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PHASE I WORK PLAN FOR INDOOR AIR SAMPLING AND MITIGATION

DELPHI VOC PLUME SITE

DELPHI AUTOMOTIVE HOLDINGS GROUP
HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

U.S. EPA ID # OHD000817023

by

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Submitted to

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TABLE OF CONTENTS Page

1.0 BACKGROUND 1

1.1 Introduction 1
1.2 Site History 1
1.3 Approach 2

2.0 SITE MOBILIZATION 4

2.1 Site Safety 4
2.2 Pre-Investigation Meetings 4

3.0 SAMPLING ACTIVITIES 5

3.1 Access for Quarterly Indoor Air Sampling 6
3.2 Sub-Slab Soil Vapor Sampling 7
3.3 Indoor Air Sampling 8
3.4 Background Ambient Air Sampling 9
3.5 Sample Analysis 9
3.6 Quality Assurance Project Plan 10
3.7 Indoor Air Sampling Reporting 10

4.0 DATA EVALUATION 11

4.1 Evaluation of Indoor Air and Sub-Slab Data 11

5.0 MITIGATION 13

5.1 Access for Mitigation 13
5.2 System Description 14
5.3 System Installation 14
5.4 Operation and Maintenance 14
5.5 Mitigation Monitoring 15
5.6 Completion of Mitigation Program 16
5.7 Mitigation Monitoring Reporting 16

6.0 DATA MANAGEMENT 17

7.0 PROJECT MANAGEMENT 18

7.1 Responsibilities and Functions 18
7.2 Indoor Air Sampling and Mitigation Summary Report 18
7.3 Progress Meetings 18
7.4 Schedule 19

TABLES
FIGURES

APPENDIX A	**Administrative Order on Consent**
APPENDIX B	***Vapor Intrusion Study Approach, Delphi Home Avenue Facility* (ENVIRON, August 2005, Revised March 2007)**
APPENDIX C	**Ohio Department of Health Letter (June 4, 2007)**
APPENDIX D	**Health and Safety Plan (HASP)**
APPENDIX E	**Standard Operating Procedures for Construction and Installation of Permanent Sub-slab Soil Gas Wells**
APPENDIX F	**Standard Operating Procedure (SOP) – Indoor/Outdoor Ambient Air Sampling**
APPENDIX G	**Indoor Air Assessment Questionnaire and Building Inventory for Residential Structures**
APPENDIX H	**Examples of Community Outreach Documents and Access Agreement Forms**
APPENDIX I	**Quality Assurance Project Plan (QAPP)**
APPENDIX J	**Example of Data Management Spreadsheet**

LIST OF TABLES

Table No.	Title
1	Property Addresses and Course of Action

LIST OF FIGURES

Figure No.	Title
1	Project Locus
2	Phase I Study Area and Course of Action
3	Schematic of Sub-Slab Depressurization System
4	Project Management Organizational Chart

1.0 BACKGROUND

1.1 Introduction

This Work Plan provides the scope of activities for Phase I indoor air sampling and mitigation being conducted as part of Delphi Corporation's ongoing environmental investigation activities at the Delphi Automotive Holdings Group Home Avenue Operations (the "Facility") located at 2701 Home Avenue in Dayton, Montgomery County, Ohio (Figure 1).

This Phase I Work Plan has been developed to address volatile organic compounds (VOCs) detected in soil vapor in the vicinity of Delphi's Home Avenue Facility and is one step among many that Delphi has voluntarily undertaken to investigate, remediate and monitor VOCs in the subsurface beneath the Facility and in neighboring areas.

The Phase I work described herein is being performed pursuant to an Administrative Order on Consent between U.S. EPA and Delphi Corporation (Appendix A).

To date, Delphi has investigated and characterized subsurface conditions beneath its property and in the surrounding area. Samples of soil, groundwater and soil vapor have been analyzed to determine where VOCs are present and at what levels.

Data collected during Delphi's voluntary, ongoing environmental investigations have been used to define apparent source areas and to develop the appropriate strategies to remediate VOC impacts. Delphi has installed and currently operates a Soil Vapor Extraction (SVE) system in proximity to those apparent source areas at the Home Avenue Facility to remove VOCs from the subsurface. The system has been operating since March 2006 and its performance is routinely monitored.

As Delphi has become aware of the potential for migration of VOCs in soil vapor offsite, it has expanded its investigations into the surrounding area.

1.2 Site History

The Facility is located in a mixed industrial, residential and commercial area in southwest Dayton. The Facility was developed by General Motors Corporation (GM) in 1918 and has continuously operated as an automobile parts manufacturing, shipping and warehouse facility to the present. In January 1999, Delphi Automotive Systems separated from GM to form a new company. Later the company was renamed Delphi Corporation, with the Facility operating under the Delphi Energy & Chassis (E&C) Systems Division. The Facility currently operates under the Delphi Automotive Holdings Group (DAHG) of Delphi Corporation.

Delphi has performed investigations at its Home Avenue Facility and in right-of-ways in neighboring residential areas. The investigations were conducted in five phases between February 2005 and May 2007 and included installation of thirty-five (35) permanent soil vapor monitoring points, forty (40) temporary soil vapor monitoring points, sixty-five (65) soil borings and ten (10) monitoring wells. These investigations also included collection of sixteen (16) indoor air samples, fourteen (14) outdoor air samples, fifteen (15) sub-slab air samples and fifteen (15) near slab air samples. A total of one hundred sixty-eight (168) soil vapor samples, one hundred seventy-two (172) soil samples, thirty (30) ambient air samples and thirty-five (35) groundwater samples (11 from wells and 24 from soil borings) were collected during the

investigations and analyzed for VOCs. A summary of the environmental investigation data was provided to the U.S. EPA in June 2007.

1.3 Approach

The results of both onsite (the Facility property) and offsite (in the vicinity of the Facility) soil vapor investigations conducted to date for the Delphi Home Avenue Facility indicate that tetrachloroethene (PCE), trichloroethene (TCE) and chloroform are present in soil vapor at the Facility and offsite in the vicinity of the Facility. These constituents are referred to herein as the constituents of concern.

Delphi compared the analytical results of the soil vapor samples collected from the offsite sampling locations to conservative residential screening criteria to determine if conditions exist that warrant further investigation of the potential for significant exposures via vapor intrusion. Additional information on the development of the conservative residential screening criteria used in that evaluation is presented in the document, *Vapor Intrusion Study Approach Delphi Home Avenue Facility* (ENVIRON, August 2005, revised March 2007), attached as Appendix B, which had been initially reviewed with the Ohio EPA in support of Delphi's environmental investigation planning in June 2005.

The analytical results for the offsite soil vapor samples were compared to screening criteria for two hypothetical residential risk scenarios: Residential, assuming concrete floor basement construction, and the more conservative risk scenario: Residential, assuming dirt floor basement construction. These hypothetical risk scenarios are described in more detail in the ENVIRON document (Appendix B). This data evaluation formed the basis for the scope of an indoor air investigation undertaken voluntarily by Delphi.

Delphi's voluntary indoor air investigation targeted nineteen (19) structures in the vicinity of the area exceeding the dirt floor hypothetical residential risk scenario. Five of the structures were determined to be uninhabitable (i.e. vacant, abandoned or condemned). Delphi received permission from property owners to sample ten (10) of the fourteen (14) habitable structures. Table 1 includes a list of the nineteen addresses in the study area and their occupancy status at the time of the investigation. Figure 2 illustrates the proximity of those structures relative to the Facility.

Delphi's indoor air investigation was conducted from April 2007 to May 2007, and was performed in accordance with *Soil Vapor Intrusion Investigation Work Plan, Delphi Automotive Holdings Group Home Avenue Facility* (Haley & Aldrich, Inc., April 2007). Prior to beginning that indoor air investigation, Delphi met with Ohio EPA in February and March 2007 and with the Southwest Priority Board and City of Dayton in March 2007 to discuss the anticipated scope of the investigation.

Samples collected during the indoor air investigation were submitted to Columbia Analytical Services, Inc., a National Environmental Laboratory Accreditation Conference (NELAC) accredited laboratory, for analysis of VOCs by U.S. EPA Test Method TO-15. The analytical results for samples collected during the April/May 2007 sampling events have been presented to the respective property owners and have been provided to the Ohio Department of Health and the U.S. EPA.

In early May 2007, Delphi met with representatives of the U.S. EPA, the Ohio EPA, the City of Dayton, the Ohio Department of Health, and Public Health – Dayton & Montgomery County (PHDMC) (formerly Montgomery County Combined Health District) to discuss the results of Delphi's indoor air investigation, and the U.S. EPA's progress in completing its independent soil vapor investigations, being conducted in generally the same area as the Delphi investigation.

In a June 4, 2007 letter from the Ohio Department of Health (ODH) to the U.S. EPA, ODH provided their recommendations for health-based guidance numbers to be used in the evaluation of indoor air and sub-slab data collected in the vicinity of the Delphi Home Avenue site. These guidance numbers are considered by ODH and the Agency for Toxic Substances and Disease Registry (ATSDR) to be protective of public health, and establish for this project the screening levels for evaluation of TCE, PCE and chloroform in indoor air and soil vapor samples. The indoor air and sub-slab soil vapor screening levels established for this project are consistent with the screening levels established for U.S. EPA investigations performed at three other sites in Ohio. A copy of the ODH letter is provided in Appendix C of this Work Plan. The screening levels identified for TCE, PCE and chloroform in the ODH letter and presented in Section 4.0 of this Work Plan are herein referred to as the "ODH recommended screening levels" for indoor air and sub-slab soil vapor.

Based on the results of Delphi's indoor air investigation performed in April/May 2007 and the results of the U.S. EPA's independent investigations as presented to Delphi in July and August 2007, Delphi understands that it is necessary to conduct quarterly indoor air sampling at five (5) structures and mitigation at five (5) structures (Table 1). This conclusion was derived upon evaluating the investigation data against the ODH recommended screening criteria.

The approach for the additional indoor air sampling and the mitigation activities is documented in this Phase I Work Plan for Indoor Air Sampling and Mitigation. A Phase II Work Plan will be submitted to address sampling required beyond the scope of this Phase I Work Plan.

2.0 SITE MOBILIZATION

2.1 Site Safety

A Health and Safety Plan (HASP) has been developed for this project. The HASP establishes the procedures for protecting personnel and subcontractors during the sampling, monitoring and mitigation activities addressed in this Work Plan.

The HASP is based on the data collected at the Facility and the surrounding area. The HASP includes security procedures developed in collaboration with the Dayton Police Department and the Southwest Priority Board to assure the security and comfort of property owners, residents, personnel and subcontractors during sampling and mitigation activities.

The HASP will be updated, as necessary, as information is collected that warrants its revision. The HASP is included as Appendix D.

2.2 Pre-Investigation Meetings

Delphi has met with representatives of the U.S. EPA, the Ohio EPA, the Ohio Department of Health, Public Health – Dayton & Montgomery County, the City of Dayton, the Southwest Priority Board, and the Dayton Police Department to discuss Delphi's plans for the indoor air investigation, and to collaborate on development of communication and security strategies. Delphi has also met with the owners of properties included in the investigations, conducted in April/May 2007, to communicate the results of those sampling events. Delphi will continue to meet with these interested parties as this Phase I Work Plan is implemented.

3.0 SAMPLING ACTIVITIES

The scope of the indoor air sampling program included in this Work Plan consists of quarterly sampling at five (5) structures (Table 1). These are locations where the constituents of concern have been detected in sub-slab soil vapor samples at levels that exceed the respective sub-slab ODH recommended screening levels, while the results for the indoor air sample collected at that structure are below the respective indoor air ODH recommended screening level. ODH has recommended sub-slab screening levels as the respective indoor air screening level multiplied by ten (10).The indoor air and sub-slab soil vapor ODH recommended screening levels for the constituents of concern for this project are presented in Section 4.0 of this Work Plan.

For each quarterly sampling event performed at a structure, one soil vapor sample will be collected from immediately below the structure slab (i.e. sub-slab), and one indoor air sample will be collected from the basement or first floor living space of each structure.

Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g. framed drywall, masonry), one indoor air sample will be collected from each basement area. Additionally, as part of this sampling program, outdoor ambient air background samples will be collected upwind in the vicinity of the sampled structure. Standard Operating Procedures (SOPs) for collection of sub-slab soil vapor samples, indoor air samples and outdoor ambient air samples are included as Appendices E and F of this Work Plan.

Upon the U.S. EPA's approval of this Phase I Work Plan, a schedule of quarterly sampling will be established for each of the structures included in the quarterly sampling program. The sampling events performed by Delphi at the structures in April/May 2007 constitute the first round of this sampling for these locations. It is anticipated that the next round of quarterly sampling will commence in November 2007 and will be complete when four consecutive quarterly rounds of indoor air results are below the indoor air ODH recommended screening levels.

Should an indoor air sample result in the detection of any of the constituents of concern at a level that exceeds the respective indoor air ODH recommended screening level, and the evaluation of that data indicates that vapor intrusion, rather than ambient air or indoor sources, is the sole or predominant source of exceedance, mitigation measures will be employed as described in Section 5.0.

