INDOOR VAPOR PATHWAY SCREENING ASSESSEMENT

SUPPLEMENTAL RI WORKPLAN
HARLEY-DAVIDSON MOTOR COMPANY, OPERATIONS, INC.
YORK, PENNSYLVANIA FACILITY

Prepared for:

Harley-Davidson Motor Company, Operations, Inc.
1425 Eden Road
York, Pennsylvania 17402

Prepared by:

Langan Engineering and Environmental Services, Inc.
30 South 17th Street, Suite 1500
Philadelphia, Pennsylvania 19103-4005

October 2003
1406704

Langan
Engineering and Environmental Services, Inc.

30 South 17th Street, Suite 1500, Philadelphia, PA 19103-4005
♦ (215) 864-0640 ♦ (215) 864-0671 ♦

INDOOR VAPOR PATHWAY SCREENING ASSESSEMENT

SUPPLEMENTAL RI WORKPLAN
HARLEY-DAVIDSON MOTOR COMPANY, OPERATIONS, INC.
YORK, PENNSYLVANIA FACILITY

Prepared by:

Jeffrey A. Smith, P.G., Project Manager

Gerard Coscia, P.E., Senior Associate

Colleen Costello, P.G., Senior Associate

October 2003
1406704

Langan
Engineering and Environmental Services, Inc.

30 South 17th Street, Suite 1500, Philadelphia, PA 19103-4005
♦ (215) 864-0640 ♦Fax: (215) 864-0671 ♦

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 PURPOSE

The primary purpose of this vapor intrusion screening assessment is to collect reliable soil vapor analytical data to supplement existing groundwater analytical data and determine whether or not the vapor intrusion pathway poses an unacceptable risk to human health. This evaluation is critical toward addressing the vapor intrusion pathway and satisfying the Environmental Indicator goal of reducing or controlling the risk to human health, if any, at the Harley-Davidson York, Pennsylvania facility by 2005.

2.0 BACKGROUND AND PRELIMINARY SCREENING ASSESSMENT

At the Harley-Davidson York facility, elevated concentrations of volatile organic constituents (VOCs) have been detected in samples of groundwater collected from monitoring wells. The migration and volatilization of the VOCs in groundwater and the potential exposure pathway via vapor intrusion is a human health environmental indicator that needs to be further evaluated to determine if vapors exist in excess of risk based levels. Residential dwellings exist along the northeastern and southeastern Harley-Davidson property boundaries. Additionally, there are a limited number of on-site building areas that are generally used for administrative or other purposes where there is the potential for non-occupational exposures that would not necessarily be addressed by the Occupational Safety and Health Administration (OSHA). These on-site buildings include: Building No. 1. (Administration Office), Building No. 7 (Medical/ Security), Building No. 8 (Cafeteria), Building No. 11 (Office/Storage), Building No. 13 (Computer Building), and Building No. 45 (Test Lab/MC Audit/Maintenance Trades). The general locations of these areas that will be further investigated to evaluate the potential vapor intrusion exposure pathway are shown on the aerial photograph taken in May 2002 and provided on Figure 1.

As initial steps in the evaluation and assessment of the vapor intrusion pathway, Langan completed a preliminary screening assessment following the USEPA Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (November 2002). This Draft subsurface vapor intrusion guidance involves a three-tier methodical screening process that is conservative and can be used to determine whether there is a potential for an unacceptable risk. In preparing this workplan the three-tier screening evaluation was performed for one of the proposed areas of investigation but the screening evaluation will be completed for all proposed areas as part of implementing this workplan.

Given the rapidly evolving science concerning vapor intrusion, this screening assessment is preliminary and has been based on general assumptions and the existing groundwater data for wells sited near the northeastern and southeastern property boundaries and the identified non-occupational areas of the facility. Some key facts and/or assumptions are:

- There are no known impacts of VOCsto unsaturated soils in the vicinity of the northeastern and southeastern property boundaries and/or areas located further north or south beyond the limits of the property.

- Only potential exposure scenarios were considered and it is conservatively assumed, though not confirmed, that the concentrations of volatile constituents in samples of groundwater from wells within the immediate vicinity of each area are representative of the groundwater concentrations beneath the buildings and residential dwellings of interest.

- The depth to groundwater beneath these areas of investigation is generally 20 to 35 feet below ground surface.

2.1 Tier 1 Preliminary Screening Assessment

To illustrate the draft vapor intrusion screening process, we have prepared the following description of the tiered screening evaluation conducted for the southeast property boundary area (SPBA). At the Tier 1 screening level, Langan identified the following constituents present in on-site groundwater at the SPBA that are listed in Table 1 of the USEPA draft vapor intrusion guidance:

- Bromoform
- 1,2-Dichloroethene
- Chloroform
- Chloromethane
- Tetrachloroethene (PCE)
- Trichloroethene (TCE)

As defined in the USEPA draft vapor intrusion guidance, these constituents are sufficiently volatile and potentially toxic to pose a threat to human health via the vapor intrusion pathway. Given the presence of these volatile constituents in groundwater and the location of inhabited buildings immediately off-site and downgradient of the SPBA, the assessment proceeded to the Tier 2 screening level.

2.2 Tier 2 Preliminary Screening Assessment

The Tier 2 screening step involves comparing measured concentrations (in this case in on site groundwater) to the recommended “generic criteria”. As a first pass conservative screening, groundwater target constituent criteria corresponding to a risk level of 10^{-6} were used. The concentrations detected in monitoring wells near the SPBA during three recent sampling episodes were then also compared to the least stringent (10^{-4} risk level) target screening concentrations. The results of this screening comparison are summarized below.

Volatile Organic Compound in Groundwater	Range of Concentrations (ug/L)	USEPA Draft Vapor Intrusion Screening Levels for Groundwater			
		Generic		50 x Generic (1)	
		R=1x10^{-6}	R=1x10^{-4}	R=1x10^{-6}	R=1x10^{-4}
Bromoform	1.1	0.0083	0.83	0.415	41.5
Chloroform	0.2 - 3	80	80	4000	4000
Chloromethane	0.5 – 1	6.7	250	335	12,500
1,2-Dichloroethene*	1.3 –137	210	210	10,500	10,500
Tetrachloroethene	1 – 424	5	110	250	5,500
Trichloroethene	1 - 1420	5	5.3	250	265

Notes:

The compounds presented here are those compounds detected in groundwater at the SPBA that are listed in Table 1 of the Guidance as sufficiently volatile and toxic.

All concentration/levels are listed in micrograms per liter (ug/l) equivalent to parts per billion (ppb).

**The range of concentrations is for 1,2-Dichloroethene which does not differentiate individual concentrations for the cis-1,2-Dichloroethene and trans-1,2-Dichloroethene chemical isomers; screening levels are for the cis-1, 2-Dichloroethene chemical isomer.*

(1) A site-specific evaluation is recommended by the guidance if observed concentrations are greater than 50 times the generic criteria.

R = risk factor

Bromoform, PCE, and TCE were detected in groundwater at the southeast perimeter at concentrations greater than the generic criteria and the 50 times the generic target concentration at the 1x10-6 risk level. TCE was also detected in groundwater at the SPBA at concentrations greater than 50 times the generic target concentration at the 10^{-4} risk level.

Based on a similar precursory screening assessment using the available groundwater analytical data for monitoring wells in the vicinity of the Northeast

Property Boundary Area (NPBA) and the targeted on-site buildings, similar constituents have been detected in groundwater at concentrations that exceed the conservative generic target concentrations in these areas. The complete vapor intrusion screening assessment for each area of investigation will be presented in the final vapor intrusion screening assessment report. In lieu of any soil-gas data that is representative of conditions that may exist near the building foundations, the conservative Tier 2 screening assessment warrants a more site-specific sampling/analysis assessment in these specific areas.

2.3 Tier 3 Site Specific Vapor Intrusion Screening Assessment

If warranted after completing the tiered vapor intrusion screening evaluation following USEPA Guidance for each area of interest, a focused site-specific assessment will be performed to further assess the potential vapor intrusion pathway related to migration and volatilization of halogenated VOCs from groundwater. The site-specific assessment will involve the collection and analysis of soil vapor samples that are taken at locations to assess potential vapor intrusion pathways associated with nearby off-site residential structures and targeted on-site buildings at the Harley-Davidson facility. In two phases of investigation, the soil vapor data will be collected at discrete depth intervals and, along with existing groundwater data, will provide a more reliable and robust dataset to assess the potential vapor intrusion pathway.

As a first step in the Tier 3 process, vapor concentrations obtained from readily accessible areas will be assumed to be similar to vapor concentrations adjacent to the nearby inhabited structures. This approach is considered conservative, especially in regard to off-site structures, because groundwater data in the area suggest that the highest concentrations exist at the property boundary and that the groundwater concentrations decrease in the downgradient direction toward the residential structures (see *Draft Southern Property Boundary Area; Interim Study Report; Harley-Davidson, Inc. Facility; York, Pennsylvania by* R.E. Wright and Associates, Inc., September 1996 and *Groundwater Extraction And Treatment System Annual Operations Report For The Period July 1, 2001 Thru June 30, 2002; Harley-Davidson, Inc. Facility; York, Pennsylvania* (2002)).

