ID activities will focus primarily on the carbon tetrachloride contamination and associated contamination found in the 200 West Area of the Hanford Site.

1.2.3 200 West Area Carbon Tetrachloride ERA

The ERA is ongoing in association with the carbon tetrachloride contamination in the 200 West Area. The ERA is being conducted by the DOE at the direction of the U.S. Environmental Protection Agency (EPA) and Washington Department of Ecology (Ecology). The ERA is a removal action under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), which allows ERA to be taken where early remediation will abate imminent hazard or prevent significantly increased degradation that might occur if action was delayed until completion of a remedial investigation/ feasibility study (RI/FS) and record of decision (ROD).

The ERA is based on concern that the carbon tetrachloride residing in the soils underlying the 200 West Area is continuing to serve as a source of con-tamination to the ground water. Thus, the purpose of the ERA is to minimize contaminant migration within the unsaturated soils in the 200 West Area by removing the carbon tetrachloride. The proposed action for removing the carbon tetrachloride is to use soil vapor vacuum extraction with above-ground treatment, using a network of soil vapor extraction vadose wells.

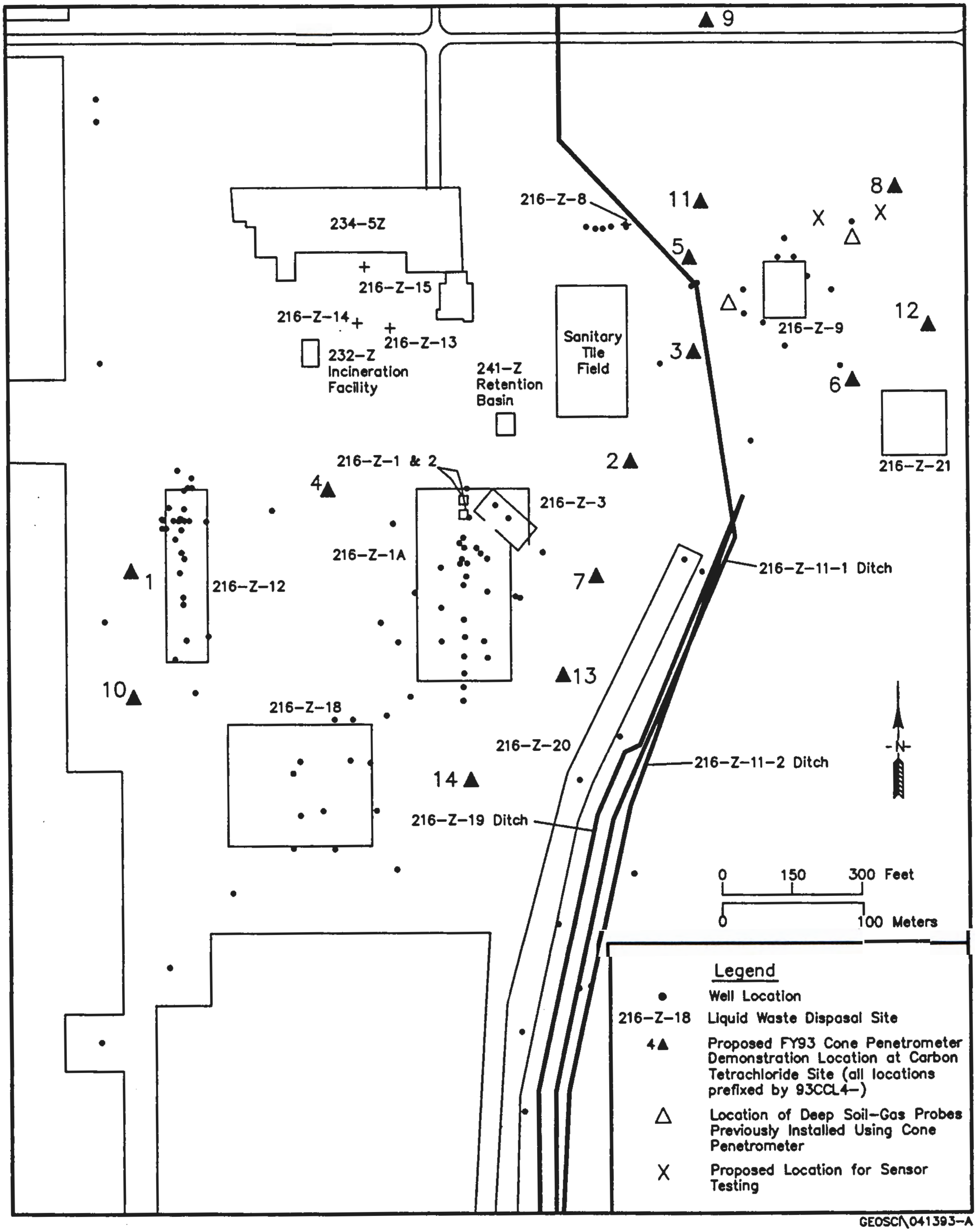
1.2.4 ERA/VOC-Arid ID Coordination.

The VOC-Arid ID and the ERA are separate projects; however, by using the ERA site for demonstrations of the VOC-Arid ID, both projects benefit. The ERA site provides a large source of contaminant at a controlled, characterized location. The VOC-Arid ID provides for additional characterization of the contaminant site as well as better, faster, and/or cheaper remediation tech-nologies. By combining these two projects, the efficiency and cost effectiveness of each project increases significantly.

1.3 SITE SETTING

This demonstration will be conducted at approximately 16 sites near the 216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib. Figure 1 identifies locations for this demonstration.

Figure 1. Demonstrations Locations.



The upper geologic unit of the 200 West Area consists of two facies: (1) coarse-grained sand and granule to boulder gravel from which matrix is commonly lacking, and (2) fine- to coarse-grained sand and silt that commonly display normally graded rhythmites a few centimeters to several decimeters thick. In general, this unit is composed of approximately 50% sand and gravel, 45% cobble, and 5% boulder, and ranges in thickness from 6 m to >60 m. It is underlain by 1.5 to 18 m of silts and fine sands, which in turn are underlain by another gravel unit.

Carbon tetrachloride vapor concentrations observed during drilling throughout the 200 West Area since 1987 range from less than detectable to several hundred parts per million volume in unsaturated zone. Observed concentrations are highest in the vicinity of, and west of, the three sites (216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib) where the carbon tetrachloride was discharged to the soil column. In situ soil gas samples from wells being drilled near 216-Z-9 Trench in 1992 reached >5,000 ppm carbon tetrachloride. Baseline monitoring of wellheads of wells >20 m deep and soil gas probes in 1992 indicate carbon tetrachloride concentration >10,000 ppm at 216-Z-9 and >1,000 ppm at 216-Z-14 (Last and Rohay 1993).