During the quarterly sampling events, Delphi will document any changes to the structure that have occurred since the initial sampling event performed at that address. Additionally, Delphi will document any household products observed in the vicinity of the areas sampled. This information will be compared with the questionnaire completed during the initial sampling events performed at that structure. An example of the questionnaire is provided as Appendix G.

Structures to be sampled in this phase of the sampling program excludes buildings which have been determined to be uninhabitable (e.g., condemned, windows and doors boarded, dilapidated condition) at the time of the sampling event. The occupancy status of the structure will be evaluated and verified with the City of Dayton each quarter during this sampling program.

The scope of the indoor air sampling program covered by this Work Plan includes:

- Collection and analysis of soil vapor from beneath the slab of the basement floor, or from beneath the slab of the first floor if no basement is present (sub-slab samples);
- Collection and analysis of indoor air samples collected in the basement or first floor of living space if no basement is present;
- Collection of outdoor, ambient air samples upwind from the structure area; and
- Collection of information pertaining to the construction of the structures and any household products located in proximity to the indoor air sampling point.

Specific guidance utilized in the preparation of this Work Plan was provided by the U.S. EPA, Office of Solid Waste and Emergency Response, *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) EPA 530-D-02-004 (November 2002)*. An additional resource for creating this Work Plan was *Generic Work Plan Outline and Site Safety Plan for Potentially Responsible Parties (PRPs)* (Ecology and Environment, Inc. Technical Assistance Team June 1992), provided to Delphi by the U.S. EPA.

Samples collected during this phase of the sampling program will be submitted to Columbia Analytical Services for analysis of VOCs by EPA Test Method T0-15. Evaluation of soil vapor and air sampling data collected during this phase of the sampling program will be conducted following the approach described in Section 4.0 of this Work Plan.

3.1 Access for Quarterly Indoor Air Sampling

Delphi has developed and implemented multi-faceted community outreach strategies to keep stakeholders informed of the activities associated with its ongoing environmental investigations. These strategies have included written correspondence with residents and property owners, phone calls, face-to-face meetings with property owners and other stakeholders, and distribution of Ohio Department of Health Fact Sheets. Additionally, Delphi has established a toll-free centralized information hotline (1-866-4DELPHI) to facilitate communication between Delphi and its stakeholders. This telephone number is included in all correspondence from Delphi.

Where sampling activities have been performed in areas owned by or in possession of someone other than Delphi Corporation, Delphi has exercised the following measures to gain authorization to access to the properties for purposes of sampling:

- General information concerning Delphi's intent to collect soil vapor and indoor air samples was mailed to residents and property owners within the vicinity of the structures selected for inclusion in the sampling program.
- A letter was mailed to each property owner (as identified in Montgomery County's publicly available property records) of the structures included in the sampling program. This "request to sample" letter explained the indoor air investigation program, how samples were going to be collected, and included Ohio Department of Health Fact Sheets for each of the three constituents of concern, as well as the Fact Sheet explaining routes of chemical exposure. The request to sample letter requested access to the property for the purpose of collecting air and soil vapor samples, and included an access agreement form to be signed by the property owners and returned to Delphi. A stamped, self-addressed envelope was provided with the letter. Delphi's toll-free hotline number was also provided as a means for property owners to initiate response.

- If no response or signed access agreement was received from a property owner within approximately one week of mailing the request to sample letter, and the property owner has a published telephone number, Delphi's public relations representative attempted to reach that individual by phone.
- In the event Delphi could not reach the party by telephone or no telephone number was published, Delphi sent a second letter requesting permission to collect samples at the property.
- A flyer was hung from the door at those addresses for which no response from the property owner was received.

All mailings were distributed through the United States Post Office standard delivery service.

Only those structures for which Delphi was granted written permission by the property owner to sample were sampled during the April/May 2007 investigation. Examples of the general information letter, Request to Sample letter, the door hanger flyer and the access agreement for that sampling event are presented in Appendix H.

Similar measures will be employed for communicating with property owners of structures identified for inclusion in the quarterly indoor air sampling program. Delphi will contact these property owners by phone and/or certified mail to obtain signed access agreements for participation in the quarterly sampling program. These similar measures will be considered "best efforts" as required by the AOC.

As with Delphi's previous investigations, only structures for which Delphi has been granted written permission by the property owner to sample will be included in the quarterly indoor air sampling program. The U.S. EPA will be informed of structures for which no response has been received from the property owner of record, or for which access is denied. This information will be included in the air sampling and mitigation program summary report.

3.2 Sub-Slab Soil Vapor Sampling

One temporary or permanent soil vapor sampling point will be installed beneath the basement slab or the first floor slab, if no basement is present, within the structure. If sub-slab sampling cannot be performed without causing significant disturbance (e.g., damaging carpet, or wood or ceramic floors) to the building, or the property owner refuses to allow sub-slab sampling, a soil vapor sampling point will not be installed beneath the slab.

The location of the sub-slab sampling point will be determined based upon building construction, foundation type and information concerning utilities. The sampling point will be installed through the slab to a depth of several inches into the sub-slab material. The sampling point will be appropriately sealed to prevent the infiltration of indoor air. The sub-slab soil vapor sample will be collected using a batch certified 6-Liter SUMMA® canister equipped with an integrated flow controller over a 24-hour period. The SOP for installation of the sub-slab soil vapor points for this project has been provided by the U.S. EPA and is included as Appendix E of this Work Plan.

The SUMMA® canisters and flow controllers used to collect the sub-slab soil vapor samples will be obtained from Columbia Analytical Services. The SUMMA® canisters will be monitored to confirm that the sample remains intact during transit to the laboratory. Canister

vacuum will be recorded on a chain of custody (COC) form before shipping to the analytical laboratory and upon arrival at the laboratory to verify sample integrity.

The sub-slab soil vapor samples will be shipped at ambient temperature under the COC to Columbia Analytical Services for analysis of VOCs using EPA Method TO-15. Laboratory quality control samples will include method blank and laboratory control sample (LCS) analyses. The laboratory SOP for the analysis of VOCs by U.S. EPA Method TO-15 is included as an attachment to the Quality Assurance Project Plan (QAPP) (Appendix I).

3.3 Indoor Air Sampling

One indoor air sample will be collected from the basement of each structure or from the first floor living space if no basement is present, or where a sub-slab sample cannot be collected due to constraints described in Section 3.2 of this Work Plan. Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g., framed drywall, masonry), an indoor air sample will be collected from each basement area. Location of the sampling point in each structure will be selected depending upon the construction and features of the building (e.g., dirt floors, sumps) and location of household products.

The indoor air sampling will be performed concurrently with sub-slab soil vapor sampling being conducted at that structure. The structure's heating and cooling systems will remain in their normal operating status (e.g., the occupant's normal settings) during the sampling event. Delphi will request of property owners and tenants that vents discharging to the area of indoor air sampling be closed approximately 24 hours prior to the sampling event and remain closed during the sampling period. The status of vent closure will be documented in field notes. Additionally, Delphi will encourage the structure's residents to restrict access to the area being sampled.

The SUMMA® canister used to collect the indoor air sample will be placed on a table, bench or similar structure, roughly 2 to 4 feet above floor level, to approximate the breathing zone with respect to assessing indoor air. The indoor air sample will be collected using a batch certified 6-Liter SUMMA® canister equipped with an integrated flow controller over a 24-hour period. The SOP for collection of indoor air samples is provided as Appendix F.

The SUMMA® canisters and flow controllers used to collect the indoor air samples will be obtained from Columbia Analytical Services. The SUMMA® canisters will be monitored to confirm that the sample remains intact during transit to the laboratory. Canister vacuum will be recorded on the COC before shipping to the analytical laboratory and upon arrival at the laboratory to verify sample integrity.

The sub-slab soil vapor samples will be shipped at ambient temperature under the COC to Columbia Analytical Services for analysis of VOCs using EPA Method TO-15. Laboratory quality control samples will include method blank and LCS analyses. The laboratory SOP for the analysis of VOCs by U.S. EPA Method TO-15 is included as an attachment to the QAPP (Appendix I).

A photoionization detector (PID) will be used to perform an indoor ambient air screening prior to the initiation of the indoor air sampling event. The PID will be used to identify potential

sources of VOCs within the structure and assist in the placing of the SUMMA® canister. Additionally, prior to the initiation of indoor air sampling activities, Delphi will document information relevant to identifying potential VOC sources from interior materials (e.g., construction materials, cleaning products) that may impact the sample analysis. This information will be compared to data collected during the previous sampling performed by Delphi at that location.

Although Delphi will have no control over activities conducted in the structure throughout the sampling duration, Delphi will attempt to select a sampling location away from any VOC sources inside the structure to mitigate analytical interference to the extent feasible.

3.4 Background Ambient Air Sampling

One outdoor ambient air background sample will be collected concurrently with the sub-slab soil vapor and indoor air sampling event at that structure. The outdoor ambient air sample will be collected upwind in the vicinity of the structure, based on prevailing wind directions, using a batch certified 6-Liter SUMMA® canister equipped with an integrated flow controller over a 24-hour period. Delphi will not have control over the sampling device during the duration of the 24-hour sampling period; therefore, Delphi will attempt to assure custody of the canisters by securing them with steel cables and padlocks. The SOP for collection of air samples is provided as Appendix F.

The SUMMA® canisters and flow controllers used to collect the outdoor ambient air samples will be obtained from Columbia Analytical Services. The SUMMA® canisters will be monitored to confirm that the sample remains intact during transit to the laboratory. Canister vacuum will be recorded on the COC before shipping to the analytical laboratory and upon arrival at the laboratory to verify sample integrity.

The sub-slab soil vapor samples will be shipped at ambient temperature under the COC to Columbia Analytical Services for analysis of VOCs using EPA Method TO-15. Laboratory quality control samples will include method blank and LCS analyses. The laboratory SOP for the analysis of VOCs by U.S. EPA Method TO-15 is included as an attachment to the QAPP (Appendix I).

3.5 Sample Analysis

Soil vapor samples will be analyzed by EPA Method TO-15 to achieve as possible the following method detection limits (MDLs) for each of the constituents of concern:

Chemical Name	Method Detection Limit (part per billion by volume of air)
TCE	0.18
PCE	0.15
Chloroform	0.20

Actual reporting limits may vary and could be higher based on the presence of VOCs within the structures associated with the activities over which Delphi has no control. Such conditions could require dilution of samples and corresponding elevated reporting limits for the target

VOC. If the final reporting limit achieved by the laboratory is greater than the screening level for a constituent of concern, re-sampling will be performed at the relevant structure.

3.6 Quality Assurance Project Plan

Quality control samples will be analyzed by the laboratory (e.g., method blanks, laboratory control samples), in accordance with the QAPP provided as Appendix I to this Work Plan.

3.7 Indoor Air Sampling Reporting

Data collected during the indoor air sampling activities will be reported within a timely manner to the U.S. EPA, ODH, PHDMC and the owner of the structure sampled.

4.0 DATA EVALUATION

The conservative indoor air and sub-slab soil vapor ODH recommended screening levels for this project are as follows:

Indoor Air and Sub-slab Soil Vapor ODH recommended Screening Levels for VOCs in Residential Structures[1] (parts per billion by volume)			
Chemical Name	ATSDR[2] Indoor Air Short-Term Action Level	Indoor Air Long-Term Screening Level[1]	Sub-Slab Soil Vapor Screening Level[1]
TCE	100	0.4	4
PCE	200	12	120
Chloroform	50	2.2	22
1. Established in correspondence from Ohio Department of Health (June 4, 2007) 2. ATSDR = Agency for Toxic Substances Disease Registry			

The following presents the data evaluation decision matrix for this project:

- Where indoor air results are below the indoor air ODH recommended screening levels, and sub-slab soil vapor results are above the soil vapor ODH recommended screening levels, the structure will be included in the quarterly sampling program described herein.
- Where indoor air results are above indoor air ODH recommended screening levels, and sub-slab soil vapor results are above sub-slab ODH recommended screening levels, mitigation is warranted.
- Where indoor air results are below indoor air ODH recommended screening levels, and sub-slab soil vapor results are below sub-slab ODH recommended screening levels, no further action is warranted.
- Where indoor air results are above indoor air ODH recommended screening levels, and sub-slab soil vapor results are below sub-slab soil vapor ODH recommended screening levels, it is presumed that a source other than soil vapor has contributed to the indoor air sample exceedance, and mitigation may not be warranted.

4.1 Evaluation of Indoor Air and Sub-Slab Data

As described in Section 3.0, the quarterly indoor air sampling program will generate indoor air data, sub-slab soil vapor data, and ambient background air data. After these data are generated by the analytical laboratory, Delphi and the U.S. EPA will evaluate the data to make decisions regarding the need for further action. In addition to comparison of the data with the established indoor air and sub-slab ODH recommended screening levels, the data evaluation will include the following:

- Comparison of soil vapor and indoor air data with ambient background concentrations;
- Comparison of indoor air data with sub-slab soil vapor data;
- Comparison of indoor air data with reasonably expected indoor air concentrations for other known or suspected in-home sources (e.g., trihalomethanes [THMs], including chloroform that can be a by-product of drinking water purification processes).