Initial Soil Vapor Qualitative Field Analysis

As an initial soil vapor screening phase, vertical profiling of soil vapor concentrations at each area of investigation will be conducted using a Membrane Interface Probe complete with an Electrical Conductivity (EC) Sensor. The combined MIP/EC tool will be pushed into the ground collecting data from the surface to the target depth or refusal. The logs generated will reveal both the general soil types as well as the location of any VOCs detected. The MIP system heats the soil to between 100 degrees and 250 degrees. VOCs in the subsurface, if present, then pass through a permeable membrane in the probe and are analyzed using PID, FID and ECD detectors. Two advantages of the MIP system are that it detects VOCs in-situ and can be used in most soil types and provides real-time data that can be readily viewed and interpreted to streamline and focus more quantitative data collection efforts. The soil types are classified based on electrical conductivity responses recorded by the probe. The collective results can be used to refine the conceptual model for the site and more accurately identify the most critical depths and soil types to focus more quantitative sampling and analysis. The Standard Operating Procedure for the collection of soil vapor samples using the Membrane Interface Probe is included in Appendix A.

Focused Soil Vapor Quantitative Analysis

Based on the MIP conductivity and soil vapor field analyses, hydraulic push methods (i.e. Geoprobe) will be used to obtain representative and discrete soil vapor samples at targeted locations where the soil vapors appear to be most concentrated and/or at soil types that appear to be more coarse-grained (permeable) and could have a greater effect on vapor migration. As part of a second mobilization and field effort, a subset (approximately one-third) of the discrete soil vapor samples collected and analyzed using the MIP will be re-sampled by accessing each targeted soil interval and using a Summa canister to collect a representative soil vapor sample. All soil vapor samples collected using Summa canisters will be analyzed for volatile organic compounds in accordance with "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air", EPA/625/R-96/010b, second edition, January 1999, Method TO-15. Soil vapor sampling methods and field sampling protocol for collecting soil vapor samples for quantitative analysis are summarized in Appendix B.

Also, readily available information will be ascertained to determine the construction details for inhabited buildings and for nearby buried utilities that could influence vapor migration, if present. The local building code office will be contacted to request available information and access to records that document the construction details particularly foundation and sub grade structure details for the residences and inhabited buildings located south and north of the property. We will also contact the sewer authority to obtain as-built drawings and/or construction details for sanitary and storm sewers located in the immediate vicinity of the property, particularly south of the SPBA.

3.0 DATA QUALITY OBJECTIVES

Data quality objectives were developed to relate the quantity and quality of the data that will be collected to study the problem, ultimate use of the data, and to support decisions. Data quality objectives are summarized below in terms of the process presented in the Guidance for Data Quality Objectives Process (EPA QA/G-4, August 2000).

I Problem Definition

At the Harley-Davidson York facility, the migration of elevated concentrations of VOCsin groundwater and the potential vapor intrusion pathway is a human health environmental indicator that needs to be further evaluated to determine if vapors exist in excess of risk based levels. Residential dwellings are located immediately off-site to the northeast and southeast of the property and certain on-site buildings areas that are generally used for administrative or other purposes are potentially at risk of exposure via vapor intrusion. The vapor intrusion pathway is one human health consideration that needs to be addressed as part of satisfying the environmental indicator goals for the site by 2005.

II Decision

Using available groundwater analytical data and the conservative vapor intrusion screening criteria in the Draft Vapor Intrusion Guidance, sufficiently volatile and toxic organic compounds have been detected in groundwater samples taken near targeted on-site building areas and the NPBA and SPBA. These data alone are not sufficient to determine whether the vapor intrusion pathway is complete or incomplete and will be supplemented by soil classification and soil vapor analytical data as well as other site specific information. The soil vapor data will be used to identify and differentiate any areas of investigation where contaminated groundwater is the only potential source of vapors or where a source may be present within the unsaturated soil zone (not likely at the SPBA and NPBA), if any. The appropriate generic target media-specific concentrations and screening risk levels presented in the Draft Vapor Intrusion Guidance will be used and compared to the groundwater and soil vapor concentrations at these areas of the site.

III Inputs to the Decision

Using both qualitative field analytical techniques and quantitative laboratory analytical methods, soil gas samples will be collected and analyzed to establish a vertical profile of vapor concentrations and to supplement the existing groundwater VOC analytical data. The combined dataset will be evaluated to assess the reliability and adequacy of the data for its intended use in evaluating vapor intrusion exposure pathway and environmental indicators. A more complete analysis of the combined dataset along with other site-specific factors that may be revealed will be performed using professional judgment following the Draft Vapor intrusion screening guidance and conservative risk-based criteria to determine whether a vapor pathway exposure risk could exist.

Soil vapor data collection and analysis will supplement the existing groundwater analytical data and together will provide a more reliable and adequate dataset to evaluate the potential vapor intrusion pathway. As a screening assessment, these data will be compared to the conservative soil vapor screening criteria in the Draft Vapor Intrusion Guidance to further evaluate whether the vapor exposure pathway may be complete. Readily available construction information pertaining to nearby (on-site and off-site) inhabited buildings will be compiled along with details of nearby utilities, and other known sub-grade features. Building air exchange rates that could affect preferential vapor migration pathways will be also be evaluated. This information will result in an improved site conceptual model to more completely assess the vapor intrusion pathway potential based on more site-specific conditions.

As appropriate, modeling (after Johnson, P.C. and R. Ettinger, 1991, Heuristic *Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings,* Environmental Science and Technology, 25 #8, 1445-1452) may be considered useful and may be conducted to further evaluate the vapor intrusion risk. At this time, any modeling efforts will be based on the results of the screening assessment using the groundwater and soil vapor analytical data and the site specific factors that have yet to be determined.

Various investigation activities will provide the data necessary to make decisions:

- Field data such as soil characteristics, soil classification and any field evidence of impacts (e.g. visual, olfactory, PID/FID/ECD) will assist in the characterizing subsurface conditions that could influence vapor distribution and migration.

- Soil vapor samples will be collected at locations along the Harley-Davidson NPBA and SPBA where some residences are located within about 100 feet to

200 feet of groundwater monitoring wells that contain volatile organic constituents. Similarly, soil gas samples will be collected near select on-site buildings that are associated with administrative office or other duties that are not necessarily governed by OSHA. The soil vapor data will be collected at multiple discrete depth intervals and will be first analyzed in the field using semi-quantitative field analytical techniques. A subset of soil vapor samples analyzed using the MIP will be re-taken using Summa canisters and analyzed by a qualified analytical laboratory for target volatile organic compounds using analytical Method TO-15.

- Method TO-15 analytical results will be provided in a full data deliverable format to facilitate data validation and support decisions. A third party sub-contractor, using the Region III Modifications to National Functional Guidelines for Organic will validate the soil vapor analytical results as they are critical to decision points (i.e. evaluating the potential vapor intrusion exposure risks).

- Readily available information will be ascertained to determine the construction details for inhabited buildings and for any nearby buried utilities that could influence vapor migration. As available, site specific information regarding building air exchange rates will also be evaluated.

IV Study Boundaries

In terms of the scope and boundaries of the screening assessment, three specific areas of the site have been targeted based on the greatest perceived possible risk via the indoor vapor intrusion pathway to nearby inhabited buildings (see Figure 1).

This investigation effort is a screening evaluation designed to collect supplemental data that will enhance the reliability and adequacy of the existing groundwater analytical data toward evaluating the vapor intrusion potential and associated environmental indicator goals. This screening evaluation is designed in accordance with Draft USEPA Vapor

Intrusion Guidance which uses an iterative/phased, decision-making process. The data collected will build on and benefit from the findings of earlier phases of investigation. In that regard, the use of modeling to further evaluate site specific factors is a consideration but the purpose and scope of any modeling efforts, if necessary, will be determined based on the results of the soil vapor sampling, data collection, and further vapor intrusion screening analysis. The vapor intrusion screening evaluation will be complete when it can be sufficiently demonstrated that the Environmental Indicator goal of reducing or controlling the risk to human health via the vapor intrusion pathway is met.

Timeliness and flexibility have been factored into the investigation to streamline site characterization efforts and efficiently and effectively accomplish goals and objectives. The investigation is designed to use a semi-quantitative field analytical approach followed by a focused soil vapor sampling effort at those specific locations and soil depths that appear to pose the greatest potential risk and could have the most influence on possible migration of volatile organic soil vapors via the vapor intrusion pathway.

V Decision Rule

First, field analytical results will be qualitatively considered for the presence or absence of VOCs in soil vapor. If VOCs are detected, then field analytical results will be further considered to assess the degree of impact relative to field analytical detection limits and other samples in a given area, over a discrete depth or soil type. Based on these data, specific locations and soil depths will be selected to re-collect soil vapor samples using Summa canisters. Using EPA Method TO-15 to achieve desired low-level quantitation limits, the soil vapor samples will be analyzed and results compared to the appropriate generic screening criteria provided in the Draft EPA Vapor Intrusion Guidance and possibly to other site specific risk-based screening criteria that may be calculated based on site specific factors and/or soil vapor modeling efforts, as appropriate. Ultimately, decisions on the vapor intrusion pathway and associated risks will be based on a site conceptual model and screening assessment using the available groundwater VOC analytical data, the soil vapor analytical data, and site specific data/factors that affect vapor exposure and human health risk.