Concentrations of carbon tetrachloride vapors measured in unsaturated zone boreholes within 30 m of the three sites ranged from 1 to 200 ppm vol at depths of 24 to 63 m below ground surface. However, the observed vapor concentrations may vary with time and appear to be influenced by fluctuations in the barometric pressure (DOE-RL 1991a).

Carbon tetrachloride breakdown products, chloroform and methylene chloride, also have been observed in soil samples in trace amounts. Other substances identified in trace amounts in at least one soil sample from the 200 West Area include: benzene, fluoromethane, 1,1-dichloroethylene, trans-1,2-dichloroethylene, trichlorofluormethane, methyl isobutyl ketone, and toluene (DOE-RL 1991a).

The carbon tetrachloride coexists at different depths with radionuclides. The primary radionuclide components of the aqueous and organic liquids discharged to the three carbon tetrachloride disposal sites were plutonium and americium. The plutonium contamination extends approximately 30 m beneath the 216-Z-1A Tile Field; the lateral spread is limited within a 9-m-wide zone around the perimeter of the tile field. Other radionuclides, such as radioactive isotopes of cesium, cobalt, hydrogen, iodine, strontium, and technetium, have been discharged to the soil column beneath the 200 West Area. In addition, radon gas occurs naturally in Hanford Site soils.

2.0 TECHNOLOGY DESCRIPTIONS

This section describes the technologies to be demonstrated under this ITP. All four sensor systems will be operated in the PNL mobile laboratory and connected to a common computer-controlled gas sampling manifold. The gas handling equipment consists of a metal bellows pump attached to the gas sampling tip of the CPT via a 0.25-in.-outside diameter (OD) nylon or polyethylene plastic tubing. This system can be used to draw up to several liters per minute of soil gas out of the gas sampling tip. The pump inlet employs a knockout trap and particulate filter to remove water and particulate material. Standards can be admitted into the line downstream through solenoid-actuated valves. All four sensor systems will draw off a common manifold so that all measurements can be made on a common basis. Gas chromatography (GC) grab samples will also be taken from the manifold. Actuation of the solenoid valves will be controlled by the HaloSnif computer system described below.

2.1 CONE PENETROMETER

The CPT is an electronically instrumented probe, which is forced into the subsurface soils using a hydraulic load, frame-mounted on a heavy truck. The weight of a typical CPT truck is approximately 40,000 to 50,000 lb. For soil characterization, the probe includes a conical tip and friction sleeve, which provides independent measurements of vertical resistance beneath the tip and frictional resistance on the side of the probe as a function of time.

The standard CPT consists of a 1.405-in.-OD tool, a 60-deg angle, hardened-steel conical tip, and a friction sleeve that is 1.405-in. OD and 5.27 in. in length. The tool is advanced by using push rods measuring 1.405 in. OD by 3.28 ft in length. The CPT is driven at a rate of 24 to 48 in/min. Data are collected and recorded via computer at a rate of every 2 cm. The hydraulic driver, rods/tools, and the computer for sample analysis are contained within the weighted truck (ASTM 1986, D-3441).

The weight of the CPT truck being used for the FY 93 demonstration and operation will be increased to approximately 68,000 lb using clean lead weight. The CPT will use a 1.75-in.-OD rod with an oversized 60-deg tip attached to the probe. The 1.75-in. rod maintains a tensile strength of 108,000 lb/in^2 as compared to the 1.405-in., which is only 48,000 lb/in^2.

2.2 HALOSNIF SYSTEM

The HaloSnif system has been designed for monitoring the concentration of chlorine containing VOC in gas (air, or soil gas). For activities relating to the VOC-Arid ID, HaloSnif will be interface to the CPT equipped with a gas sampling tip. Soil gas will be drawn continuously through the gas sampling tip and associated tubing and supplied to the HaloSnif sensor through the sampling manifold described above. HaloSnif will monitor in real time the concentration of chlorinated compounds in the soil gas as a function of depth.

During monitoring operation, HaloSnif operating at sub-ambient pressure (40 torr), continuously draws an air sample through a critical orifice into the plasma excitation chamber, where it is mixed with helium and excited with a radio frequency (RF) signal inductively coupled to the plasma chamber. The plasma chamber is coupled via a fused silica optical fiber to the signal processor unit. The optical emission of the plasma is filtered with an narrow bandpass filter designed to monitor the 837.6-nm emission line from the excited chlorine atom. The intensity of the chlorine line is directly proportional to the concentration of chlorine containing species in the sample gas. The detection sensitivity for carbon tetrachloride is 5 ppm vol. The response of the system is linear from the detection limit to 10,000 ppm vol.

Data acquisition is achieved using a LabView (trade name of National Instruments, Austin, Texas) data acquisition software package mounted on a PC system. The data acquisition system is interfaced to the electro-optical signal processing module via a 0- to 10-V analog output. Real-time concentrations of total chlorinated compounds are displayed on the monitor for observation by onsite personnel. All data are stored in computer memory for post-run processing and analysis. The data acquisition panel has also been modified to provide interactive control of solenoid valves associated with the gas handling manifold to be used for sample inlet and calibration of all four sensor systems included in the test.

2.3 PAWS SYSTEM

The PAWS system consists of two surface acoustic wave (SAW) devices contained in a single test case. This case is mounted on a personal computer (PC) board containing RF electronics for independently operating both devices as oscillators. In this oscillator configuration, relative changes in the frequency of operation can be used to accurately monitor changes in the wave velocity. In addition, by using RF power detectors to monitor changes in the RF power level in the oscillator circuit, changes in device insertion loss can be monitored to evaluate wave attenuation (a second device response). Typically, the two SAW devices are coated identically with a sorptive polymer material. Since the test case has isolated chambers for each device, one device can be challenged with a stream of the environment to be tested while the other is isolated from the environment and used as a reference. As the species to be sensed (carbon tetrachloride for this test) is sorbed into the polymer, a mass increase and a softening of the polymer occur. These physical changes in the polymer result in changes in both the wave velocity and the wave attenuation. Based on prior calibration of these responses with chemical concentration, the wave velocity response (the more sensitive of the two responses) can be used to determine the carbon tetrachloride concentration. In addition, since the ratio of the two responses has been found to depend on the chemical species being detected, it can be used to verify that the sensor responses are consistent with those expected for carbon tetrachloride.

