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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 335

File: C.G. 212-700.a

335

TECHNICAL MEMORANDUM CH2MHILL

Passive Soil Gas Survey at Dunn Field

PREPARED FOR: Dorothy Richards, CEHNC

PREPARED BY: Tom Beisel

DATE: July 15, 1998

Soil analytical data collected by OHM during construction of the Dunn Field groundwater recovery system found PCE in shallow soil (0-4 feet) along the western and northern fence line of Areas B and C. Additional information on the location of the VOC sources at Dunn Field is needed prior to the collection of soil samples as outlined in the approved RI/FS Work Plan. The WES geophysical data, Parsons geophysical data, near-surface soil VOC data, historical information, and quarterly groundwater reports were evaluated. Two distinct chlorinated VOC plumes; Trichloroethene (TCE) and Tetrachloroethene (PCE) are present in the Fluvial Aquifer. A TCE plume migrating generally to the east is centered under Area B and the PCE plume trends along the northern fence line of Areas B and C.

To assist in better locating the VOC sources to groundwater from the Dunn Field disposal areas a passive soil gas survey is proposed. The survey will be performed using passive soil gas modules placed to a depth of three feet over a grid based on 50-foot centers. The zones to be surveyed include: all of Area B as defined in the ASR, a portion of Area A associated with the mustard disposal site, and a 150 foot wide band along the northern fence line of Area C. Anomaly avoidance will be practiced in areas A and B. The contractor will maintain a distance of at least 25 feet from all pit/trench defined anomalies. The passive soil gas modules in Area B will be analyzed for chlorinated VOCs over all of Area B and chemical warfare materiel (CWM) breakdown products around the CWM disposal area. The Area A soil gas modules installed around the mustard disposal areas will be analyzed for CWM breakdown products. The soil gas modules installed along the fence line of Area C will be analyzed for chlorinated VOCs.

Gore-Sorber, manufactured by W. L Gore and Associates, Inc., is the preferred method for performing the survey. Analysis of the modules will be performed by W. L Gore lab. Gore-Sorber soil gas modules are easily installed to a depth of three feet without use of a hand auger or other method that involves digging/excavation. The Gore-Sorber module allows for the transfer of soil gas and not water to the collector and is sorbent-based, utilizing hydrophobic adsorbents, which minimize interference by water vapor. The sampler housing is micro-porous and inherently waterproof for use in the potentially wet or saturated soils at Dunn Field.

The contractor will develop a site-specific safety plan specifically for the soil gas survey (i.e. implementing OE avoidance). This will be approved by the Huntsville Corps of Engineers Safety Office before any field work is executed.

W. L. GORE & ASSOCIATES, INC.

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GORE-SORBER® EXPLORATION SURVEY
GORE-SORBER® SCREENING SURVEY

DESCRIPTION OF SERVICE

Screening Survey Applications

GORE-SORBER® Screening Surveys employing GORE-SORBER® Modules (patented passive soil vapor sampling devices) have been used successfully at many sites for determining subsurface areas impacted by VOCs and SVOCs. Organic compounds commonly detected include fluorinated and chlorinated solvents, straight- and branched chain aliphatics, aromatics, and polycyclic aromatic hydrocarbons (PAHs). Many of these compounds are associated with a wide range of petroleum products, including gasoline, mineral spirits, heating oils, creosotes, and coal tars. GORE-SORBER Screening Surveys have also been used successfully to screen for nitroaromatic explosives.

Common applications include detection of compounds to: 1) trace soil and ground water plumes in porous and fractured media, 2) monitor progress of subsurface in-situ remedial actions, 3) to provide baseline data for real estate transfer assessments, and 4) to reduce groundwater monitoring costs. Prudent use of this technology can optimize and reduce soil and groundwater sampling efforts resulting in significant cost savings over the life of site assessment and remedial action programs.