VI Tolerable Limits on Decision Errors

There are effectively two levels of data quality for the vapor intrusion screening assessment: field data and laboratory analytical data. Field data will be used primarily as an initial screening tool to guide sample selection and investigation design, and will not be used independently to assess potential risk. The field analytical data will be used in a qualitative manner to focus soil vapor sample collection/analysis efforts to those areas, depths, and soil types that more directly contribute to potential vapor intrusion risks. Field data quality is a function of the limitations of the field instrumentation and operator skill/experience. To ensure optimal performance and reliability of field instrument readings, all field instrumentation will be standardized/calibrated following the manufacturer's recommendations and standard operating procedures.

There are lower tolerance limits on decision errors that relate directly to characterizing potential risks to human health and the environment (i.e. exposure pathways/receptors). Laboratory analytical data are generally of a higher quality with a greater degree of precision, accuracy, and quality assurance/control than field data. To be protective and ensure the validity of results, all laboratory data will be provided in full deliverable format to enable validation by a third party, as needed, and to support decisions concerning potential risks to human health via the vapor intrusion pathway will be fully validated by a third party.

All reasonable efforts will be made to detect and eliminate errors in field data derived from human error or instrument malfunction. Field activities will be implemented by staff properly trained in such areas as use of field equipment and field characterization of soils and drill cuttings. Field equipment will be calibrated and maintained in accordance with manufacturer's specifications.

VII Optimize the Design for Obtaining Data

As discussed earlier, the investigation will follow a phased approach with later phases building on and benefiting from earlier findings. The laboratory data is linked to the decision rule; therefore, it will be of high quality, definitive, and defendable. The laboratory analyses will be performed by a qualified laboratory (to be selected and named prior to sampling) that participates in a quality assurance/quality control program that is comparable to the program adopted by EPA. Analyses and will be conducted in accordance with strict protocols and documentation will be provided in a full deliverable package to enable data validation.

The following sections discuss how data will be collected and how data quality will be evaluated and documented.

4.0 SAMPLE COLLECTION/ANALYSIS

Vertically discrete samples of soil gas will be collected and analyzed to quantify the vapor concentrations of the target halogenated VOC constituents that pose a threat of vapor intrusion due to volatilization from groundwater emanating from the property. As part of an initial field sampling/analytical phase, borings will be drilled and soil vapor samples collected along both the northeast and southeast property boundaries as depicted on Figure 2 and 3, respectively. For on-site building areas that will be investigated, soil borings will be drilled along the exterior building perimeter walls with at least one set of vertically discrete vapor samples taken along each exposed, exterior wall, pending underground utility and access clearance. Soil vapor samples will be collected throughout the depth of penetration to an assumed nominal depth of 15 feet below ground surface at each boring location. Sample will be field analyzed using the MIP and PID/FID/ECD detectors as described in Section 2.3.1 and detailed in Appendix A. These data will be used to qualitatively evaluate the vertical profile of soil vapor concentrations at each location.

As a second field mobilization effort and based on the MIP field analytical results, select locations, depths and soil types will be revisited and soil vapor samples will be collected at these locations to produce quantitative and more reliable analytical data to assess the vapor intrusion pathway. Hydraulic push methods (i.e. Geoprobe) will be used to obtain representative and discrete soil vapor samples for analysis Samples will be obtained using a Summa canister and will be submitted to a fixed analytical laboratory for analysis. Sample collection methods and protocol using a Geoprobe and Summa canister are included in Appendix B.

All soil vapor samples will be analyzed for volatile organic compounds in accordance with “Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air”, EPA/625/R-96/010b, second edition, January 1999, Method TO-15. The analytical laboratory selection process for this work is ongoing and the selected laboratory will be named before proceeding with the soil vapor sampling work. The selected laboratory will be qualified to perform the required analyses and will participate in a quality assurance/quality control program that is comparable to the program adopted by EPA.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

The following sections outline the general field and laboratory quality assurance/quality control measures that will be incorporated into this focused Vapor Pathway Screening Assessment task. All soil vapor samples will be analyzed for the presence of the listed target VOCs that have been detected in groundwater that pose a possible vapor intrusion risk based on the conservative level of screening performed to date. Specific analytical quality assurance (QA) and quality control (QC) elements associated with achieving the objectives for this vapor intrusion screening task are summarized below.

5.1 Analytical Methodology

The laboratory analytical method designated for soil vapor samples collected during this vapor intrusion task is Method TO-15 as specified in “Compendium of

Methods for the Determination of Toxic Organic Compounds in Ambient Air", EPA/625/R-96/010b, second edition, January 1999. The target compound list (TCL) and priority pollutant list (PPL, excluding acrolein, acrylonitrile, and 2-chlorethyl vinyl ether) are subsets of the compound list that is targeted by this method. TO-15 is well suited to this vapor intrusion assessment because it can provide analytical results for a long list of compounds and achieve much lower detection limits. Detection limits in the part per billion volume (ppbv) range can be achieved using a cryofocusing procedure that enables much larger sample volume to be analyzed.

The targeted analytical parameters, vapor intrusion screening criteria and analytical reporting limits for the TO-15 analytical method are summarized below.

TARGET ANALYTES, REPORTING LIMITS
& VAPOR INTRUSION SCREENING CRITERIA

Target Volatile Organic Compound in Groundwater	USEPA Draft Target Soil Gas Concentration and Indoor Air Attenuation Factor (AF) (ppbv)		Method TO-15 Reported Detection Limits
	Shallow R=1x10-6 AF=0.1	Deep R=1x10-6 AF = 0.01	Summa Canister (ppbv)
Bromoform	2.1	21	
Chloroform	2.2	22	0.047
Chloromethane	15	150	0.067
1,2-Dichloroethene*	88	880	0.073
Tetrachloroethene	1.2	12	0.048
Trichloroethene	0.041	0.41	0.043
Vinyl Chloride	1.1	11	0.031

*The range of concentrations is 1,2-Dichloroethene which does not differentiate individual concentrations for the cis-1,2-Dichloroethene and trans-1,2-Dichloroehne chemical isomers; screening levels are for the cis-1, 2-Dichloroethene chemical isomer.

R = risk factor

5.2 Equipment Decontamination

Any equipment that comes into contact with a sampling medium, except for disposable implements, will be decontaminated prior to use and between sampling locations. Decontamination may be accomplished by steam cleaning (e.g. drilling tools/equipment) or by using the following procedure:

- Physical removal of residual material from equipment.
- Thorough, vigorous scrubbing with soft bristle brush and laboratory grade, non-phosphate detergent.
- Two thorough rinses with tap water.
- Laboratory grade pure water rinse.

Disposable items will be utilized, as appropriate, during the vapor intrusion sampling task to reduce the potential for crossover contamination. To ensure sample integrity and prevent cross-contamination from one sample to another, equipment decontamination procedures have been established. The sampling probes and apparatus will be decontaminated internally and externally prior to each day's sample collection, and at additional intervals as judged appropriate by the sampling team. Prior to each day's work, the sampling equipment will be washed with an Alconox/Liquinox cleaner/water solution, and is rinsed with potable water and then again with DI water. New tubing is used for each sample. During sampling, all unused supplies will be kept away from the sampling area in a clean area and covered with plastic.

All decontamination liquids will be contained and temporarily transferred to 55-gallon DOT-specified clean steel drums with completed labels pending proper off-site disposal or to other approved containers to be directed to the on-site treatment system prior to discharge. Potentially contaminated soils derived from the investigation will be drummed or properly contained or stockpiled on-site awaiting proper treatment/disposal.

5.3 Field Quality Control

For field quality control, all equipment will be calibrated daily prior to use for field activities. All calibration procedures will be conducted in accordance with manufacturer guidelines and operating procedures. The equipment to be used in the field will include a MIP with PID, FID and ECD detectors, a hand-held photoionization detector and groundwater level meters. All field equipment will be checked daily to detect signs of deterioration and obvious dirt. Spare and replacement parts will be carried in the field to minimize downtime due to possible equipment failure. The instruments will be decontaminated between each sample location.

As a QA/QC measure, one Summa™ Canister will be set up to draw ambient air, and a replicate will also be obtained by hooking two canisters to the same borehole with one valve and a “T” fitting. The canisters will be sealed and sent via overnight courier to the laboratory and the samples will be analyzed for target VOCs by USEPA Method TO-15. Replicate samples will be collected at a frequency of one for every twenty samples with at least one per sample analysis/delivery group. Ambient air blanks will be collected at a frequency of one per day. All blank sample information will be noted in the field notebook.

5.4 Sample Shipment and Custody

Sample containers will be obtained directly from the laboratory to ensure that the containers are free of contamination and are the appropriate volume for the requested analysis. Following sampling, the sealed sample container will be labeled with the following information: site name, sample number, initials of collector, date and time of collection, type of sample, analysis requested, and preservative, as appropriate.

Sample labels will be taped onto the sample containers. Following labeling, sample containers will be placed in a cooler for storage and shipment. Ice, sealed in double plastic bags or "blue ice" will be placed in each cooler to maintain all samples at 4 degrees Celsius (4°C). Chain-of-custody (COC) forms will be enclosed in each cooler. Coolers will be sealed with custody seals in such a manner that the custody seal would be broken if the cooler were opened. The lid of the cooler will be securely taped shut. Sample coolers will be hand delivered or shipped to the analytical laboratory via overnight service.