Since the polymer coating is also softened with temperature, these devices do have a thermal sensitivity. One method being used to compensate for this sensitivity is to subtract the response of the chemically isolated reference device. For the velocity response, this involves using a mixing circuit with a low pass filter. This circuit provides a frequency output proportional to the difference in frequencies of the two oscillator circuits. In addition to providing a single signal that is compensated by the reference device, this mixing configuration also decreases the frequency to be measured from almost 100 MHz to under 1.0 MHz, greatly simplifying the precise measurement of the frequency. For the attenuation responses, voltages from the RF detectors on each oscillator circuit can be measured independently and compared by the data analysis routine. The second PC board also contains a circuit, enabling active temperature control of the device test case. Finally, the temperature of the test case is monitored directly so a correction of the two responses using software routines is possible (the user inputs the temperature coefficients based on prior calibration).

Data acquisition and system control is achieved using a specially designed PC board that has: (1) a frequency counter; (2) eight channels of 16-bit analog-to-digital conversion for monitoring voltages from the RF power detectors and various temperature evaluations; (3) eight digital outputs used to activate relays for powering pumps and solenoid valves; (4) a microprocessor programmed such that a single, two-character command is used to acquire all the relevant sensor data, and other two-character commands are used to activate/deactivate the relays; and (5) a serial communications port enabling direct computer access (RS-422 for downhole systems where long cables are used or RS-232 for aboveground systems).

The environmental sampling system consists of a pump attached to an inlet port with an in-line fitted filter, a bypass line with a pressure relief valve to provide a constant sensing pressure, a sensing line with a carbon-based scrubber, a three-way solenoid valve to direct the gas to this scrubber on demand to establish sensor baseline, a sensor test case, and an exit port. During the CPT test series, this sampling system will be interfaced to the CPT soil gas tip through the gas sampling manifold described above. Calibration checks on the PAWS will be coordinated with the HaloSnif activities and noted in the permanent field record.

The entire PAWS system is housed in a 6- by 8- by 13-in. module that communicates with a notebook computer over the serial port and is powered with a single 12-V power source. A software routine written in the LabWindows domain will accept user setup inputs and will automatically turn on the sampling pump, activate the three-way valve to establish sensor baseline, acquire the data from the module, calculate the carbon tetrachloride concentration as a function of time from the sensor responses, and plot the results in real-time for observation by onsite personnel. In addition, hard copy plots can be generated at the completion of each run using a portable printer.

2.4 DSITMS SYSTEM

The DSITMS system is built around a commercially available ion trap mass spectrometer. A direct air inlet system designed by workers at ORNL provides mixing of inlet air with helium at a rate that can be synchronized with the ion trap scan rate. The DSITMS can be operated continuously with mass spectral information displayed on a PC, which provides instrument control and data storage. Quantification of individual mass peaks can be performed with post processing software. With suitable adjustment of helium inlet mixing, the instrument can attain very high low-end sensitivity. Through the use of high mixing ratios, the dynamic range of the instrument can be extended up to 100 ppm vol. An external dilutor will be added to extend the range by at least one more order of magnitude. Samples will be admitted to the instrument through the gas sampling manifold described above.

2.5 INFRARED PHOTOACOUSTIC SPECTROMETER

The Model 1302 Multigas Analyzer manufactured by B&K is an infrared photoacoustic infrared spectrometer, which takes advantages of the unique spectral properties of volatile contaminants found at the site (i.e. carbon tetrachloride, chloroform, and methylene chloride) to identify the types and quantities of the contaminants in a gas stream. A volume of gas (ca. 150 mL) is drawn through an analysis chamber containing sensitive acoustic microphones. The gas is then irradiated with a pulsed, mid-infrared band of light selected by a narrow bandpass filter. The choice of filter is determined by the target contaminants principal absorption band. The instrument can be equipped with five filters for simultaneous determination of separate analytes. A sixth channel is used for correction of water interferences. The analyte gas absorbs light to a degree dependent on the concentration of the contaminant in the gas. The absorbed radiation is then primarily converted to heat. The change in temperature produces a pressure wave that is sensed by the microphones. Analyte concentration is measured as a function of acoustic wave amplitude.

The principal advantage of this technology are small size and weight (>1.0 ft^3 and 20 lb), chemical specificity, and field ruggedness. Lower detection limits for most analytes tend to be in the low or sub parts per million range. Dynamic range spans four to five orders of magnitude up to at least 1,000 ppm vol. B&K instruments have been used successfully in the past with the ARA CPT at Savanna River and other sites and, as such, represent a baseline technology. The baseline technology for all four sensors used in this demonstration will be the GC analysis and certified gas standards.

The B&K sensor will be interfaced to the gas sampling manifold a flow rate of 100 to 200 Ml/min.

2.6 PORTABLE FOURIER TRANSFORM INFRARED PHOTOACOUSTIC SPECTROMETER

The portable Fourier transform infrared spectrometer (Model 1301), also produced by B&K, is a highly sensitive and versatile instrument that can be used both as an analyzer, determining what component gases are present in a gas stream, and as a monitor for repeated concentration measurements on specific gases over variable periods of time. The Model 1301 takes advantage of the same spectral properties of volatile compounds as the Model 1302 mentioned previously. an air sample is drawn into the analysis cell. Broad band light is modulated from an infrared source to produce a time-varying signal by passing it through a modified interferometer producing an interferogram. A laser diode and detector provide a reference system, which is used to trigger and synchronize sampling of the interferograms produced. The infrared light reflected from the interferometer output mirror enters the analysis cell. Here, it is selectively absorbed by the gas sample, causing the temperature of the gas to fluctuate. This, in turn, produces a corresponding pressure fluctuation, i.e., an acoustic signal. The frequencies of acoustic signal depend on the wavelengths of the light absorbed by the sample. The photoacoustic signal is measured by two microphones mounted in the cell, yielding an electrical signal proportional to the amount of light absorbed. The electrical signal is then filtered, converted from an analogue to a digital signal, and then fourier transformed to produce an absorption spectrum. User-defined filter bands (up to three per gas) determine individual concentration values. These are obtained from the spectrum by integrating between the chosen limits for the filter bands and applying a conversion factor for the analyte.

Results are displayed in three forms:

- display of full absorption spectra (for analysis)
- tables of concentrations (for monitoring, average and instantaneous values are displayed)
- "time history" concentration curves (for monitoring).