Description Of GORE-SORBER Screening Modules

A typical GORE-SORBER Screening Module consists of several separate GORE-SORBER® passive sorbent collection devices (sorbers). A typical sorber is 15 to 25 millimeters (mm) long, with a 3 mm inside diameter (ID), and contains 40 milligrams (mg) of a suitable granular adsorbent material depending on the specific compounds to be detected. Typically, polymeric and carbonaceous resins are used for their affinity for a broad range of VOCs and SVOCs. The sorbers are sheathed in the bottom of a one (1) foot length of vapor-permeable insertion and retrieval cord which is fashioned with a loop. This construction is termed a GORE-SORBER module. Both the retrieval cord and sorbent container are constructed solely of inert, hydrophobic, microporous GORE-TEX® expanded polytetrafluoroethylene (ePTFE, similar to Teflon® brand PTFE). The loop is used as a means of tying the module to a string for installation and retrieval. Attachment 1 shows a typical screening module.

A unique feature of ePTFE membranes are that they are hydrophobic and exclude liquid water, yet they do not retard vapor transfer, thus allowing VOC and SVOC vapors to freely penetrate the module and collect on the adsorbent material. This ability to protect the sorbent media from contact with ground and soil pore water without retarding soil vapor diffusion facilitates the application of GORE's soil vapor screening methods in very low permeability and poorly drained soils.

Quality Assurance (QA) Measures

As standard practice, all modules are individually numbered and tracked throughout the entire manufacturing, field deployment, and analytical process. Completed modules are subjected to a 16-hour "bake-out" under a nitrogen blanket in a vacuum oven at 150 °C prior to shipment to the customer. Finally, each module is sealed into a clean glass vial with a Teflon liner. All modules are transported to and from the customer's site in sealed glass vials and boxes supplied by GORE. Five to ten percent additional trip blanks will accompany the modules to and from the site. Associated manufacturing blanks and trip blanks are always tested with each project as controls. Full details of GORE's QA measures are documented in our Quality Assurance Manual.

Screening Survey Installation And Retrieval Procedures

Installation of the modules is performed by the customer. Although GORE-SORBER modules can be installed to any depth, a slam bar or electric rotary hammer-drill is typically used to auger a 3/4 to 1-inch diameter pilot hole for the deployment of the modules to an average depth of two (2) to three (3) feet below grade.

After the pilot hole is completed, modules are tied to a section of Nylon® cord and inserted into the completed boreholes, using the stainless steel insertion rod supplied by GORE. The Nylon cord is typically fastened to a cork, which is tamped flush with the ground surface to assist in retrieval of the module, and to seal the annulus of the boring. Additional modules that are designated as trip blanks should be noted on the installation/retrieval log and left (unopened) in the shipping box for the duration of the field exposure.

Module retrieval requires that field personnel locate the module, remove the cork, grasp the Nylon cord and manually pull the module from each location. Corks and Nylon cord are separated from the module and discarded. The exposed modules are resealed in their respective designated shipping vials and placed in the supplied shipping box. Boxes with field-exposed modules and trip blanks are returned along with the Chain-of-Custody (COC) form to GORE's laboratory in Elkton, MD usually via overnight courier.

Screening Module Exposure Time

GORE's suggested module exposure time is 10 to 14 days.

Analytical Procedures

On receipt of the modules at the GORE laboratory, each box is opened, the samples are logged, and the COC is inspected. Samples are then transferred to a temporary holding facility with a positive pressure zero-air supply until analysis.

Analytical instrumentation consists of Hewlett-Packard 5890 gas chromatographs and 5971A mass selective detectors, as well as Perkin-Elmer ATD-400 automated thermal desorption units. Sample preparation simply involves cutting the tip off the bottom of the sample module and transferring an exposed sorbent container (sorber) to a thermal desorption tube for analysis. Sorbers remain clean and protected from dirt, soil, and groundwater by the insertion/retrieval cord, and require no further sample preparation. The replicate samples remain in the zero-air container until discarded. Laboratory QC is described below:

Level 2 Screening Method Quality Assurance:

This is our standard analytical screening method, which is essentially a modified EPA method 8260A/8270B. Before each run sequence, two instrument blanks, a sorber containing 5µg BFB (Bromotluorobenzene), and a method blank are analyzed. The BFB mass spectra must meet the criteria set forth in Statement of Work (SOW) for Organic Analysis Multi-Media Multi-Concentration (SOW OLM 010.0 and revisions) before samples can be analyzed. A BFB-containing sorber is also analyzed after every 30 samples and/or trip blanks, as is a method blank. Standards containing our target compounds at three calibration levels of 5, 20, and 50µg are analyzed at the beginning of each run. The %RSD criterion for all target compounds is less than 35% RSD. If this criterion is not met for any target compound, the analyst has the option of generating second- or third-order standard curves, as appropriate. A second-source reference standard, at a level of 20µg per target compound, is analyzed after every ten samples and/or trip blanks, and at the end of the run sequence. No surrogates are added. Positive identification of target compounds is determined by the presence of the target ion and at least two secondary ions, retention time versus reference standard, and the analyst's judgment. All analytical data are reported as mass of analyte, in micrograms (µg) per sample.

Laboratory data deliverables packages can be provided at the customers request, and may include all analytical results for samples, standards and blanks, and mass spectra comparisons with standards for all detects.

Interpretation of Screening Survey Data

In general, the detection of VOCs and SVOCs in field-exposed modules indicates that potential sources (i.e. soil adsorbed-, dissolved- and separate-phase organics) of the detected compound(s) may exist in proximity to the module location. The module will adsorb migrating gases present in the adjacent media (soil or water). The processes that govern the movement of gases in the subsurface are complex, involving interactions between the soil, soil moisture, pore gasses, ground water, and the volatile contaminant. Chemical and microbiological processes can further influence the presence of soil gases, by reacting with or metabolizing these compounds.

Vapor pressure, water solubility, molecular weight, and the Henry's Law partitioning coefficient, are all important chemical parameters to consider when interpreting soil vapor data. The Henry's Law coefficient reflects a compound's behavior when partitioned into air and water, which aids in understanding an organic chemical's likely state in the subsurface. An understanding of the site geology (geologic structure, geochemistry), hyrogeolology and operational history are also important when interpreting the distribution of soil gases.

Contour Maps Of Soil Vapor Analytes

Graphic presentation of the data extracted from GORE-SORBER Modules is normally presented by overlaying the contamination patterns detected during analysis onto CAD maps supplied by the customer. Either minimum surface curvature or kriging models (GEOSOFT® Mapping Software) are employed. Standard "B-sized" (11" x 17") color contour plots are included with each project, however "E-size" (24" x 36") plots are available, if requested. The site plan base map(s) provided by the customer must include a scaled drawing with relevant site features, and an overlay containing the sample locations for the survey.

Tentatively Identified Compounds (TICs)

Some of the modules may contain non target analytes (compounds not on GORE's target list). GORE can provide tentative identification of prominent non-target compound peaks (TICs). These compounds can include non-target soil vapor analytes, and contaminants introduced during sample transport and installation/retrieval activities.

Reporting of Results

The results of the GORE-SORBER Screening Survey will be summarized in a brief report which will include the chain of custody, analytical data summary table, sample chromatograms, and color contour maps. A laboratory analytical data deliverables package incorporating results of samples, standards and blanks, and mass spectra compared to standards for all detects can be provided as an option.