Chain-of-custody procedures provide an accurate written record that can be used to trace the possession of samples from the time of collection through sample analysis and data reporting by the laboratory. Both the field team and the laboratory are responsible for documenting sample custody. A sample is considered to be in an individual's custody if any of the following criteria are met: 1) the sample is in your possession; 2) it was in your possession and then locked up or sealed to prevent tampering; or 3) it is in a secured area.

Custody documentation will be maintained for each sample collected in the field. The field team member performing the sampling is responsible for the care and custody of the samples until they are properly dispatched. Chain-of-custody forms will be used to document sample custody. The following information will be specified for each sample on the field chain-of-custody form: sample number; sample matrix; date and time of sample collection; analysis requested; number of containers per sample; sample preservation; and method of shipment. One chain-of-custody form will be used for each sample cooler shipped for analysis. All other pertinent sample information including sample location will be recorded in the field notebook.

The chain-of-custody form will be signed by sampling personnel. The forms will be placed in a watertight plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form. The sampler retains a copy of the form for the project file.

Samples will be received at the laboratory by the sample custodians who examine each sample to ensure that it is the expected sample, inspect the sample containers for possible damage, and ensure that the documentation is complete and adequate. The sample custodians will ensure that each sample has been preserved in the manner required by the particular test to be conducted and stored according to the correct procedure. Samples will be maintained at 4°C until analysis begins.

6.0 DATA VALIDATION, REDUCTION, AND REPORTING

Validation of the analytical data package will be performed by a qualified third party Data Validator that will be identified to the USEPA prior to sampling. The laboratory will provide full data deliverables. The validation of data will be performed using general guidance in the Region III modifications to "Laboratory Data Validation Functional Guidelines for Validating Organic Analyses", USEPA 9/94. This document specifies procedures for validating data generated for Contract Laboratory Program (CLP) analyses. Therefore, method quality control requirements will also be used to evaluate the data. The data validation will include an assessment of the following items: chain of custody documentation, holding times, laboratory method blank results, surrogate recoveries, spike sample analysis results, mass tuning results, initial and continuing calibrations, internal standard performance, qualitative identification, and quantitation of results.

Upon completion of the data validation, Data Validation Reports (DVRs) will be prepared to present the data validation findings. A DVR will be prepared for each SDG data package reviewed. Analysis results forms, annotated by hand to reflect qualifier codes resulting from the data validation review, will be included with both the reports. These qualifier codes will be presented in the far right margins of the analysis results forms, and will be clearly identifiable. A glossary defining each data validation qualifier code will also be included with the report. The full data deliverables, including all raw laboratory data, will be submitted to EPA. Field measurements will be recorded in the field logbooks, which will be stored with the Langan project files. Laboratory data files will be stored at the laboratory.

Valid soil vapor data along with previously available groundwater analytical that is representative of conditions beneath each investigation area will be compiled and compared to the vapor intrusion screening criteria. Site specific data, including local soil characteristics, hydrogeologic conditions, horizontal and vertical VOC concentrations, building construction details, indoor air exchange volumes/rates, and any nearby sub-grade features that could affect vapor distribution/migration will be qualitatively considered and presented in an updated site conceptual model. The site conceptual model will provide the framework for performing a vapor intrusion screening evaluation. As this soil vapor screening evaluation is being conducted as an expedited task that is part of a site-wide remedial investigation effort, the findings from this vapor intrusion screening evaluation will be summarized in an interim technical report. The report will present all validated data and the findings for the screening evaluation of the potential vapor pathway evaluation. The use of vapor intrusion modeling to further evaluate site specific factors will be considered and may be proposed. If appropriate after consideration of all the data collected as part of this screening evaluation, the purpose and scope of any modeling efforts will be defined and performed.

7.0 SCHEDULE

The project implementation schedule is provided in Figure 4 and has a total estimated projected duration of 18 weeks after USEPA's approval of the workplan. A contingency of 4 weeks has been incorporated into the schedule for the possibility that vapor intrusion modeling may be conducted to enable a more detailed site specific evaluation of the vapor intrusion exposure pathway but the actual scope of the vapor intrusion modeling efforts will be defined based on the findings of the initial screening evaluation/tasks that have been designed. The implementation schedule may be slightly refined, if necessary, once the scopes for any vapor modeling tasks are able to be better assessed. After all data is reviewed and interpreted, a draft technical report of the findings of this screening assessment will be provided by Harley-Davidson to EPA for their review.

FIGURE 1.

PROPOSED SOIL VAPOR SAMPLING AREAS OF INVESTIGATION,

Harley Davidson Motor Company, York, PA Facility

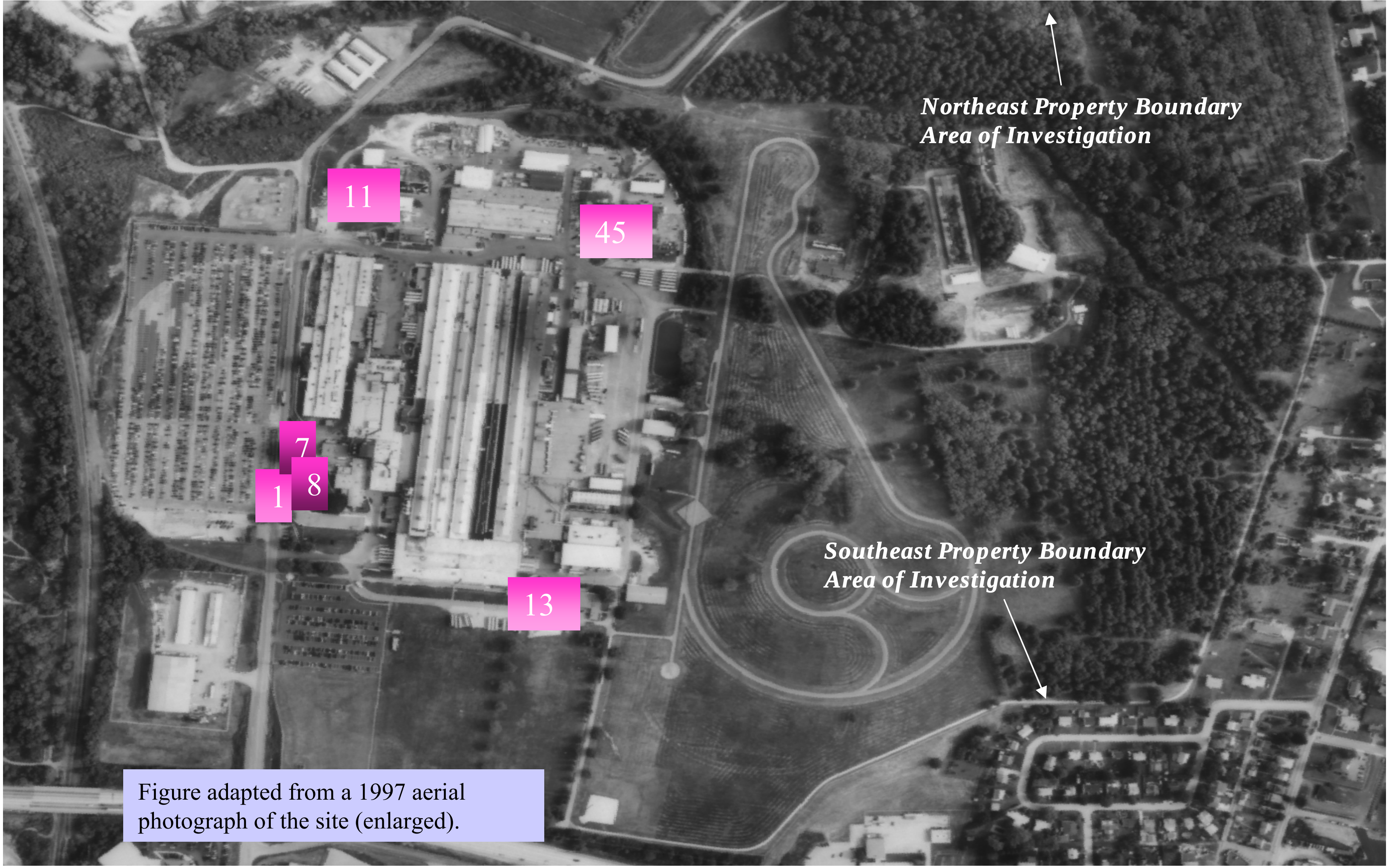


Figure adapted from a 1997 aerial photograph of the site (enlarged).

FIGURE 2.