This technology has the same advantages, e.g., small size, weight, selectivity, and field ruggedness as the filter-based B&K unit. However, in principle, the Model 13-1 can measure almost any gas that is infrared active. Detection thresholds are gas-dependent, but lie typically in the range of 0.1 to 10 ppm vol. Up to 100 different gas setups, to measure 100 different gases, can be defined and stored in a catalog in the internal memory of the unit. In addition, reference spectra from a reference diskette can be read and displayed and used for qualitative comparison as well as for "indirect calibration" of the instrument.

3.0 DEMONSTRATION OBJECTIVES AND MEASURES OF SUCCESS

3.1 OBJECTIVES

3.1.1 CPT

The test objectives for the field demonstration of the CPT are presented below.

1. Evaluate soil collection capacity of the 1.75-in.-OD soil sampler in Hanford soils.
2. Evaluate the capability of the 1.75-in.-OD CPT to penetrate Hanford soils in the selected locations.
3. Evaluate decontamination process during back pull of the CPT rod and tools.
4. Install subsurface monitoring points, including soil gas ports and pressure transducers, at specified locations and depths for use of the ERA.
5. Install vapor extraction wells at specified locations and depths for use of the ERA.
6. Conduct vertical profiling of soil gas during installation of ERA wells.
7. Sample perched water or dense nonaqueous phase liquid, if encountered.
8. Demonstrate ability to interface chemical sensor systems with the CPT.

3.1.2 HaloSnif System

The test objectives for the initial field demonstration of the HaloSnif-CPT interface are presented below.

1. Evaluate effectiveness of the current HaloSnif system for continuous, real-time analysis of carbon tetrachloride concentrations (or other degradation products) during CPT pushes.

2. Evaluate agreement of carbon tetrachloride concentrations (or other degradation products) from the HaloSnif system with baseline technology values (GC analysis and certified gas standards).

3. Evaluate field implementability of the HaloSnif system to CPT:

   - Determine ease of system setup and integration with CPT for soil gas monitoring of volatile chlorinated compounds.

   - Identify system changes to improve implementability based on observations of principal investigator and field team leaders.

3.1.3 PAWS System

Test objectives for the field demonstration of the PAWS system for carbon tetrachloride monitoring of gas samples drawn using a CPT are:

1. Evaluate the ability to interface the PAWS sensor system with the CPT system and achieve full operation.

2. Evaluate the effectiveness of the PAWS system for real-time analysis of the contaminant concentration with depth:

   - Evaluate response speed and the corresponding change in depth over which the contaminant concentration can be evaluated (i.e., speed of push times response time equals depth interval).

   - Evaluate agreement of carbon tetrachloride concentrations from the PAWS system with other analyses being performed as part of this field demonstration.

   - Calculate minimum detection limits for carbon tetrachloride based on noise levels and accuracy of baseline evaluation. Identify maximum time limit between scrubber baseline evaluations based on observed sensor drift rates.

   - Evaluate the ability to operate continuously and provide information on concentration changes with depth during a full push.

3.1.4 DSITMS System

The DSITMS has not been utilized for this purpose and its suitability for this application is somewhat questionable. This test series will provide an initial opportunity to determine if this type of application is appropriate for the instrument in future tests. The test objectives for the field demonstration of the DSITMS system for gas-phase contaminant monitoring of gas samples drawn using a CPT are presented below.

1. Evaluate the ability to interface the DSITMS sensor system into the CPT system and achieve full operation.
2. Evaluate the effectiveness of the ITMS system for real-time analysis of the contaminant concentrations with depth.
   - Evaluate agreement of carbon tetrachloride concentrations from the DSITMS system with other analyses being performed as part of this field demonstration.
   - Determine the upper operating range of the instrument in direct sampling mode.
   - Evaluate the ability to operate continuously and provide information on concentration changes with depth during a full push.

3.1.5 Infrared Photoacoustic Spectrometer

The B&K sensor system has been used in previous tests for monitoring of vapor phase contaminants during CPT tests. The system will be used as a baseline technology. Since it is commercially procurable at relatively low cost, field rugged, and easy to operate, it provides a high quality point of reference. Other instruments must have some demonstrable advantage over this or related technologies to make a credible claim to superiority.

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3.1.6 Portable Fourier Transform Infrared Photoacoustic Spectrometer

The test objectives for the initial field demonstration of the portable Fourier transform infrared spectrometer are presented below.

1. Evaluate the ability of the portable Fourier transform spectrometer to analyze for carbon tetrachloride and chlororform in near real-time.

2. Evaluate agreeement of carbon tetrachloride concentrations from the portable Fourier transform infrared spectrometer with other technologies participating in this field demonstration (particularly the B&K infrared photoacoustic spectrometer Model 1302).

3. Evaluate the ability for continuous monitoring to provide information on concentration changes with depth during a push with the CPT.

3.2 MEASURES OF SUCCESS

3.2.1 CPT

The following will be used to measure system success:

1. The volume of sample collected with the 1.75-in.-OD soil sampler(s) will be recorded. The number of times that the sampler can be reused and the quality of the soil sample obtained will also be recorded.
2. The location, number of attempts and depth of all push attempts will be recorded.
3. The process, including time and materials, for decontamination of the rod and probes will be recorded.
4. The location, number of attempts, depth of all push attempts, and capacity to provide vapor samples from the subsurface to the four sensor systems will be recorded.
5. The location, number of attempts, depth of all push attempts, and the quality of well provided will be recorded.
6. The capacity of the CPT to provide vertical profiling during installation of wells will be measured and record.
7. Measure the quantity of perched water or DNAPLs collected with the CPT sampler, if these liquids are encountered.
8. Record the time and effort to interface the CPT to with the sensor systems.

3.2.2 HaloSnif System

The following measurements of the HaloSnif sensor will be performed during the testing.

1. Measure the amount of time taken between concentrations measurements of carbon tetrachloride (or degradation products) during CPT pushes.
2. The concentrations of carbon tetrachloride (or degradation products) measured in the soil gas from the CPT system will be compared to the baseline value measured by GC analysis or certified gas standards.
3. The amount of time it takes to hook up the Halosnif to the CPT will be recorded. The number of changes necessary to speed up the process of hooking up the Halosnif to the CPT will also be recorded.