The conclusion that mitigation is warranted at a structure included in the quarterly sampling program presumes that the sampling data indicates that vapor intrusion, rather than ambient air or indoor sources, is the sole or predominant source of the VOCs detected above the ODH recommended screening levels in the indoor air sample.

The evaluation of the sub-slab data collected to date indicates the need to expand the Phase I sampling program to additional structures in the vicinity of the Home Avenue Facility. This work will be addressed in a subsequent Phase II work plan.

5.0 MITIGATION

Subject to the data evaluation and presumptions stated in Section 4.0 of this Work Plan, where TCE, PCE and/or chloroform are detected in indoor air samples at levels exceeding the ODH recommended indoor air screening levels, mitigation will be employed. To date, five (5) structures have been identified for mitigation. These locations are identified in Table 1 of this Work Plan.

Mitigation could include installation of a sub-slab depressurization (SSD) system to reduce the levels of the VOCs present in indoor air. If building construction or conditions do not allow for installation of an SSD system, alternative mitigation strategies, such as impermeable membranes and/or indoor air treatment, may be considered.

The objective of an SSD system or alternative mitigation strategy is to reduce vapor concentrations in indoor air. Mitigation systems will be installed only in those buildings where the constituents of concern are detected at levels exceeding the ODH recommended indoor air screening levels, and where written authorization to install and monitor the system is granted by the property owner.

Delphi will work closely with the contractors responsible for the installation of the mitigation systems to ensure proper installation and operation of the systems.

5.1 Access for Mitigation

Where mitigation activities are to be performed in areas owned by or in possession of someone other than Delphi Corporation, best efforts to obtain all necessary written access agreements to a particular property will be performed. The access agreement will address installation of the mitigation system as well as periodic monitoring and inspection of the system, and will include provisions for payment of an annual stipend to defray utility costs associated with operation of the mitigation system.

Delphi will exercise the following measures as best efforts to gain access to the properties for purposes of mitigation and post mitigation monitoring:

- Delphi will contact the owners of properties sampled to schedule a face-to-face meeting. The meetings will be conducted individually with property owners. Representatives of the Ohio Department of Health and/or Public Health – Dayton & Montgomery County will be invited to attend. During that meeting, Delphi will explain why mitigation is prudent, how mitigation systems work and the mitigation system monitoring schedule. Delphi will inform each of these property owners of the requirement to execute a signed access agreement before mitigation can be employed.
- If the property owner is not agreeable to a face-to-face meeting or cannot be reached by phone, Delphi will mail the information to that property owner by certified mail. After approximately one week, Delphi's community relations representative will attempt to follow-up (via phone call or door hanger, if necessary) with the property owner with whom Delphi was unable to meet to determine whether that owner is agreeable to installation of a mitigation system and the subsequent mitigation monitoring program.
- Should a property owner decline to participate in the mitigation program, Delphi will request the property owner's signature of declination.

The U.S. EPA will be informed of structures for which no response is received from the property owner of record, or for which access is denied. This information will be included in the air sampling and mitigation summary report.

Authorization through a signed access agreement with the respective property owner must be obtained before mitigation systems can be installed. An example of the access agreement is presented in Appendix H.

5.2 System Description

Where SSD technology is used to reduce the migration of VOCs into structures, this will be accomplished by creating lower pressure in the sub-slab as compared to the ambient indoor air space. This reduced pressure will be induced by connecting a suction fan to piping that is inserted in a suction cavity below the slab.

The SSD system exhaust standpipe will terminate at least 12 inches above the surface of the structure's roof; in a location at least 10 feet away from any window or other opening into the conditioned spaces of the structure that is less than 2 feet below the exhaust point, and at least 10 feet from any adjoining or adjacent buildings. Labels on the depressurization piping will clearly identify the purpose of the system. The suction fan will operate continuously to vent the subsurface beneath the slab.

The power supply for the fan will be locked with a padlock or other device to prevent accidental shut-off of the system. A key to the lock will be provided to the property owner to allow for the power to be turned off for maintenance or other necessary purposes. A permanent vacuum gauge will be installed on each system on the suction side of the fan. Following start-up of the system, an initial vacuum reading will be recorded. A schematic of a typical SSD system is shown in Figure 3.

5.3 System Installation

Installation of the SSD system will be conducted by A to Z, a certified radon mitigation contractor licensed by the State of Ohio Department of Health, with experience in installing similar systems. The contractor will follow the methods outlined in *ASTM Standard E 2121-03 – Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings*. Prior to installing the mitigation system, Delphi and the contractor will consult with the property owner to evaluate the residence for purposes of determining the location where the installation of the SSD system will be most effective and convenient for the property owner.

All components of the system will be installed compliant with the applicable mechanical, electrical, building, plumbing, energy and fire prevention codes, standards and regulations of the local jurisdiction.

5.4 Operation and Maintenance

A key to the SSD system padlock and an operation and maintenance (O&M) manual will be provided to each property owner within 60 days following installation of the mitigation system.

The O&M manual will include, at a minimum, the following information:

- A description of the mitigation system and its basic operating principles;
- A description of the proper operating procedures for the system;
- The manufacturer's operation and maintenance instructions and warranties;
- Instructions for determining whether the system is operating properly;
- Photographs of system components;
- Analytical results for investigative and monitoring samples collected at that residence; and
- A list of contacts.

5.5 Mitigation Monitoring

Post mitigation system installation monitoring will be conducted to verify effective operation of the system. One indoor air sample and one sub-slab vapor sample will be collected from each structure in which a mitigation system is installed. Additionally, as part of the mitigation monitoring program, subsurface vacuum will be measured with a magnehelic gauge from the permanently installed sub-slab sampling points.

Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g. framed drywall, masonry), an indoor air sample will be collected from each basement area. The indoor air sampling and sub-slab soil vapor sampling will be performed in accordance with the sampling procedures described in Section 3.0 of this Work Plan and the attached SOPs (Appendices E and F). These samples will be collected while the mitigation system is operating. Additionally, the structure's heating and cooling systems will remain in their normal operating status (e.g., the occupant's normal settings). Delphi will request of property owners and tenants that vents discharging to the area of indoor air sampling be closed approximately 24 hours prior to the sampling event and remain closed during the sampling period. The status of vent closure will be documented in field notes.

Access to the property for this monitoring will be included in the access agreement for the mitigation system installation.

To verify the effectiveness of soil vapor intrusion mitigation, post mitigation system installation monitoring will occur at approximately the following intervals:

- 30 days after installation of the system;
- 60 days after installation of the system; and
- 180 days after installation of the system.

Post mitigation system installation monitoring will be performed annually following the first year of installation.

During each mitigation system monitoring event, an inspection of the system will be performed. The scope of the inspection will include:

- System vacuum/pressure readings;
- Confirmation of operation of the system fan;
- Visual inspection of system piping and components;

- Visual inspection of floor and wall seals; and
- Confirmation of operation with the property owner.

If any indoor air sample collected during the mitigation system monitoring event reveals that the system has not reduced the constituents of concern to a level below their respective screening levels, a subsequent sample will be collected within 30 days. If this follow-up sample confirms concentrations are above screening levels, the mitigation system design and construction will be re-evaluated and additional engineering controls will be implemented. Recommendations for system modification, if warranted, will be provided to the U.S. EPA and implemented at the affected structure within 60 days of U.S. EPA's approval. If the follow-up sample indicates concentrations are below screening levels, the established sampling schedule will resume.

5.6 Completion of Mitigation Program

Maintenance and monitoring of any mitigation system will be discontinued when Delphi demonstrates to the U.S. EPA that sufficient reduction of soil vapor levels has been achieved in the vicinity of the related structure such that significant risk to human health no longer exists.

Following shutdown of any mitigation system, Delphi will implement a schedule of quarterly post-mitigation monitoring at the related structure. The post-mitigation quarterly monitoring program will consist of collection of one indoor air and one sub-slab soil vapor sample at the related structure each quarter for four consecutive quarters.

The mitigation and monitoring activities will be considered complete when four consecutive quarters of indoor air results for the related structure are below the ODH recommended indoor air screening levels.

5.7 Mitigation Monitoring Reporting

Copies of post-mitigation system installation monitoring data will be submitted in a timely manner to the U.S. EPA, ODH, PHDMC, and the respective property owner.

6.0 DATA MANAGEMENT

Copies of sampling data will be submitted to the U.S. EPA, ODH, PHDMC and the respective property owner. A data management spreadsheet will be maintained and distributed to members of the project technical committee to communicate the project's latest validated data. An example of this spreadsheet is included as Appendix J.

Field activities will be documented and recorded on field forms, an example of which is provided as an attachment to the QAPP (Appendix I). Field forms will be utilized to document observations, measurements, and significant events that have occurred during field activities.

All laboratory reports will document sample custody, analytical chronology, analytical results, adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies.

The final data deliverables will comply with the QAPP.

7.0 PROJECT MANAGEMENT

7.1 Responsibilities and Functions

Figure 4 illustrates the organizational structure for management of this project. The names, titles and telephone numbers for individuals identified in the organizational chart are provided in Figure 4.

7.2 Indoor Air Sampling and Mitigation Summary Report

Upon completion of this indoor air sampling and mitigation program, Delphi will prepare a summary report detailing the activities performed and data collected. Items to be presented in the investigation summary report include:

- Documentation of the quarterly sampling and mitigation monitoring activities;
- Evaluation of the data generated during those activities;
- Laboratory analytical data; and
- Conclusions.

The summary report will be submitted to the U.S. EPA, ODH and PHDMC.

7.3 Progress Meetings

Progress meetings, typically in the form of weekly conference calls, will be conducted with the project technical committee to discuss the progress of implementation of the Work Plan. The frequency of these progress conference calls may be modified as the level of project activity changes.

The technical committee anticipated to participate in the weekly progress conference calls is comprised of representatives of U.S. EPA and its subcontractors, representatives of Delphi and its subcontractors, ODH and PHDMC.

Delphi will provide conference call participants the telephone number and pass code for the call, and will prepare and distribute a weekly call reminder and any laboratory data generated since the previous call. The technical committee weekly conference call agenda will be developed appropriate to the Work Plan activities being conducted at that time and may include:

- An updated spreadsheet presenting the latest validated sample data;
- Field sampling status report;
- Mitigation status report;
- Description of activities planned for the upcoming week; and
- Any project issues or problems encountered.

7.4 Schedule

The actual sampling and mitigation schedule of activities will be dependent upon the timeframe in which permission to access the structures is obtained from the property owners, and the results of sample analysis are received from the laboratory; however, the following timetable is planned:

- Initiation of steps to obtain access agreements for quarterly sampling within fourteen (14) days of receiving from the U.S. EPA written approval of this Work Plan.
- Initiation of steps to obtain access agreements for installation of mitigation systems within fourteen (14) days of receiving from the U.S. EPA written approval of this Work Plan.
- Initiation of quarterly sampling activities within thirty (30) days of receiving authorized access agreements from property owners.
- Initiation of mitigation activities within (30) days of receiving authorized access agreements from property owners.
- Submittal to U.S. EPA of work plan for Phase II sampling activities within forty-five (45) days of approval of this Phase I Work Plan.

The U.S. EPA will be updated on the actual schedule of activities related to implementation of this Work Plan during the weekly progress meetings.

Tables

TABLE 1
PROPERTY ADDRESSES AND COURSE OF ACTION
DELPHI VOC PLUME SITE
PHASE I INDOOR AIR SAMPLING AND MITIGATION WORK PLAN

Street Number	Street Name	Description of Residential Structure	Description of Best Efforts to Reach Property Owner for Access Agreement	Comments	Course of Action Based on Data Evaluation
E...	Ex. 6 P... Names, ...	Single family structure		Abandoned, uninhabitable structure	
Ex...	Ex. 6 P... Names, ...	Single family structure	Letters mailed 4/11/07 & 4/20/07; door hangers on 5/02/07 & 5/18/07	No response received from property owner	
E...	Ex. 6 P... Names, ...	Single family structure	Letter mailed 4/11/07	Sampled	Quarterly indoor air sampling
Ex. 6 -...	Ex. 6 P... Names, ...	Two-family structure	Letters mailed 4/11/07 & 4/20/07	Sampled	Quarterly indoor air sampling
Ex...	Ex. 6 P... Names, Addresses and p...	Single family structure	Letters mailed 4/11/07 & 4/20/07; door hangers on 5/02/07 & 5/18/07	No response received from property owner	
Ex...	Ex. 6 P... Names, ...	Single family structure	Letters mailed 4/11/07 & 4/20/07; door hangers on 5/02/07 & 5/18/07	No response received from property owner	
Ex. 6 P... N...	Ex. 6 P... Names, Addresses and pho...	Three-family structure	Letter mailed 4/11/07	Sampled	Mitigation
E...	Ex. 6 P... Names, Addresses and p...	Single family structure		Abandoned, uninhabitable structure	
E...	Ex. 6 P... Names, Addresses and ph...	Single family structure	Letters mailed 4/11/07 & 4/20/07	Sampled	Quarterly indoor air sampling
Ex...	Ex. 6 P... Names, Addresses and p...	Single family structure	Letter mailed 4/11/07	Sampled	Mitigation
Ex. 6 -...	Ex. 6 P... Names, Addresses and p...	Two-family structure	Letter mailed 4/11/07 Follow-up letter mailed 4/18/07; phone calls on 4/15/07, 4/16/07 & 4/18/07	Property owner returned signed access agreement. Property owner failed to respond to multiple attempts to schedule sampling event.	