PROPOSED SOIL VAPOR SAMPLING – SOUTHEAST PROPERTY BOUNDARY,

Harley Davidson Motor Company, York, PA Facility

LEGEND

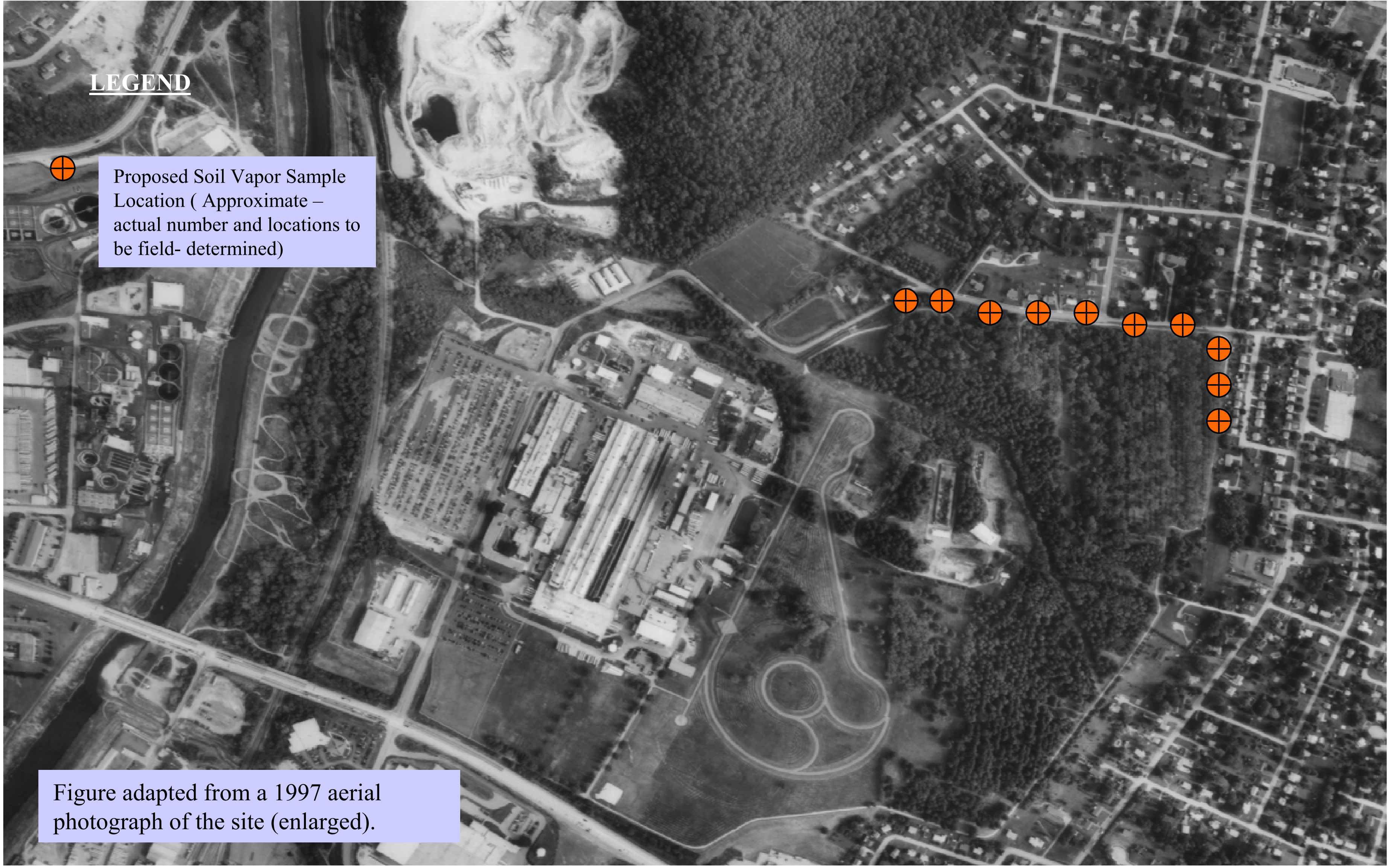
⊕ Proposed Soil Vapor Sample Location (Approximate – actual number And locations to be field-determined)

Figure adapted from a 1997 aerial photograph of the site (enlarged).

FIGURE 3.

PROPOSED SOIL VAPOR SAMPLING – NORTHEAST PROPERTY BOUNDARY,

Harley Davidson Motor Company, York, PA Facility



LEGEND

⊕ Proposed Soil Vapor Sample Location (Approximate – actual number and locations to be field- determined)

Figure adapted from a 1997 aerial photograph of the site (enlarged).

Figure 4
Indoor Vapor Screening Assessment Schedule
Harley-Davidson Motor Company Facility
York, Pennsylvania

Weeks from USEPA Approval of Final Vapor Pathway Assessment Workplan:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Preparation for Field Activities																				
Sample Location Layout/Utility Clearance	▨	▨																		
Drill Rig Mobilization - Geoprobe with MIP/EC			▨	▨																
Drill Rig Re-Mobilization - Geoprobe w/ Summa canisters					▨	▨														
Soil Vapor Sampling/Analysis																				
Sample Collection			▨	▨	▨	▨														
Laboratory Analysis of Soil Samples					▨	▨	▨	▨	▨	▨	▨									
Site Conceptual Model/Exposure Pathway Assessment																				
Data Validation								▨	▨	▨	▨	▨	▨							
Data Evaluation/Interpretation and Pathway Assessment										▨	▨	▨	▨	▨	▨	▨	▨	▨		
Vapor Pathway Modeling (Contingency)													▨	▨	▨	▨				
Reports																				
Draft Technical Report									▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		

Notes/Assumptions:
-Schedule assumes standard laboratory turnaround time (TAT) for data availability (3 to 4 weeks).

APPENDIX A

Geoprobe Membrane Interface Probe

Standard Operating Procedure

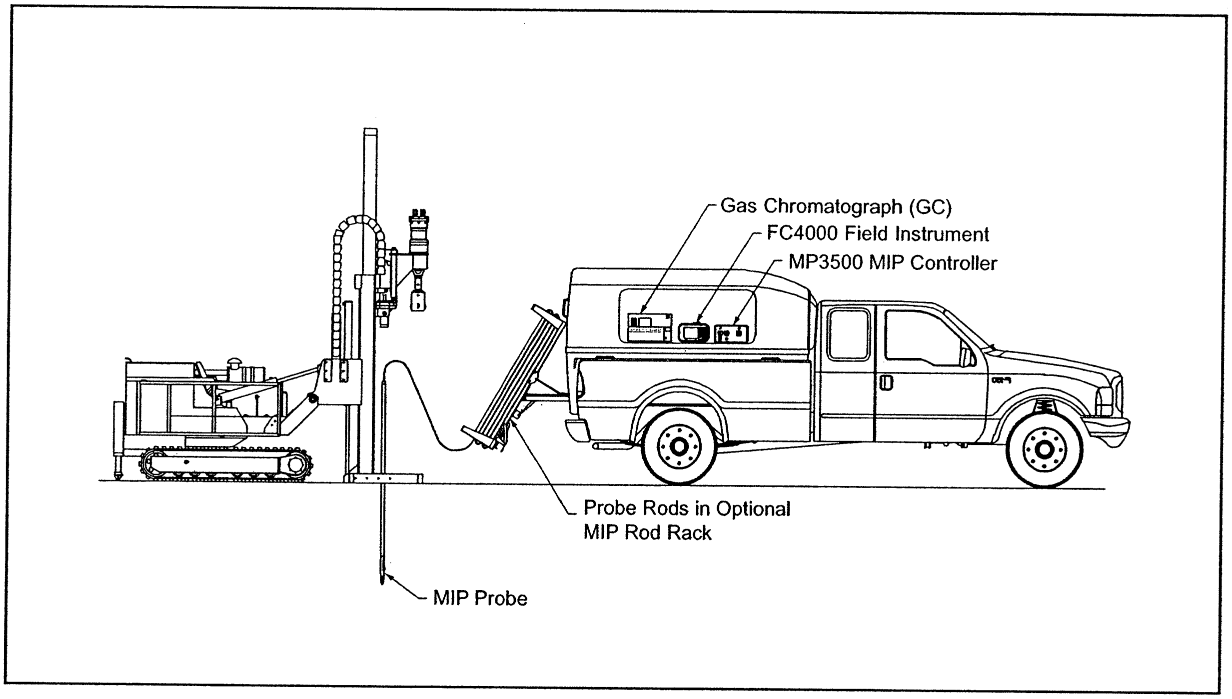
May 2003

GEOPROBE® MEMBRANE INTERFACE PROBE (MIP)

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3010

PREPARED: May, 2003



THE MIP SYSTEM MAY BE DEDICATED TO A SINGLE CARRIER VEHICLE FOR USE IN TANDEM WITH MULTIPLE GEOPROBE® DIRECT PUSH MACHINE MODELS

Geoprobe Systems®

A DIVISION OF KEJR, INC.

Geoprobe Systems®

**Geoprobe® and Geoprobe Systems®, Macro-Core® and Direct Image®
are Registered Trademarks of Kejr, Inc., Salina, Kansas**

1.0 OBJECTIVE

This document serves as the standard operating procedure for use of the Geoprobe Systems® Membrane Interface Probe (MIP) to detect volatile organic compounds (VOCs) at depth in the subsurface.

2.0 BACKGROUND

2.1 Definitions

Geoprobe®: A brand name of high quality, hydraulically-powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and testing, soil conductivity and contaminant logging, grouting, and materials injection.
**Geoprobe® is a registered trademark of Kejr, Inc., Salina, Kansas.*

Membrane Interface Probe (MIP): A system manufactured by Geoprobe Systems® for the detection and measurement of volatile organic compounds (VOCs) in the subsurface. A heated probe carrying a permeable membrane is advanced to depth in the soil. VOCs in the subsurface cross the membrane, enter into a carrier gas stream, and are swept to gas phase detectors at ground surface for measurement.