3.2.3 PAWS System

The following will be used to measure system success:

1. The amount of time it takes to hook up the PAWS system to the CPT will be recorded. The number of changes necessary to speed up the process of hooking up the PAWS system to the CPT will also be recorded.
2. The PAWS system will be measured against predetermined values for performance which are currently expected to be: 1) speed of response, 2) accuracy of determining the carbon tetrachloride concentrations, 3) detection limit of less than 100 ppm for carbon tetrachloride, and 4) measure the length of time the system can be continuously operated.

3.2.4 DSITMS System

The following will be used to measure system success:

1. Observe and record the capability of setting up, calibrating, and operating the DSITMS under field conditions in the mobile laboratory at the CPT test site.
2. Determine whether or not it is possible to calibrate and operate the instrument (with a dilutor if necessary) with carbon tetrachloride or chloroform concentrations of 1 to 1,000 ppm vol present. Compare quantification on-spot samples with the GC measurements.

3.2.5 Infrared Photoacoustic Spectrometer

The ability of the B&K sensor to provide continuous, quantitative real-time information on carbon tetrachloride concentrations at will be observed and measured. If suitable filters and calibration standards are available, chloroform and methylene chloride will also be measured. Quantification of on spot samples will be compared to the GC measurements.

3.2.6 Portable Fourier Transform Infrared Photoacoustic Spectrometer

The following will be used to measure system success:

1. Determine whether or not it is possible to measure carbon tetrachloride and chloroform in concentrations from 1 ppm vol to a few thousand ppm vol, alone and in the presence of each other (and other potentially interferants that result from the degradation of carbon tetrachloride).
2. Comparison of carbon tetrachloride concentrations measured from the CPT system to the baseline value measured by GC analysis or certified gas standards and other technologies present at this demonstration.

4.0 REGULATORY COMPLIANCE

This section identifies the regulatory compliance requirements for this field demonstration. The major requirements for the demonstration are derived from the National Environmental Policy Act (NEPA), CERCLA, and the Resource Conservation and Recovery Act (RCRA). Because of the limited nature of residuals from this demonstration, no requirements under the Clean Air Act, Clean Water Act, or other federal or state environmental laws are specifically applicable.

4.1 OVERVIEW OF SYSTEM RESIDUALS

The four sensor systems to be tested will operate as ex situ detectors requiring extraction of a soil vapor sample and transport to the surface. There are limited residuals generated by the demonstration. Soil gas will be extracted from the gas sampling tip of the CPT system at a rate of approximately 1 L/min. HaloSnif samples at approximately 0.6 mL/min. PAWS and the DSITMS also have relatively low sampling rates. The excess sampling stream flow will be vented to the atmosphere outside the mobile laboratory. The effluent stream will be monitored periodically with a hand-held photoionization detector to verify that the breathing zone is safe. The B&K sensor requires a larger flow to obtain rapid response; therefore, the emissions will be monitored periodically.

4.2 NEPA

NEPA, 42 USC 4321 et seq., is the basic federal charter for protecting the nation's environment. NEPA's focus is to ensure that federal agencies such as DOE give appropriate consideration to environmental impacts in their decisionmaking.

On December 4, 1992, DOE determined that characterization and environmental monitoring activities on the Hanford Site fit within a typical class of action currently available for categorical exclusion (CX) in Subpart D of DOE's NEPA implementing procedures, 10 CFR 1021. CPT demonstration as part of this test is within the scope of activities envisioned in that CX approval for the following reasons. CPT work covered under this plan is one of the drilling methods for characterization wells that is discussed in the information bulletin supporting the CX approval. While the test activities will be used to demonstrate the CPT method, these activities will also produce data that will be useful for the characterization of the Hanford Site, which is the primary purpose of the activities for which the CX was approved. The minimal impacts to the environment that will be caused by this test are clearly within the range of impacts assumed in DOE's CX approval. Accordingly, no further NEPA compliance documentation is required for demonstration of the CPT as part of this test.

On April 30, 1992, DOE determined that VOC-Arid ID sensor development and demonstration activities fit within a typical class of action currently available for a CX in 10 CFR 1021. Each of the sensor technologies to be demonstrated in this test is either specifically discussed in the information bulletin supporting the CX approval or similar in its minimal environmental impacts to the technologies that are specifically discussed and clearly within the range of impacts assumed in DOE's CX approval. Accordingly, no further NEPA compliance documentation is required for demonstration of the sensor technologies as part of this test.

4.3 CERCLA

CERCLA, 42 USC 9601 et seq., is designed to manage the unplanned, uncontrolled releases of hazardous substances. In particular, CERCLA is the governing framework for the ERA being conducted in the 200 West Area at Hanford to remove carbon tetrachloride from the soil unsaturated zone.

This CPT/sensor field demonstration will be conducted around the ERA site and in coordination with ERA activities. The ERA activities are described by DOE (DOE-RL 1991a). Depending on test results, some of the data generated may contribute to ERA site characterization. The objectives and quality objectives for ERA site characterization are detailed in the ERA site characterization work plans (Rohay 1991a, for FY 92; and Rohay et al. 1993, for FY 93).

4.4 RCRA

Subtitle C of RCRA, 42 U.S.C. 6921-6939b, establishes a comprehensive program to regulate newly generated hazardous waste. Administered by Ecology and EPA, RCRA Subtitle C requirements are contained in Chapter 173-303, Washington Administrative Code (WAC), and in 40 CFR Parts 260 through 272 and apply to the generation, accumulation, treatment, storage, and disposal of hazardous waste. No solid, hazardous, or mixed wastes are expected to be generated by this test. In the event such wastes are generated, they will be managed in accordance with applicable RCRA requirements, including Westinghouse Hanford Company (WHC) Environmental Investigation Instruction (EII) 4.2, Interim Control of Unknown, Suspected Hazardous, and Mixed Waste (Brown 1988).

4.5 WASHINGTON ADMINISTRATIVE CODE

WAC 173-160 establishes minimum standards for the construction of wells. While installing wells solely in the unsaturated zone (i.e., without penetrating an aquifer or perched groundwater) is generally excluded from these regulations, such excavations must be constructed and abandoned to ensure protection and prevent contamination of the groundwater resource. Well completions will be designed to meet applicable well construction standards or variances will be obtained from Ecology prior to drilling. Start cards will also be filed with Ecology prior to drilling.

4.6 DAVIS-BACON PLANT FORCES WORK REVIEW

A Davis-Bacon Plant Forces Work Review to cover the testing of the directional boring system was prepared and submitted to the Labor Standards Board (LSB). The LSB determined that the Davis-Bacon Act (DBA) is applicable to site preparation work. The LSB also determined that the DBA is not applicable to the work associated with setup, operation, hole grouting and removal of the CPT equipment.