TABLE 1
PROPERTY ADDRESSES AND COURSE OF ACTION
DELPHI VOC PLUME SITE
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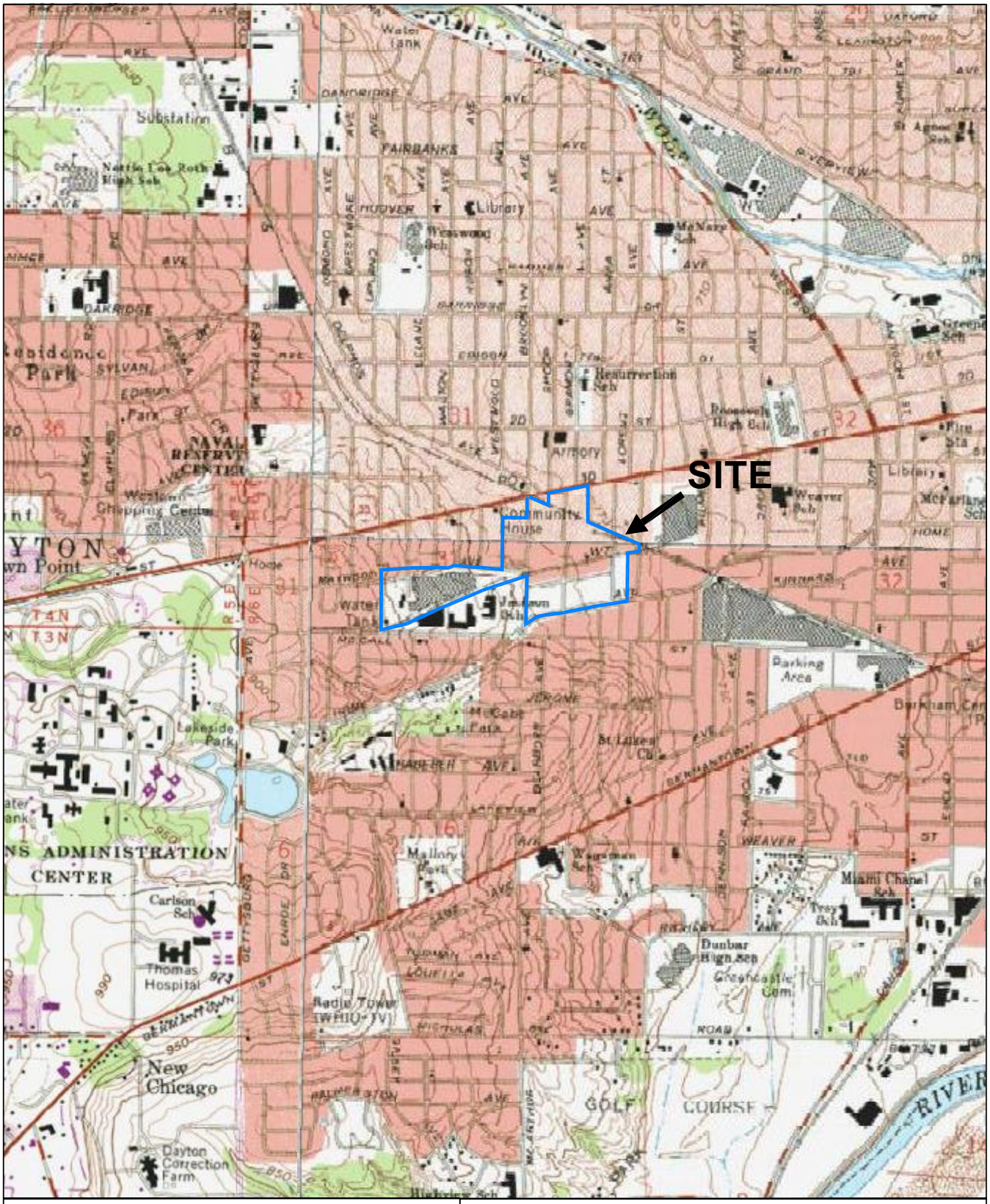
E...	Ex. 6 P... Names, Addresses and p...	Single family structure	Letters mailed 4/11/07 & 4/20/07	Sampled	Quarterly indoor air sampling
Ex. 6 P... N...	Ex. 6 P... Names, Addresses and p...	Three-family structure	Letter mailed on 4/11/07; phone call on 4/19/07	Sampled	Mitigation
Ex...	Ex. 6 P... Names, Addresses and p...	Single family structure		Abandoned, uninhabitable structure	
Ex...	Ex. 6 P... Names, Add...	Single family structure		Abandoned , uninhabitable structure	
Ex. ...	Ex. 6 P... Names, Addresses and p...	Single family structure	Letters mailed 4/11/07 & 4/20/07	Sampled	Mitigation
Ex. ...	Ex. 6 P... Names, Addresses and p...	Single family structure	Letter mailed 4/11/07	Sampled	Mitigation
Ex. ...	Ex. 6 P... Names, Addresses and pho...	Single family structure	Letter mailed 4/11/07; Door Hanger on 4/27/07	Vacant home. Posted notice: seized by Order of City of Dayton. No response received from property owner	
Ex. ...	Ex. 6 P... Names, Addresses and pho...	Single family structure	Letter mailed on 4/11/07; phone call on 4/19/07	Sampled	Quarterly indoor air sampling

Figures



SITE COORDINATES: 39°44'52"N 84°14'30"W

N
W E
S

U.S.G.S. QUADRANGLE: DAYTON SOUTH, OHIO

HALEY & ALDRICH

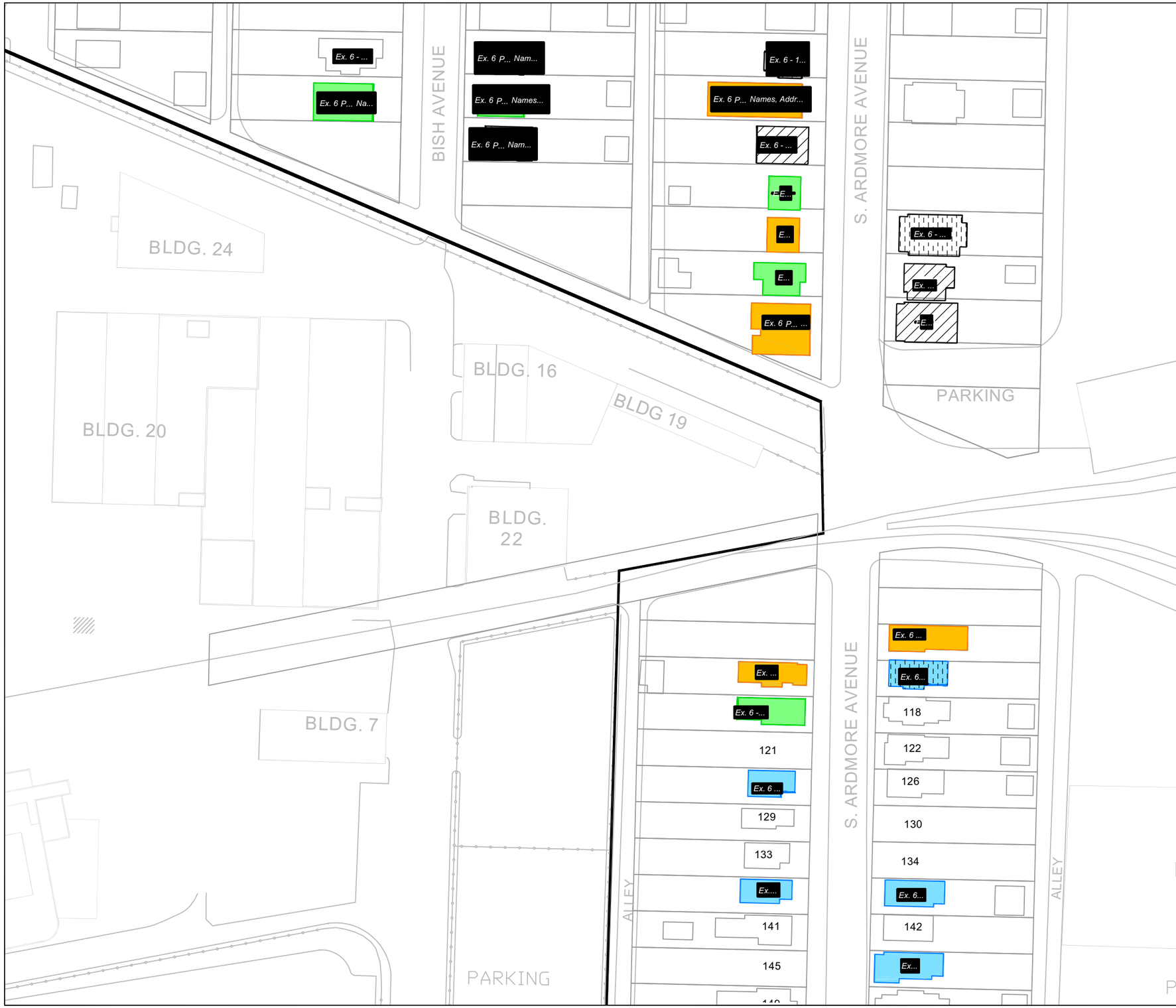
DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

PROJECT LOCUS

1:24000
OCTOBER 2007

FIGURE 1

G:\PROJECTS\26708 HOME AVE\ACAD\HOME_AVE-LOCUS.DWG



LEGEND:

- SAMPLED, NO FURTHER ACTION
- SAMPLED AND IDENTIFIED FOR MITIGATION
- SAMPLED, QUARTERLY SAMPLING PROGRAM
- STRUCTURE DEMOLISHED
- STRUCTURE UNOCCUPIED
- NO RESPONSE RECEIVED FROM PROPERTY OWNER
- NO RESPONSE RECEIVED BY DELPHI SAMPLED BY U.S.. EPA, NO FURTHER ACTION

N
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S

0 80 160
SCALE IN FEET

HALEY & ALDRICH

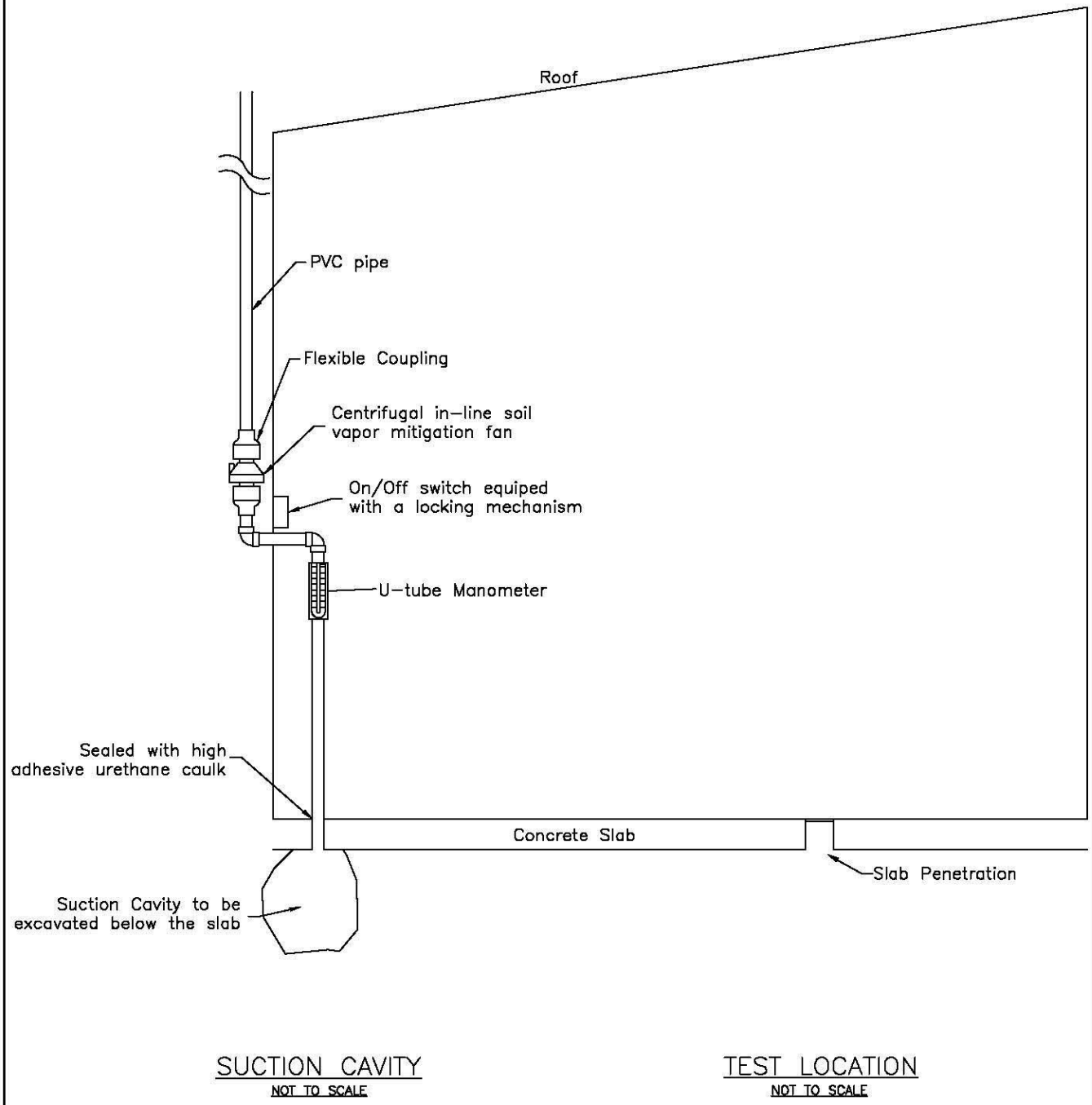
DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