2.2 Discussion

The MIP is an interface between contaminates in the soil and the detectors at ground surface. It is a screening tool used to find the depth at which the contamination is located, but is not used to determine concentration of the compound. Two advantages of using the MIP are that it detects contamination in situ and can be used in all types of soil conditions.

Refer to Figure 2.1. The MIP is a logging tool used to make continuous measurements of VOCs in soil. Volatile compounds outside the probe diffuse across a membrane and are swept from the probe to a gas phase detector at ground surface. A log is made of detector response with probe depth. In order to speed diffusion, the probe membrane is heated to approximately 100° C (212° F).

Along with the detection of VOCs in the soil, the MIP also measures the electrical conductivity of the soil to give a probable lithology of the subsurface. This is accomplished by using a dipole measurement arrangement at the end of the MIP probe so that both conductivity and detector readings may be taken simultaneously. A simultaneous log of soil conductivity is recorded with the detector response.

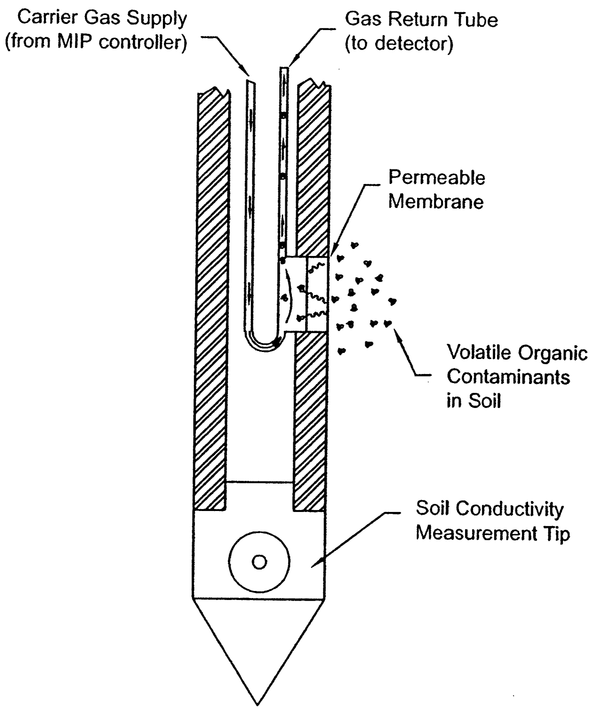


Figure 2.1
Schematic drawing of the MIP probe

3.0 Tools and Equipment

The following equipment is needed to perform and record an MIP log. Basic MIP system components are listed in this section and illustrated in Figure 3.1. Refer also to Appendix I for more required tools as determined by your specific model of Geoprobe® direct push machine.

3.1 Basic MIP System Components

Description	**Quantity**	**Part Number**
Field Instrument	(1)	FC4000
MIP Controller	(1)	MP3500
MIP/EC Acquisition Software	(1)	MP3517
MIP Probe	(1)	MP4510
Replacement Membrane	(1)	MP3512
Membrane Wrench	(1)	16172
LB Sample Tube	(1)	AT6621
Stringpot (linear position transducer)	(1)	SC160
Stringpot Cordset	(1)	SC161
MIP O-ring and Service Kit	(1)	MP2515
MIP Trunkline, 100-ft (30 m) length	(1)	MP2550
Extension Cord, 25-ft (8 m) length	(1)	SC153
Needle Valve	(1)	13700
24-in. Nafion Dryer Tube	(1)	12457

3.2 Anchoring Equipment

Description	**Quantity**	**Part Number**
Soil Anchor, 4.0-in. OD flight	(3)	10245
Anchor Foot Bridge	(1)	10824
Anchor Plate	(3)	10167
GH60 Hex Adapter (if applicable)	(1)	10809
Chain Vise	(3)	10075

3.3 Optional Accessories

Description	**Quantity**	**Part Number**
MIP Trunkline, 150-ft (46 m) length	(1)	13999
MIP Trunkline, 200-ft (61 m) length	(1)	15698
FID Compressed Air System	(1)	AT1004
Hydrogen Gas Regulator	(1)	10344
Nitrogen Gas Regulator	(1)	13940
Cable Rod Rack, for 48-in. rods	(1)	18355
Rod Cart Assembly, for 1.25-in. OD rods	(1)	SC610
Rod Cart Hitch Rack, for SC610	(1)	SC650K
Rod Cart Carrier, for SC610	(1)	SC675
Rod Wiper, for 5400 Series foot	(1)	AT1255
Rod Wiper, for 66 Series foot	(1)	18181
Rod Grip Pull Handle, for GH40 hammer	(1)	GH1255
Rod Grip Pull Handle, for GH60 hammer	(1)	9641
Water Transport System	(1)	19011

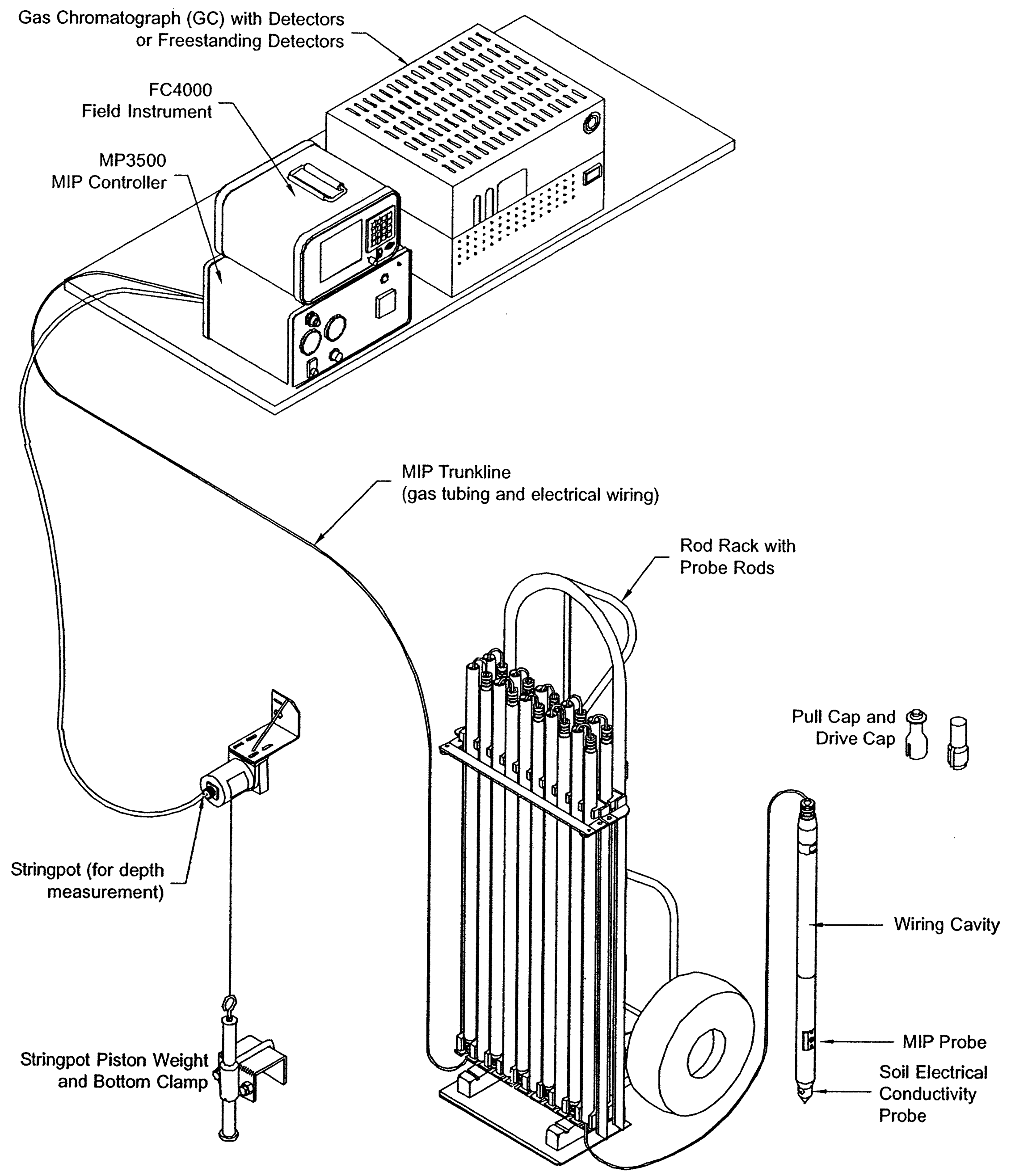


Figure 3.1
MIP system components

4.0: Quality Control - Response Testing

Response testing is an important quality control measure used to validate each log by proving that the integrity of the system is intact. Without running a response test, the operator will not know if the system is detecting the correct compounds or even if the system is working.

4.1 Preparation for Response Testing

Response testing is a necessary part of the MIP logging process because it ensures that the entire system is working correctly and also enables the operator to measure the trip time. Trip time is the time it takes for the contaminant to go from the probe, through the trunk line, and to the detectors. This time will need to be entered into the MIP software for depth calculations as described later in this document.