Rev. 4/98
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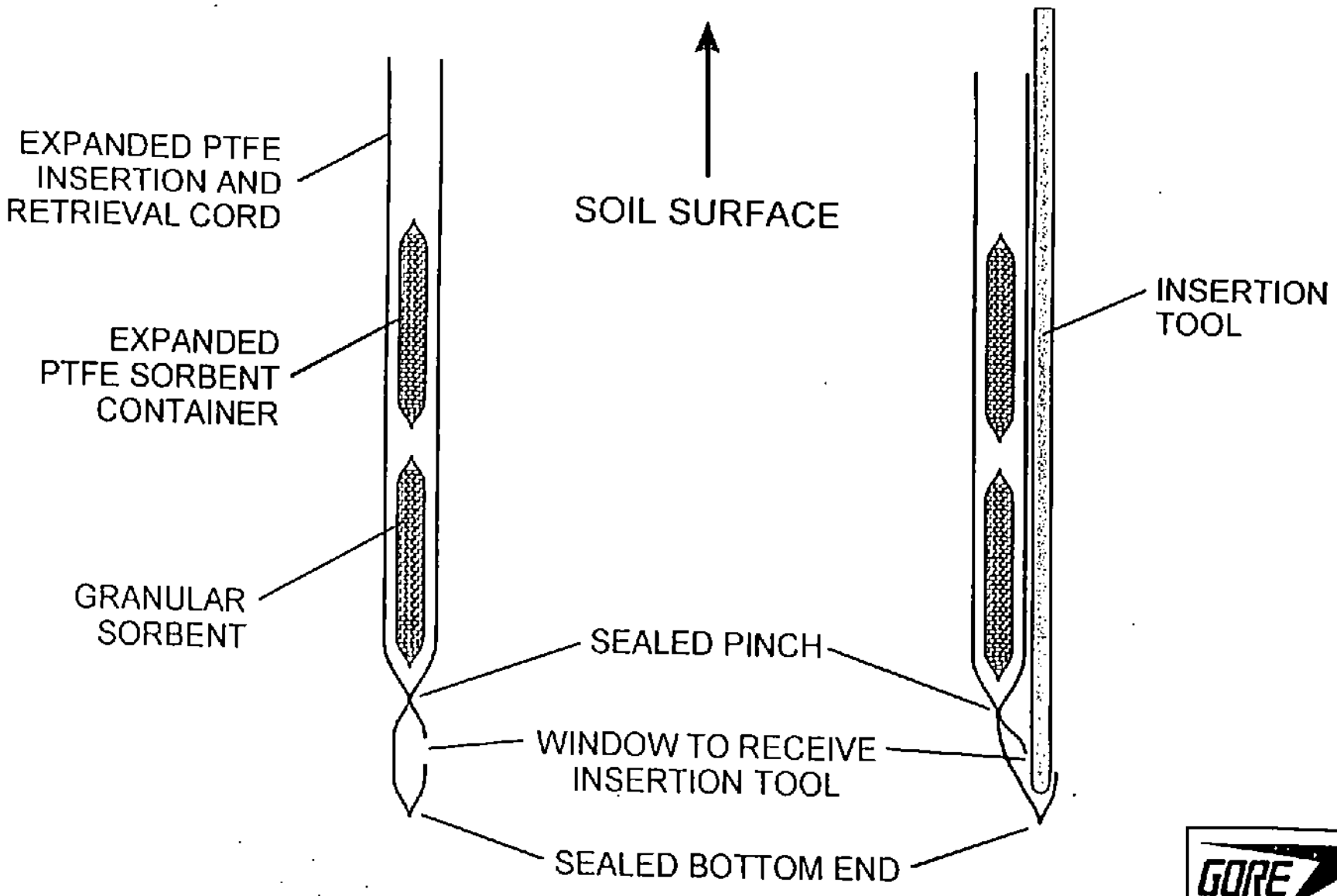
GORE-SORBER® Screening Module



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GORE-SORBER® EXPLORATION SURVEY
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GORE-SORBER® SCREENING SURVEY CAD MAP INSTRUCTIONS

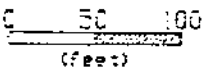
Thank you for your recent purchase of a GORE-SORBER Screening Survey. It is our goal to make certain that you are happy with our service for this project, so please do not hesitate to contact us with any questions at (410)996-3402.

Currently, we ask that the CAD drawing be generated in AutoCAD® Release 12 or earlier. If you are using another CAD program, please export and save the file in DXF format from your CAD system.

To help insure that we deliver results on time, please comply with our specifications for the supply of a CAD map of your site to Gore:

Upon installation of the GORE-SORBER® Screening Modules, a CAD map showing the module locations identified with the module serial number should be generated and forwarded to Gore (in advance of the return shipment of exposed modules).

The site drawing should include:

- A minimum number of layers with no additional hidden or frozen layers; all colored white.
- Locational entities - such as buildings, streets, property lines, etc...; all colored white.
- The module locations clearly marked and labeled with the module serial number.
- A graphical scale. 

- Be drawn in decimal ground units of the survey (i.e., feet as opposed to plot inches or architectural units); checked with the graphical scale. For example, if the graphical scale above is measured in AutoCAD, the distance will read 100, if drawn in the correct ground units (feet).
- Exploded blocks.
- Hard copy to be sent with diskette. (General example attached)
- Include any special font or other files used to generate the drawing.