PHASE I STUDY AREA AND COURSE OF ACTION

SCALE: AS SHOWN
OCTOBER 2007

FIGURE 2

G:\PROJECTS\26708 HOME AVE\ACAD\26708-RESIDENCES SAMPLED-AUG21.DWG



SUCTION CAVITY
NOT TO SCALE

TEST LOCATION
NOT TO SCALE

HALEY & ALDRICH

DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

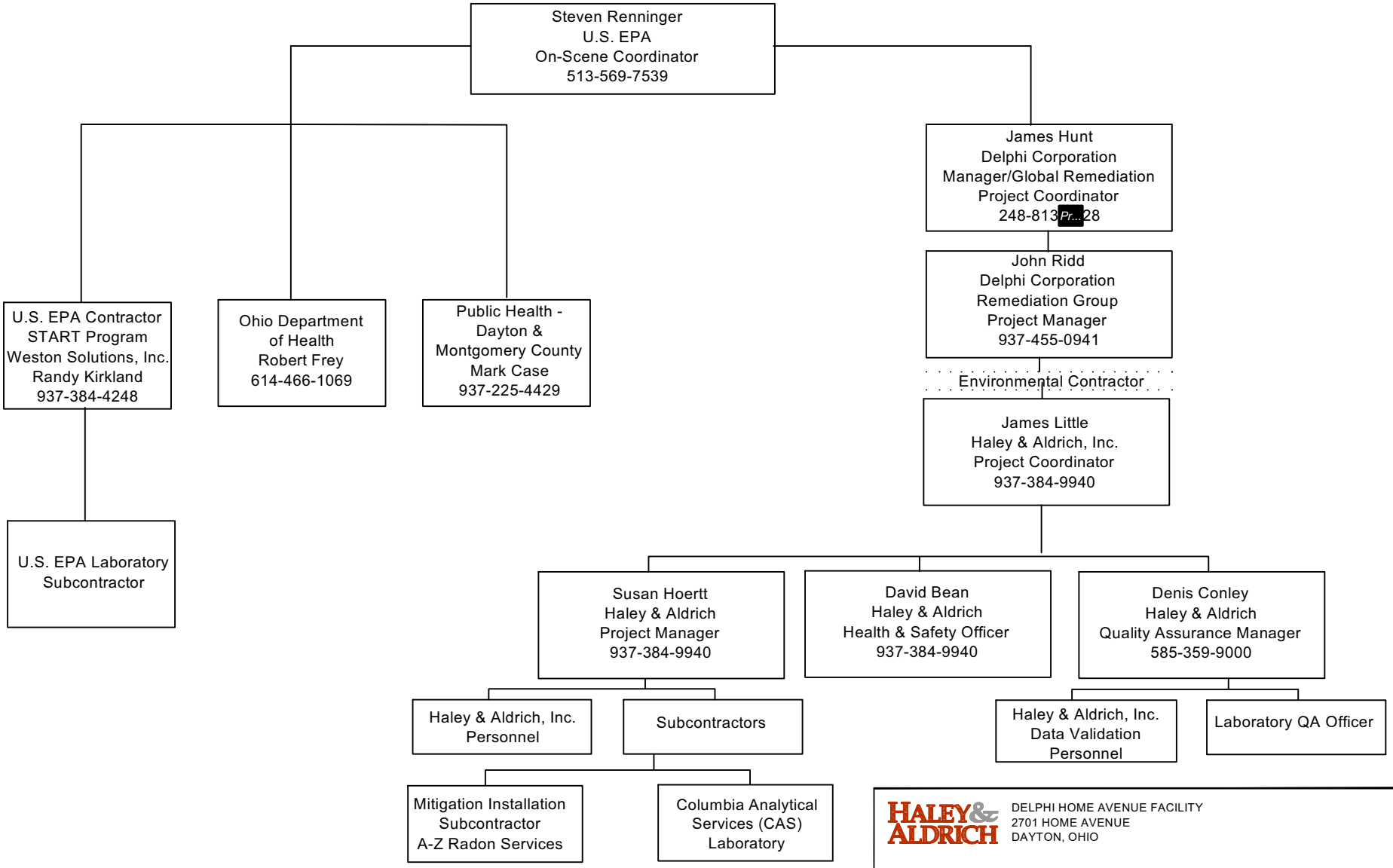
SCHEMATIC OF SUB-SLAB DEPRESSURIZATION SYSTEM

SCALE: NOT TO SCALE
OCTOBER 2007

FIGURE 3

G:\PROJECTS\26708 HOME AVE\079 SVI_INVESTIGATION_WORKPLANS\CERCLAWORK PLAN_PHASE 1\DRAFTS\26708-086-SSD TYP DETAILS.DWG

G:\PROJECTS\26708 HOME AVE\079 SVI_INVESTIGATION_WORKPLANS\CERCLAWORK PLAN_PHASE 1\DRAFTS\ORG CHART.DWG



HALEY & ALDRICH

DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

PROJECT MANAGEMENT
ORGANIZATION CHART

SCALE: NOT APPLICABLE
OCTOBER 2007

Figure 4

APPENDIX A

Administrative Order on Consent

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

IN THE MATTER OF:

Delphi VOC Plume Site
Dayton, Ohio

Respondent:

Delphi Corporation

ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMOVAL ACTION

Docket No. ____

Proceeding Under Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622

TABLE OF CONTENTS

I.	JURISDICTION AND GENERAL PROVISIONS	3
II.	PARTIES BOUND	3
III.	DEFINITIONS	4
IV.	FINDINGS OF FACT	5
V.	CONCLUSIONS OF LAW AND DETERMINATIONS	10
VI.	SETTLEMENT AGREEMENT AND ORDER	11
VII.	DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR	12
VIII.	WORK TO BE PERFORMED	13
IX.	SITE ACCESS	17
X.	ACCESS TO INFORMATION	17
XI.	RECORD RETENTION	18
XII.	COMPLIANCE WITH OTHER LAWS	19
XIII.	EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES	19
XIV.	AUTHORITY OF ON-SCENE COORDINATOR	20
XV.	PAYMENT OF RESPONSE COSTS	20
XVI.	DISPUTE RESOLUTION	23
XVII.	FORCE MAJEURE	23
XVIII.	STIPULATED PENALTIES	24
XIX.	COVENANT NOT TO SUE BY U.S. EPA	26
XX.	RESERVATIONS OF RIGHTS BY U.S. EPA	27
XXI.	COVENANT NOT TO SUE BY RESPONDENT	28
XXII.	OTHER CLAIMS	28
XXIII.	CONTRIBUTION	29
XXIV.	INDEMNIFICATION	29
XXV.	MODIFICATIONS	30
XXVI.	NOTICE OF COMPLETION OF WORK	30
XXVII	FINANCIAL ASSURANCE	31
XXVIII	INSURANCE	32
XXIX.	SEVERABILITY/INTEGRATION	32
XXX.	EFFECTIVE DATE	33

I. JURISDICTION AND GENERAL PROVISIONS

1. This Administrative Settlement Agreement and Order on Consent ("Settlement Agreement") is entered into voluntarily by the United States Environmental Protection Agency ("U.S. EPA") and Respondent. This Settlement Agreement provides for the performance of removal actions by Respondent and the reimbursement of certain response costs incurred by the United States at or in connection with the property located at 2701 Home Avenue, in Dayton, Montgomery County, Ohio, the "Delphi Site" or the "Site".

2. This Settlement Agreement is issued under the authority vested in the President of the United States by Sections 104, 106(a), 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9604, 9606(a), 9607 and 9622, as amended ("CERCLA"). This authority has been delegated to the Administrator of the U.S. EPA by Executive Order No. 12580, January 23, 1987, 52 "Federal Register" 2923, and further delegated to the Regional Administrators by U.S. EPA Delegation Nos. 14-14-A, 14-14-C and 14-14-D, and to the Director, Superfund Division, Region 5, by Regional Delegation Nos. 14-14-A, 14-14-C and 14-14-D.

3. U.S. EPA has notified the State of Ohio (the "State") of this action pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

4. U.S. EPA and Respondent recognize that this Settlement Agreement has been negotiated in good faith and that the actions undertaken by Respondent in accordance with this Settlement Agreement do not constitute an admission of any liability. Respondent does not admit, and retains the right to controvert in any subsequent proceedings other than proceedings to implement or enforce this Settlement Agreement, the validity of the findings of facts, conclusions of law, and determinations in Sections IV (Findings Of Fact) and V (Conclusions Of Law And Determinations) of this Settlement Agreement. Respondent agrees to comply with and be bound by the terms of this Settlement Agreement and further agree that it will not contest the basis or validity of this Settlement Agreement or its terms.

II. PARTIES BOUND

5. This Settlement Agreement applies to and is binding upon U.S. EPA and upon Respondent and its successors and assigns.

6. Any change in ownership or corporate status of Respondent including, but not limited to, any transfer of assets or real or personal property shall not alter Respondent's responsibilities under this Settlement Agreement.

7. Respondent shall ensure that its contractors, subcontractors, and representatives comply with this Settlement Agreement. Respondent shall be responsible for any noncompliance with this Settlement Agreement.

III. DEFINITIONS

8. Unless otherwise expressly provided herein, terms used in this Settlement Agreement which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Settlement Agreement or in the appendices attached hereto and incorporated hereunder, the following definitions shall apply:

a. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C.§§ 9601, *et seq.*

b. "Effective Date" shall be the effective date of this Settlement Agreement as provided in Section XXX (Effective Date).

c. "Future Response Costs" shall mean all costs, including direct and indirect costs, that the United States incurs in reviewing or developing plans, reports and other items pursuant to this Settlement Agreement, verifying the Work, or otherwise implementing, overseeing, or enforcing this Settlement Agreement on or after the Effective Date. Future Response Costs shall also include all costs, including direct and indirect costs, incurred prior to the Effective Date, but paid after that date and all costs, including direct and indirect costs, paid by the United States in connection with the Site between July 31, 2007 and the Effective Date.

d. "Interest" shall mean interest at the rate specified for interest on investments of the U.S. EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

e. "National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C.§ 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

f. "Settlement Agreement" shall mean this Administrative Settlement Agreement and Order on Consent and all appendices attached hereto (listed in Section XXIX (Severability/Integration/Attachments)). In the event of conflict between this Settlement Agreement and any appendix, this Settlement Agreement shall control.

g. "Parties" shall mean U.S. EPA and Respondent.

h. "Past Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States paid at or in connection with the Site through July 31, 2007.

i. "RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901, *et seq.* (also known as the Resource Conservation and Recovery Act).

j. "Respondent" shall mean Delphi Corporation, a Delaware Corporation.

k. "Site" shall mean the Delphi VOC Plume Site, encompassing the areal extent of the currently undefined soil vapor VOC plume originating from the Delphi Corporation facility (the Delphi facility) located at 2701 Home Avenue in Dayton, Montgomery County, Ohio and encompassing portions of the residential areas north and south of that facility, including but not limited to areas along Cowart, Bish and S. Ardmore Avenues.

l. "State" shall mean the State of Ohio.

m. "U.S. EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

n. "Waste Material" shall mean 1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); 2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C.§ 9601(33); 3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C.§ 6903(27); and 4) and/or 4) any "hazardous waste" under Ohio Revised Code Chapter 3734.01(j).

o. "Work" shall mean all activities Respondent is required to perform under this Settlement Agreement.