The following items are required to perform response testing:

- Neat sample of the analyte of interest (i.e.: benzene, TCE, PCE, etc.) purchased from chemical vendor
- Microliter syringes
- 25- or 50-mL Graduated cylinder
- Several 40-mL VOC vials with labels
- Testing cylinder made from a nominal 2-in. PVC pipe with a length of 24 in.
- 0.5 L plastic beaker or pitcher
- 25 mL Methanol
- Supply of fresh water, 0.5 L needed per test
- 5-gallon bucket filled with fine sand and water
- Stopwatch

Preparation of the stock standard is critical to the final outcome of the concentration to be placed into the testing cylinder.

1. Pour methanol into graduated cylinder to the 25 mL mark.

2. Pour 25 mL of methanol from graduated cylinder into 40-mL VOC vial.

3. Mix appropriate volume of desired neat analyte into 40-mL VOC vial containing 25 mL of methanol. The required volume of neat analyte for five common compounds is listed in Column 3 of Table 4.1. Use the equation at the then of this section to calculate the appropriate neat analyte volume for other compounds of interest.

4. Label the vial with name of standard (i.e. TCE, PCE, Benzene), concentration (50 mg/mL), date created, and created by (your name). This is the Stock Standard.

The equation used for making a stock standard is shown on the following page.

Table 4.1
Density and required volumes of neat compounds used to make a 50 mg/mL working standard into 25 ml of methanol

Compound	Density (mg/uL)	Volume of Neat Analyte Required to Prepare a Working Standard (uL)
Benzene	0.8765	1426
Toluene	0.8669	1442
Carbon Tetrachloride	1.594	784
PCE	1.6227	770
TCE	1.4642	854

25 mL (methanol) x 50 mg/mL = 1250 mg
1250 mg x 1/density of analyte = amount of neat material to be placed into 25 mL of Methanol

Example: Preparation of 50 mg/mL Benzene standard.
1250 mg x 1/0.8765 mg/uL = 1426 uL
Use 1426 uL of neat Benzene in 25 mL of Methanol to get a 50 mg/mL standard.

4.2 Response Test Procedure

With the standard prepared, the operator is ready to test the response of the probe as described below.

1. Immerse the probe into the 5-gallon bucket of fine sand and water to stabilize the baseline. This is necessary due to the sensitivity of the photoionization detector (PID) and the electron capture detector (ECD) to water.
2. Access the MIP Time software and view the detector vs. time data. The detector signals should be stable before proceeding.
3. Obtain 500 mL of water (either tap water or distilled) in a suitable measuring container.

Table 4.2
Volume of 50 mg/mL working standard and final concentration in 0.5 L test sample volume

Volume of 50 mg/mL Standard	Final Concentration of 0.5 L Sample (mg/L or ppm)
1000 uL	100
100 uL	10
10 uL	1

4. Use a standard volume specified in Table 4.2 to mix the desired test concentration. This is the Working Standard.
5. Pour the working standard into a nominal 2-inch x 24-inch PVC pipe and immediately insert the MIP into the solution (Fig. 4.1). Leave the probe in the test solution for 45 seconds. At the end of 45 seconds, place the probe back in the 5-gallon bucket of sand and water.
6. From the results on the MIP Time software the trip time and response time can both be measured (Fig. 4.2).

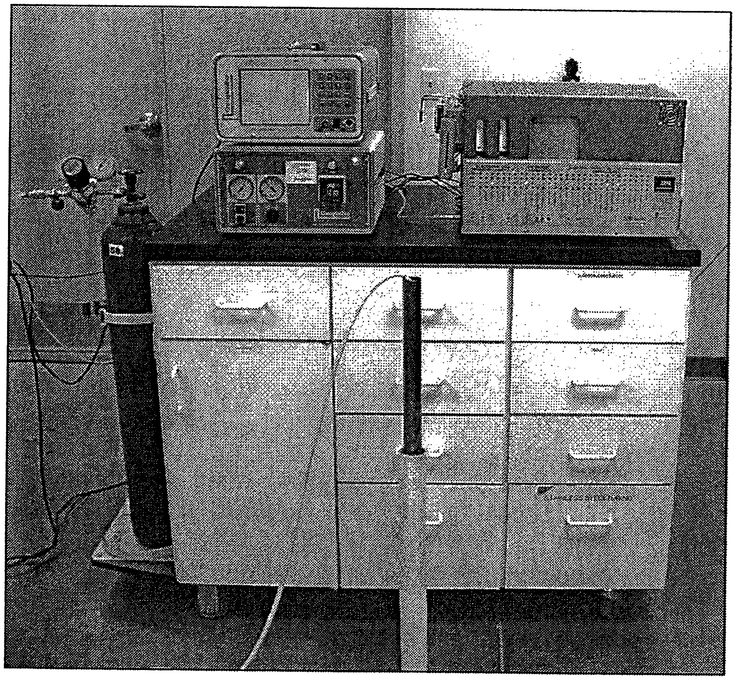


Figure 4.1
The MIP probe is placed in a PVC pipe containing the standard solution.

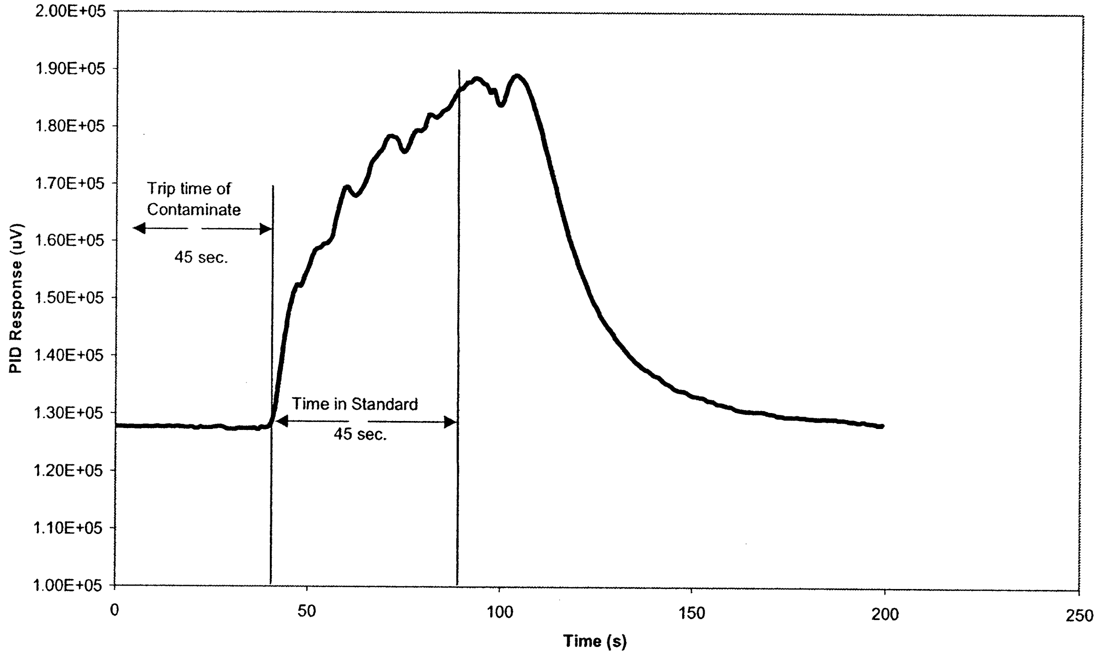


Figure 4.2
SRI PID Response Test - 10 ppm Benzene

5.0 Field Operation

1. Power on the generator.

2. Turn on any gases that will be used for the MIP system (i.e. nitrogen carrier gas, hydrogen for the FID, etc.). Check the flow rate of the system and psi on the mass flow controller. Compare these numbers to previous work.

3. Power on the detector or detectors and allow to warm up to set temperature (approximately 30 minutes).

4. Power on the MP2500 or MP3500 MIP Controller.

5. Power on the computer or the FC4000 Field Instrument.

6. Advance a pre-probe 3 to 4 feet into the subsurface at the location to be logged.

7. Remove the pre-probe and raise the probe foot of the direct push machine.

8. If advancing the MIP with percussion, raise the probe foot enough to slide the rod wiper plate underneath.

9. If pushing only, turn the desired amount of anchors into the subsurface and return the probe foot to the position from which the pre-probe was advanced. Leave the probe foot raised sufficiently to allow sliding the rod wiper underneath.

10. Place the rod wiper plate under the foot such that the opening is directly over the pre-probed hole. Lower the foot firmly onto the rod wiper.

11. If pushing only, position the anchoring bridge over the foot of the machine such that the anchors extend through the holes in the bridge (fig. 5.1). Install a chain vise at each anchor to secure the bridge.

12. With the software loaded, run a response test (Section 4.0) and record the height of the peak response and the trip time into a field notebook. Refer to Figure 4.2.

13. If the trip time is different than what was placed into the software, restart the software and enter the correct trip time.

14. Attach a slotted drive cap to the MIP drive head.

15. Insert the MIP point into rod wiper opening and drive it into the soil until the membrane of the probe is at ground level.

16. Connect the stringpot cable to the stringpot weight located on the probe foot and pull keeper pin so the weight drops to the ground.