Thank you, again, for your business. Your attention to these requests will insure prompt processing of your GORE-SORBER Screening Survey results.

IMPORTANT -- READ THIS FIRST

GORE-SORBER® Screening Survey
Module Storage, Installation, and Retrieval Information

NOTE: If you have any questions regarding installation and retrieval of your modules, please call Ray Fenstermacher, Jay Hodny or Barbara Keaveney (410) 392-7600

STORAGE

GORE-SORBER® Modules are specially cleaned and stored after manufacturing. They must remain sealed in their vials in the shipping boxes until deployment. **DO NOT** store them near potential sources of organic vapors, including petroleum fuels, fuel exhaust, solvents, or in areas of new construction or remodeling where paints, adhesives, foam insulating materials, etc. may be present.

REQUIRED TOOLS/SUPPLIES

GORE-SORBER Modules can be installed at any depth. Usually they require only a narrow pilot hole (approximately 1/2-inch to 3/4-inch in diameter) typically drilled or driven to a depth of 2 to 3 feet using hand tools (depending on project objectives, installation depth may vary at your site).

The following items are provided by GORE:

- Shipping boxes containing individually numbered passive soil gas collectors (Modules), including trip blanks;
- Stainless steel insertion rod, in threaded sections (for placement of modules in pre-drilled/driven pilot holes);
- Corks with screw eyes attached;
- String (cord) to allow the module to be installed to the recommended depth; and
- Chain of Custody and Installation/Retrieval Log.

Additional tools (to be supplied by the customer) required for installation may include:

- Equipment to lay out and mark sample locations (scaled map, measuring tapes, pin flags, spray paint);
- Disposable gloves and equipment decontamination supplies
- Slide hammer/tile probe (slam bar) or electric rotary hammer drill (AC power outlet or portable generator and extension cords required) with carbide-tipped bits or augers (1/2 to 1-inch diameter up to 36 inches long) - information on where these items can be purchased is provided below as a courtesy and does not represent any endorsement of these products or suppliers:

Item	Supplier	Phone No.
Slide Hammer/Tile Probes	Forestry Supplies	(800) 647-5368
Carbide Drill Bits (36" long)	KV Associates, Inc.	(508) 540-0561
Rotary Hammer Drill	SKILL-BOSCH Power Tools	(800) 334-5730

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Elkton, MD 21922-0010
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Fax: 410/506-4780

Accuracy Counts

Commonly Requested Analytes Detectable Using GORE-SORBER Screening Survey Collectors and Analysis

Volatiles
Vinyl Chloride
Methyl t-butyl ether
1,1-Dichloroethane
Chloroform
Benzene
1,2-Dichloroethane
Toluene
Tetrachloroethene
Ethylbenzene
o-Xylene
trans-1,2-Dichloroethene
cis-1,2-Dichloroethene
1,1,1-Trichloroethane
Carbon Tetrachloride
Trichloroethene
Octane
Chlorobenzene
m,p-Xylene

Semi-Volatiles
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
Undecane
Tridecane
Pentadecane
Naphthalene
2-Methyl naphthalene
Acenaphthene
Acenaphthylene
Fluorene
Phenanthrene
Anthracene
Fluoranthene
Pyrene

Explosives
Nitrobenzene
2-Nitrotoluene
3-Nitrotoluene
4-Nitrotoluene
1,3-Dinitrobenzene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,3,5-Trinitrobenzene
2,4,6-Trinitrotoluene
2-Amino-4,6-dinitrotoluene
4-Amino-2,6-dinitrotoluene

Chemical Agents/Breakdown Products
Mustard (as a TIC) $220
1,4-dithiane
1,4-oxathiane
Benzothiozole
p-Chlorophenylmethylsulfide
p-Chlorophenylmethylsulfoxide
p-Chlorophenylmethylsulfone
Dimethyldisulfide
DIMP (Diisopropyl methylphosphonate)
DMMP (Dimethyl methylphosphonate)
4-chloroacetophenone
2-chloroacetophenone

Pesticides/Herbicides & PCB Cogeners
Some capability demonstrated.

NOTE:
THIS IS NOT A COMPREHENSIVE LIST OF DETECTION OR ANALYTICAL CAPABILITIES

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