IV. FINDINGS OF FACT

9. Based on available information, including the Administrative Record in this matter, U.S. EPA hereby finds that:

a. The Delphi facility is located at 2701 Home Avenue, Dayton, Ohio, in a mixed residential, industrial and commercial area in Southwest Dayton.

b. The Delphi facility is assigned Resource Conservation and Recovery Act generator ID no. OHD000817023.

c. General Motors Corporation (GM) acquired the Delphi facility around 1920, and used it for automobile parts manufacturing and, during World War II, weapons manufacturing for the U.S. Government. GM's Aeroproducts Division manufactured and tested airplane and helicopter parts at the Delphi facility in the 1940s and 1950s, and its Inland Manufacturing Division manufactured auto parts from the 1960s through the 1990s.

d. Delphi Corporation (Delphi) has owned and operated the Delphi facility since 1999, when then Delphi Automotive Systems separated from GM to form a new company. The company was later renamed Delphi Corporation, operating the Delphi facility under its Delphi Energy & Chassis (E&C) Systems Division, and currently operates under the Delphi Automotive

Holdings Group (DAHG) of Delphi Corporation. Delphi fabricates and assembles rubber, plastic, and metal automotive components at the Delphi facility.

e. Underground tanks formerly located in the eastern portion of the Delphi facility held petroleum-based compounds and chlorinated solvents, including the volatile organic compounds tetrachloroethene (PCE), and chloroform. The underground storage tanks were removed in 1989.

f. The eastern end of the Delphi facility is bordered on the north and northeast by a residential area, on the east by railroad tracks and a parking area for the Peerless Storage Company warehouses, on the south and southeast by railroad tracks with more residences beyond the tracks, and on the west by Delphi manufacturing facilities.

g. During GM's ownership, hazardous substances, including the volatile organic compounds PCE, TCE and chloroform were released at and from the Delphi facility.

h. There is a release of hazardous substances, including PCE, TCE and chloroform, from the Delphi facility.

i. The soil beneath the Delphi facility is contaminated with volatile organic compounds, including PCE, TCE and chloroform.

j. Contaminated soil vapor has migrated to residential areas located north and south of the Delphi facility.

k. PCE is a hazardous substance within the meaning of Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It is a "listed hazardous substance" as that term is defined at 40 CFR § 302.4, and is included in Table 302.4 as a hazardous substance designated under Section 102(a) of CERCLA.

l. PCE is a man-made chemical that is widely used for dry cleaning garments and as a cleaner to remove grease from metal parts.

m. Exposure to PCE at very high concentrations (particularly in closed, poorly ventilated areas) may cause headaches, sleepiness, dizziness, confusion, nausea, difficulty speaking and walking, unconsciousness and even death. According to the Ohio Department of Health, there is limited evidence that PCE is a human carcinogen.

n. TCE is a hazardous substance within the meaning of Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It is a "listed hazardous substance" as that term is defined at 40 CFR § 302.4, and is included in Table 302.4 as a hazardous substance designated under Section 102(a) of CERCLA.

o. TCE is a man-made chemical that is widely used as a cleaner to remove grease from metal parts.

p. Exposure to TCE at very high concentrations (particularly in closed, poorly ventilated areas) may cause headaches, lung irritation, dizziness, poor coordination (clumsy), and difficulty speaking. According to the Ohio Department of Health, the evidence that TCE is a human carcinogen has been under review by health organizations since 2001.

q. Chloroform is a hazardous substance within the meaning of Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It is a "listed hazardous substance" as that term is defined at 40 CFR § 302.4, and is included in Table 302.4 as a hazardous substance designated under Section 102(a) of CERCLA.

r. Chloroform is a man-made chemical that is widely used in industry as a solvent or a chemical intermediate for making other chemical compounds, as well as a byproduct from chlorination of municipal water supplies.

s. Exposure to Chloroform at very high concentrations (particularly in closed, poorly ventilated areas) may cause damage to liver and kidneys, headaches, dizziness, and fatigue. According to the U.S. Department of Health and Human Services, chloroform may be "reasonably anticipated to be a human carcinogen" based on limited evidence of carcinogenicity from studies of humans and sufficient evidence of carcinogenicity from studies of laboratory animals.

t. The Agency for Toxic Substances and Disease Registry ("ATSDR") and the Ohio Department of Health ("ODH") have worked together to establish PCE, TCE and Chloroform screening and action levels for residential and commercial sub-slab and indoor air at the Site. In a letter dated June 4, 2007, ODH provided health-based guidance to evaluate the results of indoor and subsurface air sampling for chloroform, TCE, and PCE at the Site. The ODH letter states that an exceedance of the short term action levels "does not necessarily indicate that the home would be unsafe for occupancy, necessitating the evacuation of the residents. These numbers represent fairly conservative screening criteria." ODH recommended residential indoor air and sub-slab screening and action levels, which are summarized in the following table below:

Volatile Organic Compound	Long-term Screening Level for Residential Sub-Slab Air	Long-term Screening Level for Residential Indoor Air	Short-term Action Level for Residential Sub-Slab	Short-term Action Level for Residential Indoor Air
Chloroform	22 ppbv*	2.2 ppbv	500 ppbv	50 ppbv
TCE	4.0 ppbv	0.4 ppbv	1,000 ppbv	100 ppbv

PCE	120 ppbv	12 ppbv	2,000 ppbv	200 ppbv

*pppv means parts per billion per volume of air.

u. ODH also identified commercial indoor air and sub-slab screening and action levels, which are summarized in the following table:

Volatile Organic Compound	Long-term Screening Level for Commercial Sub-Slab Air	Long-term Screening Level for Commercial Indoor Air	Short-term Action Level for Commercial Sub-Slab	Short-term Action Level for Commercial Indoor Air
Chloroform	92 ppbv	9.2 ppbv	2,100 ppbv	210 ppbv
TCE	17 ppbv	1.7 ppbv	4,200 ppbv	420 ppbv
PCE	500 ppbv	50 ppbv	8,400 ppbv	840 ppbv

v. Between February 2005 and September 2006, Delphi conducted a phased subsurface investigation in this area. Phase 1 work focused on UST Areas A and B and consisted of two field events: Phase 1A and Phase 1B. Phase 2 work was conducted to the east on property owned by the Peerless Storage Company. Work associated with Phases 3 and 4 was conducted primarily in the residential areas adjacent to the Facility to the north and south. The field work conducted during this timeframe included 75 soil borings, 12 new monitoring wells, 35 soil vapor monitoring points and 49 temporary soil vapor monitoring points.

w. Concurrent with this investigative work described above, Delphi installed a remediation system to address the onsite source of soil vapors, consisting of a centralized vacuum pump connected to a series of four soil vapor extraction wells. The system operates under a permit issued by the Regional Air Pollution Control Authority (RAPCA).

x. Delphi filed for Chapter 11 bankruptcy in October 2005 and is currently in bankruptcy proceedings in the United States Bankruptcy Court for the Southern District of New York (In re Delphi Corp. et. al., Case No. 05-44481 (S.D.N.Y. Bankr.)). Delphi asserts that the Bankruptcy Court's Delphi Settlement Procedures Order entered June 29, 2006 (Doc. #4414) applies. No separate approval from the Bankruptcy Court to enter into this Settlement Agreement is being sought by Delphi.

y. After consulting with Ohio EPA, U.S. EPA, and the Montgomery County Combined Health District, Delphi by its consultant, Haley & Aldrich, conducted a vapor intrusion investigation focused on residential sub-slab air. U.S.EPA did not oversee this work. Delphi and

Haley & Aldrich collected fourteen sub-slab air samples from twelve residences located east of the Delphi facility, along Bish Avenue and South Ardmore Avenue. The sample results indicated chloroform levels ranging up to 4,700 pppv; TCE levels ranging up to 1,300 ppbv; and PCE levels ranging up to 3,600 ppbv.

z. During the sub-slab air sampling, Haley & Aldrich conducted a simultaneous vapor intrusion investigation focused on residential indoor air. In April – May, 2007, Haley & Aldrich collected indoor air samples from thirteen residences (10 structures) located east of the Delphi facility, along Bish Avenue and South Ardmore Avenue. The sample results indicated chloroform levels ranging up to 3.3 ppbv; TCE levels ranging up to 3.0 ppbv; and PCE levels ranging up to 19 ppbv.

aa. In a letter dated March 5, 2007, Ohio EPA formally requested U.S. EPA assistance in conducting a time-critical removal action at the Site. Ohio EPA made the following reference as the basis for its referral letter:

"Delphi representatives presented information to Ohio EPA Southwest District Office indicating that chloroform and PCE have migrated from the site into adjacent residential areas at levels that may present unacceptable risk in indoor air."

bb. At the request of the Ohio EPA, the U.S. EPA conducted a vapor intrusion investigation focused on residential sub-slab and indoor air. In May – July, 2007, the U.S. EPA collected sub-slab air samples from seven residences located east of the Delphi facility, along Bish Avenue and South Ardmore Avenue. The sample results indicated chloroform levels ranging up to 6,580 ppbv; TCE levels ranging up to 2,630 ppbv; and PCE levels ranging up to 20,900 ppbv.

cc. U.S. EPA has documented four residences with sub-slab detection of chloroform, TCE, and/or PCE exceeding the ODH-recommended residential sub-slab screening levels of 22 ppbv, 4 ppbv, and 120 ppbv respectively. In addition, one residence also exceeds the ATSDR residential sub-slab short-term action level of 500 ppbv for chloroform while a separate residence exceeds the residential sub-slab short-term action level of 2,000 ppbv for PCE.

dd. Based on ATSDR and ODH recommendations, the U.S.EPA followed sub-slab air sampling with indoor air sampling at seven locations in July 2007. U.S. EPA documented one residence exceeding the ODH-recommended residential long-term indoor air screening levels of 2.2 ppbv, 0.4 ppbv, and/or12 ppbv for chloroform, TCE, and PCE, respectively. There were no residences exceeding the residential short-term indoor air action levels of 50 ppbv, 100 ppbv, and 200 ppbv, for chloroform, TCE, and PCE, respectively.

ee. On July 25, 2007, U.S. EPA issued a general notice of potential liability under CERCLA to Delphi and GM, revealing concerns about conditions at the Site. The general notice sought a commitment to perform the response actions and reimburse U.S. EPA its costs incurred in connection with the Site.

ff. Respondent Delphi responded by letter dated August 3, 2007, indicating its willingness to perform the activities requested in the Notice Letter subject to negotiation of an acceptable administrative order and associated scope of work and resolving other Agency Site related claims.

gg. By letter dated August 3, 2007, General Motors indicated that it had entered into an environmental matters agreement with Delphi in 1998; and took the position that Delphi was responsible for environmental matters at the facility.

V. CONCLUSIONS OF LAW AND DETERMINATIONS

10. Based on the Findings of Fact set forth above, and the Administrative Record supporting this removal action, U.S. EPA has determined that:

a. The Delphi Site is a "facility" as defined by Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

b. The contamination found at the Site, as identified in the Findings of Fact above, includes "hazardous substances" as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

c. Respondent is a "person" as defined by Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).

d. Respondent is a responsible party under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a), and is jointly and severally liable for performance of response action and for response costs incurred and to be incurred at the Site.

i. Respondent Delphi is the "owner" and/or "operator" of the facility, as defined by Section 101(20) of CERCLA, 42 U.S.C. § 9601(20), and within the meaning of Section 107(a)(1) of CERCLA, 42 U.S.C. § 9607(a)(1).

ii. The conditions described in the Findings of Fact above constitute an actual or threatened "release" of a hazardous substance from the facility into the "environment" as defined by Sections 101(22) and 101(8) of CERCLA, 42 U.S.C. §§ 9601(22) and 9601(8).

e. The conditions present at the Site constitute a threat to public health, welfare, or the environment based upon the factors set forth in Section 300.415(b)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan, as amended ("NCP"), 40 CFR § 300.415(b)(2). These factors include, but are not limited to, the following:

i. Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants.

Vapor intrusion is the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals released to the environment can volatilize from impacted soil and/or groundwater beneath a building and diffuse toward regions of the lower chemical concentration (e.g., the atmosphere, building sub-slab). Soil gas containing these chemicals can flow into a building through cracks in the foundation or into a basement with a dirt floor due to a number of factors, including barometric pressure changes, basement type, wind load, or thermal currents.

Chloroform, TCE, and PCE are volatile organic compounds, are hazardous substances within the meaning of Section 101(14) of CERCLA and are listed at 40 CFR § 302.4. The Delphi and U.S. EPA sub-slab and indoor air sampling results indicate that chloroform, TCE, and PCE vapors are migrating into certain residential homes at levels that exceed ODH-recommended long-term screening levels. To date, indoor air concentrations do not exceed ODH-recommended short-term action levels.

Specifically, sample results from U.S. EPA and Delphi show five residences having an indoor air sample exceeding the ODH long-term screening level for chloroform (maximum of 3.3 ppbv), TCE (maximum of 3 ppbv) and/or PCE (maximum of 19 ppbv).

Sample results from U.S. EPA and Delphi document one residence exceeding the short-term residential sub-slab action level of 500 ppbv for chloroform, with a maximum chloroform concentration of 6,580 ppbv; and exceeding the short-term residential sub-slab action level of 1,000 ppbv for TCE, with a maximum of 2,630 ppbv; and one residence exceeding the short term residential sub-slab action level of 2,000 ppbv for PCE, with a maximum PCE concentration of 20,900 ppbv.

ii. The unavailability of other appropriate federal or state response mechanisms to respond to the release.