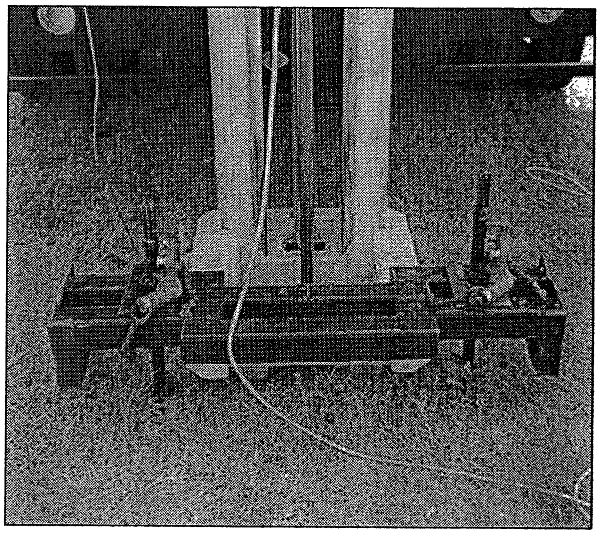


Figure 5.1
Anchor the probe foot to allow advancement of MIP probe by push only (no percussion).

NOTE: **Do not allow the stringpot cable to retract into the stringpot housing at a high rate. This will ultimately damage the stringpot.**

17. Record the system parameters in a field notebook at this time (i.e.. mass flow, trip time).

NOTE: **If the mass flow reading drops or rises more than one psi, turn off the flow at the primary controller and remove the probe from the ground. If the temperature monitor quits heating or gives an error, remove the probe from the ground.**

18. Place the trigger switch in the "ON" position.

19. Advance the probe at a rate of 1 ft/min to the predetermined log depth or until refusal is attained.

NOTE: **Refusal is attained when it takes longer than 1.5 minutes of continuous hammering to advance the probe one foot. This is the maximum time to reach one foot of probe travel.**

20. When the MIP log is complete, turn the trigger off and slowly return the stringpot cable into the stringpot housing.

21. Pull the probe rod string using either the Geoprobe® rod grip pull system or a slotted pull cap.

22. When the MIP reaches the surface, clean the face with water and run a response test. This response test should be written down in the field notes and compared to the initial test. This system check ensures the data for that log is valid.

23. Save the data to a 3.5-inch floppy disk and exit the MIP software.

24. Data from the MIP can now be graphed with Direct Image® MIP Display Log or imported into any spreadsheet for graphing.

6.0 Replacing a Membrane on the MIP Probe

A probe membrane is considered in good working condition as long as two requirements are met: 1) The butane sanity test result is greater than 1.0E+06 uV response, 2) Flow of the system has not varied more than 3 mL/min from the original flow of the system (a flow meter or bubble flow meter should be kept with the system at all times). If either one of these requirements are not met, a new face must be installed as follows.

1. Turn the heater off and allow the block to cool to less than 50° C on the control panel readout.

2. Clean the entire heating block with water and a clean rag to remove any debris.

3. Dry the block completely before proceeding.

4. Remove the membrane using the membrane wrench (Fig. 6.1). Keep the wrench parallel to the probe while removing the membrane to ensure proper engagement with socket head cap screw.

NOTE: **Do <u>Not</u> leave the membrane cavity open for extended periods. Debris can become lodged in the gas openings in the plug.**

5. Remove and discard the copper washer as shown in Figure 6.2. Each new membrane is accompanied by a new copper washer. **Do not reuse the copper washer.**

6. Inspect the open cavity for any foreign objects. Remove any objects present and clean the inside of cavity of any soil that was deposited on the wall of the block.

7. Insert the new copper washer around the brass plug making sure that it sits flat on the surface of the block.

8. Install the new membrane by threading it into the socket. Use the membrane wrench to tighten the membrane to a snug fit. Do not overtighten.

9. Turn the gas on and leave the heater off. Apply water to the membrane and surrounding area to check for leaks. If a leak is detected (bubbles are formed in the water), use the membrane wrench to further tighten the membrane.

10. Use a flow meter/bubble flow meter to check flow to the detectors. Record this value in a field notebook.

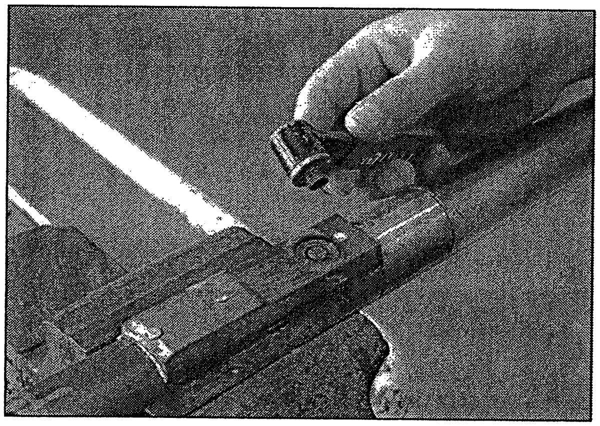


Figure 6.1
Unthread the membrane from the probe block.

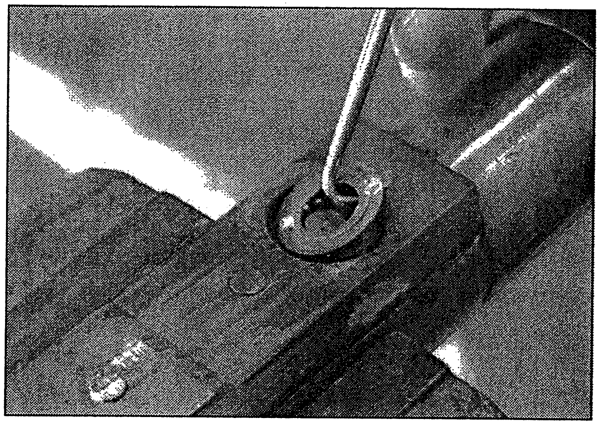


Figure 6.2
Remove and discard the copper washer.

Appendix I: Tools for Various Direct Push Machines

Model 5400 and 54DT Direct Push Machines

Description	*Part Number*
Stringpot Mounting Bracket	SC110
Stringpot Bottom Clamp	SC111
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.25-in. rods	AT1202
Slotted Pull Cap, for 1.25-in. rods	AT1203
MIP Drive Adapter, for 1.25-in. rods	MP2512
MIP Drive Head	GW1516
Probe Rod, 1.25-in. x 48-in.	AT1248

Model 54LT Direct Push Machine

Description	*Part Number*
Stringpot Mounting Bracket	11433
Stringpot Bottom Clamp	SC111
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.25-in. rods	AT1202
Slotted Pull Cap, for 1.25-in. rods	AT1203
MIP Drive Adapter, for 1.25-in. rods	MP2512
MIP Drive Head	GW1516
Probe Rod, 1.25-in. x 48-in.	AT1248

Model 5410 Direct Push Machine

Description	*Part Number*
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.25-in. rods	AT1202
Slotted Pull Cap, for 1.25-in. rods	AT1203
MIP Drive Adapter, for 1.25-in. rods	MP2512
MIP Drive Head	GW1516
Probe Rod, 1.25-in. x 48-in.	AT1248

Model 6600, 66DT and 6610DT Direct Push Machines

Description	*Part Number*
Stringpot Mounting Bracket	16971
Stringpot Bottom Clamp	11751
Stringpot Piston Weight	SC112
Slotted Drive Cap, for 1.5-in. rods	15607
Slotted Pull Cap, for 1.5-in. rods	15164
Drive Cap Adapter, for GH60 and 1.25-in. rods	15498
MIP Drive Adapter, for 1.5-in. rods	18563
MIP Friction Reducer	18564
Probe Rod, 1.5-in. x 48-in.	13359

Geoprobe Systems®

A DIVISION OF KEJR, INC.

-Corporate Offices-
601 N. Broadway • Salina, KS 67401
1-800-436-7762 • Fax 785-825-2097
www.geoprobe.com

APPENDIX B

Soil Vapor Sampling Protocol Using Summa Canisters

Geoprobe Sampling Apparatus

To collect the soil gas samples, a Geoprobe will be used to advance connected 4-foot sections of narrow diameter threaded steel casing down to the sampling depth. Once at depth, the casing will be hydraulically raised several inches in order to release a disposable drive point and open the bottom of the casing. Prior to the collection of the soil vapor samples, the entire sampling system will be purged with ambient air. Polyethylene tubing with a threaded stainless steel tip (PRT adaptor) and "O" ring will be lowered through the casing to the bottom of the hole and threaded into the PRT/expendable point holder to isolate the void space from annular space within the rods.

Summa Canister Sample Collection

The tubing will be connected to the valve on the Summa™ Canister. The 6-liter Summa™ Canister, with a field verified initial vacuum of at least 28 inches of mercury will be filled at a rate not to exceed 0.2 liters per minute (l/m). A lab certified flow controller will be used to control the rate of airflow into the canister. The Summa™ Canister will be placed as close to the borehole as possible and the intake valve will be opened to draw in air by the vacuum in the canister until the pressure gauge indicates there is an adequate sample volume (i.e., 5-inches of mercury remaining [the final pressure will range between 4 to 8 inches of mercury]).

The sample probing tools will be decontaminated before and after use at each location. New lengths of polyethylene tubing will be used for each sample collected.