4.7 CULTURAL RESOURCES REVIEW

The test sites were determined to have no historic properties as discussed in Cultural Resources Review, #89-600-014.

5.0 HANFORD COMPLIANCE

5.1 SAFETY

CPT activities will be conducted in accordance with ARA standard operating procedures and safe work practices. ARA will conform to the Hanford Site requirements for access, onsite training, safety preparations, and equipment inspections prior to use. Members of the WHC Environmental Health and Pesticide Services Group will perform lead exposure rates along with Hanford Environmental Health Foundation personnel. In addition, the Environmental Health and Pesticide Group will prepare a site specific health and safety plan to cover the hygiene and industrial safety hazards of the project.

5.2 QUALITY ASSURANCE

All work on the Hanford Site is subject to the requirements of DOE Order 5700.6C, Quality Assurance (DOE-RL 1991b), which establishes broadly applicable quality assurance (QA) program requirements.

To ensure that the field demonstration activities are consistent with DOE-RL Order 5700.6C, all work will be performed in compliance with WHC QA manual (WHC 1988) and with applicable procedures outlined in the WHC QA program plan (WHC 1990); this QA program plan describes the various plans, procedures, and instructions that will be used by WHC to implement the requirements of DOE-RL Order 5700.6C (DOE-RL 1991b).

The objective of the test plan is to ensure that the data obtained and the conclusions drawn are sufficiently accurate and reliable to support decisions associated with the evaluation of the demonstration. The field team leader will document all activities per WHC (Brown 1988) and periodically update the principal investigator on the current status of the test.

5.3 TRAINING

Personnel who need to enter the control zone around the rig will be required to have current Occupational Safety and Health Administration, 29 CFR 1910, 40-hr hazardous waste worker's training. The control zone will be approximately 5 by 5 ft around the CPT truck. ARA personnel will conform to Hanford Site requirements concerning training and safety.

Safety training requirements are listed in the hazardous waste operations permit (HWOP). Security requirements are consistent with those needed for visitor access to the test site (Laurenz 1992).

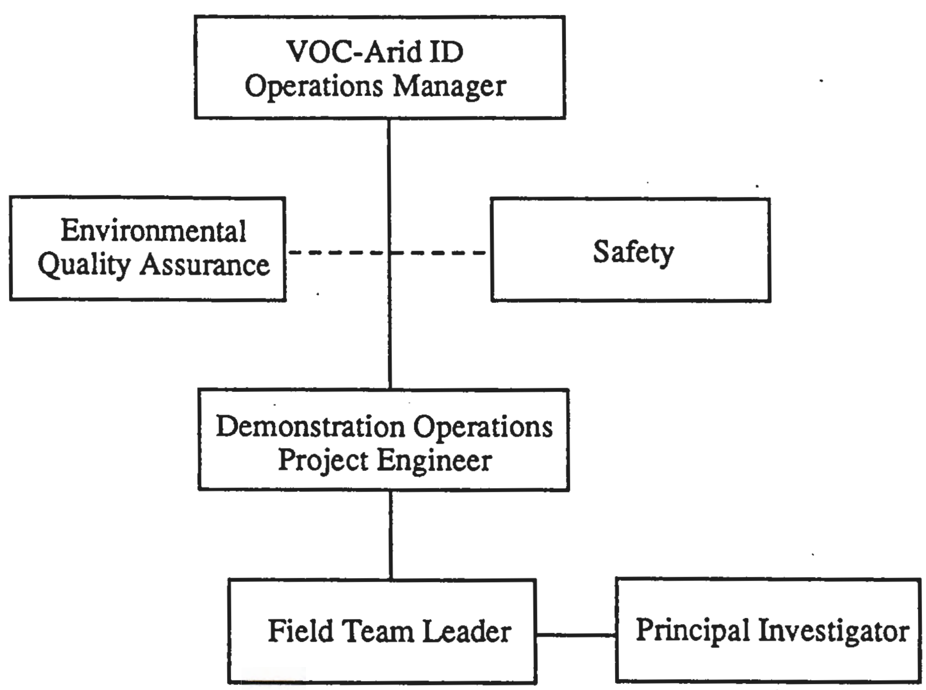
5.4 RECORDS

Records generated from drilling will be processed per WHC (Brown 1988). Issued reports will not contain any proprietary information, photos, or sketches that could infringe on the patent rights of ARA. In addition, ARA will have approval authority for proprietary issues.

6.0 ORGANIZATION AND RESPONSIBILITIES

Information on the organization and responsibilities of the VOC-Arid ID and ERA can be found in their respective project management plans. General roles and responsibilities specific to this field demonstration follow. Figure 2 illustrates the field organization. The demonstration will be performed by Demonstration Operations of the VOC-Arid ID and the principal investigators. Demonstration Operations is responsible for site characterization, engineering and conduct of field activities, and regulatory and DOE/WHC compliance. The following sections address responsibilities of principal field team members.

Figure 2. Field Demonstration Organization Chart.



6.1 DEMONSTRATION OPERATIONS MANAGER

The Demonstration Operations manager is responsible for: (1) ensuring that this demonstration is conducted in a safe and controlled manner and that all compliance issues have been resolved; (2) ensuring proper funding support for the preparation and field operations of this demonstration; and (3) ensuring necessary support for the demonstration by coordinating with involved management functions.

6.2 PROJECT ENGINEER

The project engineer is responsible for: (1) providing the principal investigator with site information as needed; (2) coordinating site access including use of demonstration site and principal investigator badging; (3) coordinating site services including utilities, transportation, facility space, and equipment and materials needed for this demonstration; and (4) conduct site preparation as needed for this demonstration.

6.3 FIELD TEAM LEADER

The field team leader is responsible for overall technical field management of the project and control onsite access. All onsite personnel report through the field team leader to accomplish their work. The field team leader is supported independently by health and safety personnel and health physics technicians monitoring for potential radiation.

6.4 SITE SAFETY OFFICER

The site safety officer is responsible for the generation of the HWOP. The site safety officer has the final authority with regard to safety related issue in the field. Although personnel onsite are obligated to conduct activities in a safe and professional manner, the site safety officer is ultimately responsible should an unsafe condition arise and be allowed to continue during any field operation.