In a letter dated March 5, 2007, the Ohio EPA requested U.S. EPA Region 5 assistance with conducting a time-critical removal action at the Site.

f. The removal action required by this Settlement Agreement is necessary to protect the public health, welfare, or the environment and, if carried out in compliance with the terms of this Settlement Agreement, will be considered consistent with the NCP, as provided in Section 300.700(c)(3)(ii) of the NCP.

VI. SETTLEMENT AGREEMENT AND ORDER

11. Based upon the foregoing Findings of Fact, Conclusions of Law, Determinations, and the Administrative Record for this Site, it is hereby Ordered and Agreed that Respondent shall comply with all provisions of this Settlement Agreement, including, but not limited to, all attachments to this Settlement Agreement and all documents incorporated by reference into this

Settlement Agreement.

VII. DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR

12. Respondent shall retain one or more contractors to perform the Work and shall notify U.S. EPA of the name(s) and qualifications of such contractor(s) within 5 business days of the Effective Date. Respondent shall also notify U.S. EPA of the name(s) and qualification(s) of any other contractor(s) or subcontractor(s) retained to perform the Work at least 5 business days prior to commencement of such Work. U.S. EPA retains the right to disapprove of any or all of the contractors and/or subcontractors retained by Respondent. If U.S. EPA disapproves of a selected contractor, Respondent shall retain a different contractor and shall notify U.S. EPA of that contractor's name and qualifications within 3 business days of U.S. EPA's disapproval. The contractor must demonstrate compliance with ANSI/ASQC E-4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995), by submitting a copy of the proposed contractor's Quality Management Plan ("QMP"). The QMP should be prepared consistent with "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B0-1/002), or equivalent documentation as required by U.S. EPA.

13. Within 5 business days after the Effective Date, Respondent shall designate a Project Coordinator who shall be responsible for administration of all actions by Respondent required by this Settlement Agreement and shall submit to U.S. EPA the designated Project Coordinator's name, address, telephone number, and qualifications. To the greatest extent possible, the Project Coordinator shall be present on Site or readily available during Site work. U.S. EPA retains the right to disapprove of the designated Project Coordinator. If U.S. EPA disapproves of the designated Project Coordinator, Respondent shall retain a different Project Coordinator and shall notify U.S. EPA of that person's name, address, telephone number, and qualifications within 4 business days following U.S. EPA's disapproval. Receipt by Respondent's Project Coordinator of any notice or communication from U.S. EPA relating to this Settlement Agreement shall constitute receipt by Respondent.

14. U.S. EPA has designated Steve Renninger of the Emergency Response Branch, Section 1, Region 5, as its On-Scene Coordinator ("OSC"). Except as otherwise provided in this Settlement Agreement, Respondent shall direct all submissions required by this Settlement Agreement to the OSC at the following address:

Steve Renninger, On-Scene Coordinator
U.S. EPA Region V
Emergency Response Branch
26 West Martin Luther King Drive (G41)
Cincinnati, OH 45268

Respondent is encouraged to make its submissions to U.S. EPA on recycled paper (which

includes significant post consumer waste paper content where possible) and using two-sided copies.

15. U.S. EPA and Respondent shall have the right, subject to Paragraphs 12 and 13, to change their respective designated OSC or Project Coordinator. U.S. EPA shall notify the Respondent, and Respondent shall notify U.S. EPA, as early as possible before such a change is made, but in no case less than 24 hours before such a change. The initial notification may be made orally but it shall be promptly followed by a written notice.

VIII. WORK TO BE PERFORMED

16. Respondent shall perform, at a minimum, the following removal activities:

a. Implement the Site Health and Safety Plan included in the approved Phase I Work Plan.

b. Assess the extent of Site-related soil vapor at certain residential properties located within the Site utilizing soil gas, sub-slab, and indoor air sampling techniques pursuant to the Phase II Work Plan.

c. If the applicable Indoor Air Screening Level for Site-related TCE, PCE, or Chloroform is exceeded, design and install interior vapor abatement systems in structures impacted by TCE, PCE, or Chloroform subsurface migration in accordance with the approved work plan(s) to meet the applicable indoor air screening level. Abatement systems may include installation of a sub-slab vapor removal system or crawl space vapor removal system, sealing cracks in walls and floors of the basement, sealing or fixing drains that could be a pathway, and/or such other systems proposed by Delphi and approved by U.S. EPA. The applicable screening levels are: 1) for residential properties, including schools, the ODH recommended residential indoor air screening level; 2) for commercial properties, the ODH recommended commercial indoor air screening level; 3) for industrial properties, the ODH recommended commercial indoor air screening level. If a property has mixed use, the more stringent standard applies.

d. Implement the approved vapor abatement system performance sample plan to confirm that applicable ODH-recommended indoor air screening levels are achieved for TCE, PCE, and Chloroform following installation of the vapor abatement systems. Work will not be completed at any structure until quarterly monitoring (4 continuous quarters) for indoor air is documented less than the applicable screening levels following termination of the installed vapor abatement system operation. The OSC, in his discretion, will determine when the operation of any vapor abatement system can be terminated.

17. Work Plan and Implementation.

a. Respondent has submitted a Phase I Work Plan for performing the removal actions

described in Paragraph 16.a., c., and d. above for those locations already found to have exceeded the ODH-recommended indoor air long-term screening levels for chloroform, TCE or PCE. Within 45 days of approval of the Phase I Work Plan, Respondent shall submit to U.S. EPA for approval a draft Phase II Work plan for performing the removal action generally described in Paragraph 16 above. The draft Phase II Work Plan shall provide a description of, and an expeditious schedule for, the actions required by this Settlement Agreement.

b. U.S. EPA may approve, disapprove, require revisions to, or modify the draft Work Plan in whole or in part. If U.S. EPA requires revisions, Respondent shall submit a revised draft Work Plan within 7 business days of receipt of U.S. EPA's notification of the required revisions. Respondent shall implement the Work Plan(s) as approved in writing by U.S. EPA in accordance with the schedule approved by U.S. EPA. Once approved, or approved with modifications, the Work Plan(s), the schedule, and any subsequent modifications shall be incorporated into and become fully enforceable under this Settlement Agreement.

c. Respondent shall not commence any Work except in conformance with the terms of this Settlement Agreement. Respondent shall not commence implementation of a Work Plan(s) developed hereunder until receiving written U.S. EPA approval pursuant to Paragraph 17(b).

18. Health and Safety Plan. Respondent shall implement the approved Health and Safety Plan in the approved Work Plan(s) during the pendency of the removal action.

19. Quality Assurance and Sampling.

a. All sampling and analyses performed pursuant to this Settlement Agreement shall conform to U.S. EPA direction, approval, and guidance regarding sampling, quality assurance/quality control ("QA/QC"), data validation, and chain of custody procedures. Respondent shall ensure that the laboratory used to perform the analyses participates in a QA/QC program that complies with the appropriate U.S. EPA guidance. Respondent shall follow, as appropriate, "Quality Assurance/Quality Control Guidance for Removal Activities: Sampling QA/QC Plan and Data Validation Procedures" (OSWER Directive No. 9360.4-01, April 1, 1990), as guidance for QA/QC and sampling. Respondent shall only use laboratories that have a documented Quality System that complies with ANSI/ASQC E-4 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995), and "EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, March 2001)," or equivalent documentation as determined by U.S. EPA. U.S. EPA may consider laboratories accredited under the National Environmental Laboratory Accreditation Program ("NELAP") as meeting the Quality System requirements.

b. Upon request by U.S. EPA, Respondent shall have such a laboratory analyze samples submitted by U.S. EPA for QA monitoring. Respondent shall provide to U.S. EPA the QA/QC procedures followed by all sampling teams and laboratories performing data collection and/or analysis.

c. Upon request by U.S. EPA, Respondent shall allow U.S. EPA or its authorized representatives to take split and/or duplicate samples. Respondent shall notify U.S. EPA not less than 3 business days in advance of any sample collection activity, unless shorter notice is agreed to by U.S. EPA. U.S. EPA shall have the right to take any additional samples that U.S. EPA deems necessary. Upon request, U.S. EPA shall allow Respondent to take split or duplicate samples of any samples it takes as part of its oversight of Respondent's implementation of the Work.

20. Post-Removal Site Control. Respondent shall implement post removal Site controls pursuant to the approved Work Plan(s) and shall provide U.S. EPA with documentation of all post-removal site control arrangements.

21. Reporting.

a. Beginning with the first full month after the effective date of this Settlement Agreement, Respondent shall submit a written progress report to U.S. EPA by the 10th day of each month, concerning actions undertaken the previous month pursuant to this Settlement Agreement, until termination of this Settlement Agreement, unless otherwise directed in writing by the OSC. These reports shall describe all significant developments during the preceding period, including the actions performed and any problems encountered, analytical data received during the reporting period, and the developments anticipated during the next reporting period, including a schedule of actions to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

b. Respondent shall submit 3 copies of all plans, reports or other submissions required by this Settlement Agreement, or any approved work plan. Upon request by U.S. EPA, Respondent shall submit such documents in electronic form.

c. Respondent shall, at least 30 days prior to the conveyance of any interest in real property at the Site, give written notice to the transferee that the property is subject to this Settlement Agreement and written notice to U.S. EPA and the State of the proposed conveyance, including the name and address of the transferee. Respondent also agrees to require that its successors comply with the immediately proceeding sentence and Sections IX (Site Access) and X (Access to Information).

22. Final Report. Within 60 calendar days after completion of all Work required by Section VIII (Work To Be Performed) of this Settlement Agreement, Respondent shall submit for U.S. EPA review a final report summarizing the actions taken to comply with this Settlement Agreement. The final report shall conform, at a minimum, with the requirements set forth in Section 300.165 of the NCP entitled "OSC Reports" and with the guidance set forth in "Superfund Removal Procedures: Removal Response Reporting - POLREPS and OSC Reports" (OSWER Directive No. 9360.3-03, June 1, 1994). The final report shall include a good faith estimate of total costs or a statement of actual costs incurred in complying with the Settlement

Agreement, a listing of quantities and types of materials removed off-Site or handled on-Site under this Settlement Agreement, a discussion of removal and disposal options considered for those materials, a listing of the ultimate destination(s) of those materials, a presentation of the analytical results of all sampling and analyses performed, and accompanying appendices containing all relevant documentation generated during the removal action (*e.g.*, manifests, invoices, bills, contracts, and permits). The final report shall also include the following certification signed by a person who supervised or directed the preparation of that report:

> "Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

23. Off-Site Shipments.

a. For work at the Site authorized under this Settlement Agreement, Respondent shall, prior to any off-Site shipment of Waste Material from the Site to an out-of-state waste management facility, provide written notification of such shipment of Waste Material to the appropriate state environmental official in the receiving facility's state and to the On-Scene Coordinator. However, this notification requirement shall not apply to any off-Site shipments when the total volume of all such shipments will not exceed 10 cubic yards.

i. Respondent shall include in the written notification the following information: 1) the name and location of the facility to which the Waste Material is to be shipped; 2) the type and quantity of the Waste Material to be shipped; 3) the expected schedule for the shipment of the Waste Material; and 4) the method of transportation. Respondent shall notify the state in which the planned receiving facility is located of major changes in the shipment plan, such as a decision to ship the Waste Material to another facility within the same state, or to a facility in another state.

ii. The identity of the receiving facility and state will be determined by Respondent following the award of the contract for the removal action. Respondent shall provide the information required by Paragraph 23(a) and 23(b) as soon as practicable after the award of the contract and before the Waste Material is actually shipped.

b. Before shipping any hazardous substances, pollutants, or contaminants from work conducted at the Site authorized under this Settlement Agreement to an off-site location, Respondent shall obtain U.S. EPA's certification that the proposed receiving facility is operating in compliance with the requirements of CERCLA Section 121(d)(3), 42 U.S.C. § 9621(d)(3), and 40 C.F.R. § 300.440. Respondent shall only send hazardous substances, pollutants, or

contaminants from the Site to an off-site facility that complies with the requirements of the statutory provision and regulation cited in the preceding sentence.

IX. SITE ACCESS

24. If the Site, or any other property where access is needed to implement this Settlement Agreement, is owned or controlled by Respondent, Respondent shall, commencing on the Effective Date, provide U.S. EPA, the State, and their representatives, including contractors, with access at all reasonable times to the Site, or such other property, for the purpose of conducting any activity related to this Settlement Agreement.

25. Where any action under this Settlement Agreement is to be performed in areas owned by or in possession of someone other than Respondent, Respondent, within 10 business days after the date the OSC determines that access to a particular property is necessary, or as otherwise specified in writing by the OSC, shall use its best efforts as approved by U.S. EPA to obtain all necessary access agreements. Respondent shall immediately notify U.S. EPA if after using its best efforts it is unable to obtain such agreements. For purposes of this Paragraph, "best efforts" includes the payment of reasonable sums of money in consideration of access. Respondent shall describe in writing its efforts to obtain access. U.S. EPA may then assist Respondent in gaining access, to the extent necessary to effectuate the response actions described herein, using such means as U.S. EPA deems appropriate. Respondent shall reimburse U.S. EPA for all costs and attorney's fees incurred by the United States in obtaining such access, in accordance with the procedures in Section XV (Payment of Response Costs).