6.5 PRINCIPAL INVESTIGATORS

WHC provided the principal investigator for drilling technologies. PNL provided the principal investigator for the HaloSnif testing. Sandia National Laboratories provided the principal investigator for the PAWS testing. DSITMS work will be performed by PNL with additional guidance provided by the developers from Oak Ridge National Laboratory. Savanna River Laboratory personnel will perform the B&K sensor measurements. The principal investigators' responsibilities include:

- ensure that the test objectives are met
- conduct the field activities through coordination with the field team leaders
- provide all monitoring equipment to be tested

- provide personnel to set up the equipment, perform the test, and analyze the results
- prepare a performance evaluation report that reviews the test results related to the objectives.

6.6 OTHER PARTICIPANTS

Test locations will be prepared and located by Hanford Site personnel. ARA personnel will mobilize the CPT equipment to the Hanford Site. The holes will be pushed by ARA personnel. After completion of the holes, ARA personnel will immediately grout the hole as the rod and probe assembly is withdrawn. WHC will be responsible for decontamination of equipment and waste disposal.

7.0 DEMONSTRATION SCHEDULE

Testing of the four sensor system interfaced with the CPT truck will be initiated and completed by the end of the third quarter if FY 93. Field demonstration activities are expected to commence on about April 19, 1993. Field testing is expected to be completed within 2 wk.

8.0 DEMONSTRATION TASKS

Activities of this ITP include testing of the HaloSnif, PAWS, DSITMS, and infrared spectrophotometer systems interfaced with the ARA CPT. These tests will be performed to evaluate and compare the performance of those systems as a real-time monitor for volatile chlorinated compounds in the unsaturated zone during CPT pushes. Data obtained during these tests will also be added to the database of site characterization information.

8.1 SITE PREPARATION

The PNL mobile laboratory will be utilized during this exercise to provide a laboratory environment to evaluate the performance of the four sensor systems. The mobile laboratory will be located directly adjacent to the CPT truck. The mobile laboratory will be located outside of the exclusion area of the ERA site or any radiation zones around the area. Power will be supplied by a mobile diesel generator (PNL will supply the generator). During testing, the generator will need to be fueled and maintained regularly by the appropriate motor pool personnel. This support will be required for a maximum period of 2 wk from the commencement of the testing (planned for April 19).

8.2 SYSTEM TESTING AND PROCEDURES

8.2.1 CPT

Testing, sampling, and analysis will be conducted in accordance with ARA CPT standard operating procedures. Calibration of measuring and analytical equipment will be defined in operator/owner manuals or by applicable standard analytical methods. The vendors procedures will reference all applicable American Society for Testing and Materials (ASTM) and other standard procedures used in conducting the CPT.

As necessary, the procedures of both companies will be modified by the WHC field team leader for application to the Hanford Site, and these modifications documented. All test procedures will be subject to WHC review and approval. In particular, every effort will be made to minimize the generation of liquid and solid waste. Decontamination of equipment will be performed during back-pulling of the rod assembly. Any rinsate will be controlled and dispositioned by WHC personnel per EII 4.3, Control of CERCLA and Other Past-Practice Investigation Derived Waste (Brown 1988). All CPT work will be in compliance with the Environmental Investigations and Site Characterization Manual (Brown 1988) or vendor procedures approved by WHC QA.

Monitoring well and vapor injection/extraction wells will be placed per WAC 173-160, Minimum Standards for Well Construction, or appropriate variances. A variety of well configurations may be used to achieve the objectives. The specific well type to be installed at each location will be selected based on further discussions with ARA when they arrive onsite. This information will be provided to the field team leader prior to initiation of the CPT demonstration at the ERA site. The target depth for all the CPT wells is approximately 120 ft.

Each cone penetration will be abandoned to ensure protection of the ground water resource and to prevent contamination of the resource (WAC 173-160-560). The CPT sites will be backfilled with a grout mixture as the rod assembly is withdrawn. WHC will grout the unsaturted zone wells and injection/extraction wells when they are no longer needed for testing.

In areas where radiation has been detected via probe monitors the rods will disconnected from the CPT truck at 6 to 8 in. above ground level and the truck driven away from the site. The rods and tools will then be removed using a rod puller or water well maintenance vehicle. At this point, both the rods and tools will be decontaminated, placed in plastic, and returned to the CPT truck. The plastic must remain on the rods and tools so that the truck is not contaminated. If the rods/tools are incapable of being decontaminated to safe limits, they will not be returned to the CPT truck. Due to the potential loss of the rods and probes, the vender should have enough available to continue with the testing.

8.2.2 HaloSnif System

For monitoring and sampling requirements, the gas sampling tip will need to be installed on the CPT. The tip will be connected to a sampling pump via 0.25-in.-OD nylon or polyethylene tubing. PNL will provide the required tubing. The tubing will need to be pre-strung through the push rods. The sampling line will be extended from the CPT truck to the PNL mobile laboratory. A sampling pump will be located in the mobile laboratory. A water trap, particulate filter, and a vacuum gage will be installed on the vacuum side of the pump to prevent water from reaching the HaloSnif or other instrumentation. A flow rate of 1 L/min is anticipated during testing however, the flow can be adjusted up or down to accommodate field conditions. Excess soil gas will vented outside of the mobile laboratory.

HaloSnif will be calibrated using certified gas standards prepared by a commercial gas supplier (i.e., Matheson, Linde, etc.). The standards will be prepared in air at concentrations in the range of 10 and 100 ppm carbon tetrachloride. A 500-ppm trichloroethylene in air standard is also available. HaloSnif will be zeroed and calibrated at the beginning and end of each CPT push.

Before pushing of the CPT begins, clock times on the CPT truck and the data acquisition computer in the mobile laboratory will be synchronized. This will allow for the plotting of concentration versus depth. During CPT pushes, HaloSnif will be used to measure the real time concentration of carbon tetrachloride (or its degradation products) in soil gas being extracted from the vadose zone around the gas sampling tip. The concentration of carbon tetrachloride will be recorded with the aid of a Macintosh computer equipped with LabView data acquisition software. All data will be archived and subsequently analyzed and reported to field team leader. A formal report will be supplied to the VOC-Arid ID at the end of the fiscal year.

To verify concentrations of carbon tetrachloride measured by the HaloSnif, discrete soil gas samples will be extracted from the respective sampling lines into glass gas sampling bulbs and analyzed per PNL technical procedure (PNL 1992, VOA-2) using conventional GC analysis. At least one sample of soil gas and one sample of calibration standard will be collected each day during a time in which stable readings have been observed on the HaloSnif.

8.2.3 PAWS System

The PAWS hardware described in Section 2.3 will be calibrated in the laboratory at Sandia and then transported to the Hanford Site. After the simple setup procedure is completed, the system will be operated using ambient air to verify full operation. In addition, samples from calibrated tanks will be used periodically to verify the calibration coefficients. The gas line from the CPT sample line will be connected to the gas inlet while valved off. Exhaust gas from the PAWS module will be sent to the exhaust system set up for the mobile laboratory.

Before pushing of the CPT begins, clock times on the CPT truck and the PAWS data acquisition computer in the mobile laboratory will be synchronized. This will allow for the plotting of concentration versus depth. Once the sample line is opened, monitoring for contamination in the site support trailer will be performed. Continuous monitoring of the sample stream will be performed during each push. The concentration with time and the depth versus time information for the push will be compiled along with the concentration versus time data from the other analysis techniques being tested. If possible, one test to determine the time lag in the CPT sample line will be performed by exposing the CPT tip to a sample of a chemical the PAWS system can detect and monitoring the time required for the sensor to respond. This time lag is important in correlating the concentration versus time data from the PAWS system with the depth versus time information for the push.

Following actual field testing, the PAWS system will be disconnected from the sample lines and disassembled in preparation for shipping. Results from the test will be documented in a data package describing the activities and basic test results. This will be submitted to Demonstration Operations within 1 mo of completion of the demonstration. In addition, an evaluation of the field demonstration based on the objectives and measures of success (Section 3.2) will be prepared and submitted to the VOC-Arid ID technology coordinator within 2 mo of completion of the demonstration.

8.2.4 DSITMS System

The DSITMS system will be installed in the PNL mobile laboratory 1 wk prior to commencement of testing. Standard gas mixture containing 10 and 100 ppm vol carbon tetrachloride in air will be used to adjust the inlet system for optimal performance and dynamic range. A Transducer Research dilutor will be added to the system to provide variable dilution up to 20-fold to extend the dynamic range. Before pushing of the CPT begins, clock times on the CPT truck and the DSITMS data acquisition computer in the mobile labora-tory will be synchronized. This will allow for the plotting of concentration versus depth. The DSITMS will continue to collect data until analyte levels exceed the upper range available with the maximum dilution factor. The system will be taken offline if extremely high levels are encountered. At the completion of each push series, all data will be post-processed and reduced to tabular form for later reporting.

At the completion of testing, the DSITMS will be removed from the mobile laboratory for other uses. Results of the DSITMS testing will be reported in the same document as the HaloSnif results prior to the end of the fiscal year.

8.2.5 Infrared Photoacoustic Spectrometer

The B&K sensor system will be installed in the PNL mobile laboratory just prior to commencement of testing. Standard gas mixtures containing 10 and 100 ppm vol carbon tetrachloride in air will be used to verify system calibration. Data will be collected continuously for all channels of interest by a laptop computer interfaced through the serial port. Before pushing of the CPT begins, clock times on the CPT truck and the B&K sensor data acquisition computer in the mobile laboratory will be synchronized. This will allow for the plotting of concentration versus depth. At the completion of each push series, all data will be post-processed and reduced to tabular form for later reporting.

At the completion of testing, the B&K sensor will be removed from the mobile laboratory and shipped back to Savanna River. Results of the B&K sensor testing will be reported in the same document as the HaloSnif results prior to the end of the fiscal year.

8.2.6 Portable Fourier Transform Infrared Photoacoustic Spectrometer

The portable Fourier transform infrared spectrometer gas analyzer will be calibrated for carbon tetrachloride, chloroform, and methylene chloride at Ames Laboratory and then transported to the Hanford Site. The unit will be installed in the PNL mobile laboratory prior to testing. Standard gas mixtures containing 100 and 1,000 ppm vol carbon tetrachloride in air will be used to verify the initial calibration. Data will be collected continuously and stored by the units' internal computer. Before pushing of the CPT begins, clock times on the CPT truck and the Model 1301 acquisition computer will be synchronized. This would allow for the plotting of carbon tetrachloride concentration versus depth.

At the end of the testing, the Model 1301 will be removed from the mobile laboratory and transported back to Ames Laboratory. Results from the Model 1301 will be post-processed and reported.

8.3 TEST SITE RESTORATION

The test site(s) will be restored after testing. Restoration will include the removal of all equipment and temporary services not necessary for other activities either ongoing or anticipated at the test site. Test holes will be completed as appropriate.

9.0 SITE SERVICES REQUIREMENTS

Other WHC organizations that will provide support to this demonstration include: Regulatory Analysis, Industrial Safety and Fire Protection, Quality Assurance, Environmental Protection, Health Physics, Environmental Safety Assurance, Inactive Facilities Surveillance, and Maintenance.

The CPT rods and cone should be monitored for contamination as they are being withdrawn from the hole. Due to the unpredictability of the refusal depth, a Health Physics technician should be available to the CPT truck during it's operation and as required by the radiation work permit. At a minimum, day/night coverage should occur to ensure the safety of the workers and the contracted equipment.

All sites located for the CPT should be stable enough for the vehicle to be easily moved on and off. The CPT system is a self contained highly mobile unit and will not require any form of exterior power or site support. If the CPT works into the evening hours, lights should be provided for safety around the vehicle.

A site-specific safety report will be written for this task per EII 6.7, Drilling Start-up List (Brown 1988). The document will include such items as expected hazards, mitigation of those hazards, monitoring requirements, action levels strategies, and personal protective equipment requirements.

10.0 DELIVERABLES

This demonstration will culminate with reports written on the CPT and each sensor to document the capabilities of the tools, probes, and systems. Lessons-learned meetings may be conducted, documented, and included as an addendum prior to issuing the written report. All principal investigators are responsible to the VOC-Arid ID technology coordinator for reporting results of this demonstration.

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WHC-SD-EN-TP-023, Rev. 1

List attachments.

Date Release Required
April 30, 1993

Title: Integrated Test Plan for Demonstration of Cone Penetrometer Including Chemical Sensor Systems

Unclassified Category UC- N/A

Impact Level 3Q

New or novel (patentable) subject matter? [X] No [] Yes
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Information conforms to all applicable requirements. The above information is certified to be correct.

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References Available to Intended Audience	[X]	[]
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Date 4/30/93

Intended Audience
[] Internal [] Sponsor [X] External

Responsible Manager (Printed/Signature) For R. C. Roos
Date 5/4/93

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP

Stamp is required before release. Release is contingent upon resolution of mandatory comments.

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V.B.
Date 5/5/93

Date Cancelled

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