26. Notwithstanding any provision of this Settlement Agreement, U.S. EPA and the State retain all of their access authorities and rights, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

X. ACCESS TO INFORMATION

27. Respondent shall provide to U.S. EPA, upon request, copies of all documents and information within its possession or control or that of its contractors or agents relating to activities at the Site or to the implementation of this Settlement Agreement, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondent shall also make available to U.S. EPA, for purposes of investigation, information gathering, or testimony, its employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

28. Respondent may assert business confidentiality claims covering part or all of the documents or information submitted to U.S. EPA under this Settlement Agreement to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C.§ 9604(e)(7), and 40 C.F.R.§ 2.203(b). Documents or information determined to be confidential by U.S. EPA will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality

accompanies documents or information when they are submitted to U.S. EPA, or if U.S. EPA has notified Respondent that the documents or information are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such documents or information without further notice to Respondent.

29. Respondent may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If the Respondent asserts such a privilege in lieu of providing documents, it shall provide U.S. EPA with the following: 1) the title of the document, record, or information; 2) the date of the document, record, or information; 3) the name and title of the author of the document, record, or information; 4) the name and title of each addressee and recipient; 5) a description of the contents of the document, record, or information; and 6) the privilege asserted by Respondent. However, no documents, reports or other information created or generated pursuant to the requirements of this Settlement Agreement shall be withheld on the grounds that they are privileged.

30. No claim of confidentiality shall be made with respect to any data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other documents or information evidencing conditions at or around the Site.

XI. RECORD RETENTION

31. Until 6 years after Respondent's receipt of U.S. EPA's notification pursuant to Section XXVI (Notice of Completion of Work), Respondent shall preserve and retain all non-identical copies of records and documents (including records or documents in electronic form) now in its possession or control or which come into its possession or control that relate in any manner to the performance of the Work or the liability of any person under CERCLA with respect to the Site, regardless of any corporate retention policy to the contrary. Until 6 years after Respondent's receipt of U.S. EPA's notification pursuant to Section XXVI (Notice of Completion of Work), Respondent shall also instruct its contractors and agents to preserve all documents, records, and information of whatever kind, nature or description relating to performance of the Work.

32. At the conclusion of this document retention period, Respondent shall notify U.S. EPA at least 60 days prior to the destruction of any such records or documents, and, upon request by U.S. EPA, Respondent shall deliver any such records or documents to U.S. EPA. Respondent may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Respondent asserts such a privilege, it shall provide U.S. EPA with the following: 1) the title of the document, record, or information; 2) the date of the document, record, or information; 3) the name and title of the author of the document, record, or information; 4) the name and title of each addressee and recipient; 5) a description of the subject of the document, record, or information; and 6) the privilege asserted by Respondent. However, no documents, reports or other

information created or generated pursuant to the requirements of this Settlement Agreement shall be withheld on the grounds that they are privileged.

33. Respondent hereby certifies that to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information (other than identical copies) relating to its potential liability regarding the Site since notification of potential liability by U.S. EPA or the State or the filing of suit against it regarding the Site and that it has fully complied and will fully comply with any and all U.S. EPA requests for information pursuant to Sections 104(e) and 122(e) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. § 6927.

XII. COMPLIANCE WITH OTHER LAWS

34. Respondent shall perform all actions required pursuant to this Settlement Agreement in accordance with all applicable local, state, and federal laws and regulations except as provided in Section 121(e) of CERCLA, 42 U.S.C. § 6921(e), and 40 C.F.R. §§ 300.400(e) and 300.415(j).

In accordance with 40 C.F.R. § 300.415(j), all on-Site actions required pursuant to this Settlement Agreement shall, to the extent practicable, as determined by U.S. EPA, considering the exigencies of the situation, attain applicable or relevant and appropriate requirements ("ARARs") under federal environmental or state environmental or facility siting laws. Respondent shall identify ARARs in the Work Plan subject to U.S. EPA approval.

XIII. EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES

35. In the event of any action or occurrence during performance of the Work which causes or threatens a release of Waste Material from the Site that constitutes an emergency situation or may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action. Respondent shall take these actions in accordance with all applicable provisions of this Settlement Agreement, including, but not limited to, the Health and Safety Plan, in order to prevent, abate or minimize such release or endangerment caused or threatened by the release. Respondent shall also immediately notify the OSC or, in the event of his/her unavailability, the Regional Duty Officer, Emergency Response Branch, Region 5 at (312) 353-2318, of the incident or Site conditions. In the event that Respondent fails to take appropriate response action as required by this Paragraph, and U.S. EPA takes such action instead, Respondent shall reimburse U.S. EPA all costs of the response action consistent with the NCP pursuant to Section XV (Payment of Response Costs).

36. In addition, in the event of any release of a hazardous substance from the Site, Respondent shall immediately notify the OSC at (312) 353-2318 and the National Response Center at (800) 424-8802. Respondent shall submit a written report to U.S. EPA within 7 business days after each release, setting forth the events that occurred and the measures taken or to be taken to mitigate any release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release. This reporting requirement is in addition to, and not

in lieu of, reporting under Section 103(c) of CERCLA, 42 U.S.C. § 9603(c), and Section 304 of the Emergency Planning and Community Right-To-Know Act of 1986, 42 U.S.C. § 11004, *et seq.*

XIV. AUTHORITY OF ON-SCENE COORDINATOR

37. The OSC shall be responsible for overseeing Respondent's implementation of this Settlement Agreement. The OSC shall have the authority vested in an OSC by the NCP, including the authority to halt, conduct, or direct any Work required by this Settlement Agreement, or to direct any other removal action undertaken at the Site. Absence of the OSC from the Site shall not be cause for stoppage of work unless specifically directed by the OSC.

XV. PAYMENT OF RESPONSE COSTS

38. Payment for Past Response Costs.

a. Within 60 days after the Effective Date, Respondent shall pay to U.S. EPA $1,696.61 for Past Response Costs. Payment shall be made to U.S. EPA electronically by either Electronic Funds Transfer ("EFT"), payment via the Automated Clearinghouse (ACH) for U. S. currency, or payment on line at the U. S. Department of Treasury website (www.pay.gov) in accordance with current procedures that U.S. EPA Region 5 will provide Respondents, and shall be accompanied by a statement identifying the name and address of the party making payment, the Site name, U.S. EPA Region 5, the Site/Spill ID Number B5KG and, if any, the U.S. EPA docket number for this action.

The fedwire message and payment should be sent to:
Federal Reserve Bank of New York
ABA = 021030004
Account = 68010727
SWIFT address = FRNYUS33
33 Liberty Street
New York NY 10045
The Field Tag 4200 of the Fedwire message should read " D 68010727 Environmental Protection Agency "

Payments via ACH are to:
PNC Bank
808 17th Street, NW
Washington, DC 20074
Contact – Jesse White 301-887-6548
ABA = 051036706
Transaction Code 22 - checking
Environmental Protection Agency
Account 310006

CTX Format

Payment via www.pay.gov should be by a form found by entry of "sfo 1.1" in a search entry box available on the website.

When the Past Response Costs identified in the above Paragraph are less than $10,000, payment may, in lieu of the described EFT method, be made by certified or cashier's check made payable to "U.S. EPA Hazardous Substance Superfund". Each check, or a letter accompanying each check, shall identify the name and address of the party making payment, the Site name, U.S. EPA Region 5, the Site/Spill ID Number B5KG, and, if any, the U.S. EPA docket number for this action, and shall be sent to:

US Environmental Protection Agency
Superfund Payments
Cincinnati Finance Center
PO Box 979076
St. Louis, MO 63197-9000

b. At the time of payment, Respondent shall send notice that such payment has been made to the Director, Superfund Division, U.S. EPA Region 5, 77 West Jackson Blvd., Chicago, Illinois, 60604-3590 and to Maria Gonzalez, Associate Regional Counsel, 77 West Jackson Boulevard, C-14J, Chicago, Illinois, 60604-3590.

c. The total amount to be paid by Respondent pursuant to Paragraph 38(a) shall be deposited in the Delphi VOC Plume Site Special Account within the U.S. EPA Hazardous Substance Superfund to be retained and used to conduct or finance response actions at or in connection with the Site, or to be transferred by U.S. EPA to the U.S. EPA Hazardous Substance Superfund.

39. Payments for Future Response Costs.

a. Respondent shall pay U.S. EPA all Future Response Costs consistent with the NCP. On a periodic basis, U.S. EPA will send Respondent a bill requiring payment that consists of an Itemized Cost Summary. Respondent shall make all payments within 60 calendar days of receipt of each bill requiring payment, except as otherwise provided in Paragraph 41 of this Settlement Agreement according to the following procedures

i. If the payment amount demanded in the bill is for $10,000 or greater, payment shall be made to U.S. EPA electronically by either an Electronic Funds Transfer ("EFT"), via the Automated Clearinghouse for U.S. currency, or online payment via the U.S. Department of Treasury website (www.pay.gov) in accordance with procedures that U.S. EPA will provide to Respondent. Payment shall be accompanied by a statement identifying the name and address of the party making payment, the Site

name, U.S. EPA Region 5, the Site/Spill ID Number B5KG, and, if any, the U.S. EPA docket number for this action.

ii. If the amount demanded in the bill is $10,000 or less, Respondent may, in lieu of the procedures in subparagraph 39(a)(i), make all payments required by this Paragraph by a certified or cashier's check or checks made payable to "EPA Hazardous Substance Superfund", referencing the name and address of the party making the payment, the Site name, U.S. EPA Region 5, the Site/Spill ID Number B5KG, and, if any, the U.S. EPA docket number for this action. Respondent shall send the check(s) to:

US Environmental Protection Agency
Superfund Payments
Cincinnati Finance Center
PO Box 979076
St. Louis, MO 63197-9000

b. At the time of payment, Respondent shall send notice that payment has been made to the Director, Superfund Division, U.S. EPA Region 5, 77 West Jackson Blvd., Chicago, Illinois, 60604-3590 and to Maria Gonzalez, Associate Regional Counsel, 77 West Jackson Boulevard, C-14J, Chicago, Illinois, 60604-3590.

c. The total amount to be paid by Respondent pursuant to Paragraph 39(a) shall be deposited in the Delphi VOC Plume Site Special Account within the U.S. EPA Hazardous Substance Superfund to be retained and used to conduct or finance response actions at or in connection with the Site, or to be transferred by U.S. EPA to the U.S. EPA Hazardous Substance Superfund.

40. In the event that the payment for Past Response Costs is not made within 60 days of the Effective Date, or the payments for Future Response Costs are not made within 60 days of Respondent's receipt of a bill, Respondent shall pay Interest on the unpaid balance. The Interest on Past Response Costs shall begin to accrue on the Effective Date and shall continue to accrue until the date of payment. The Interest on Future Response Costs shall begin to accrue on the date of the bill and shall continue to accrue until the date of payment. Payments of Interest made under this Paragraph shall be in addition to such other remedies or sanctions available to the United States by virtue of Respondent's failure to make timely payments under this Section, including but not limited to, payment of stipulated penalties pursuant to Section XVIII (Stipulated Penalties).

41. Respondent may dispute all or part of a bill for Future Response Costs submitted under this Settlement Agreement, only if Respondent alleges that U.S. EPA has made an accounting error, or if Respondent alleges that a cost item is inconsistent with the NCP. If any dispute over costs is resolved before payment is due, the amount due will be adjusted as necessary. If the dispute is not resolved before payment is due, Respondent shall pay the full amount of the uncontested costs to U.S. EPA as specified in Paragraph 39 on or before the due date. Within the

same time period, Respondent shall pay the full amount of the contested costs into an interest-bearing escrow account. Respondent shall simultaneously transmit a copy of both checks to the persons listed in Paragraph 39(b) above. Respondent shall ensure that the prevailing party or parties in the dispute shall receive the amount upon which they prevailed from the escrow funds plus interest within 20 calendar days after the dispute is resolved.

XVI. DISPUTE RESOLUTION

42. Unless otherwise expressly provided for in this Settlement Agreement, the dispute resolution procedures of this Section shall be the exclusive mechanism for resolving disputes arising under this Settlement Agreement. The Parties shall attempt to resolve any disagreements concerning this Settlement Agreement expeditiously and informally.

43. If Respondent objects to any U.S. EPA action taken pursuant to this Settlement Agreement, including billings for Future Response Costs, it shall notify U.S. EPA in writing of its objection(s) within 21 calendar days of receipt of notification of such action, unless the objection(s) has/have been resolved informally. This written notice shall include a statement of the issues in dispute, the relevant facts upon which the dispute is based, all factual data, analysis or opinion supporting Respondent's position, and all supporting documentation on which such party relies. U.S. EPA shall provide its Statement of Position, including supporting documentation, no later than 21 calendar days after receipt of the written notice of dispute. In the event that these 21-day time periods for exchange of written documents may cause a delay in the work, they shall be shortened upon, and in accordance with, notice by U.S. EPA. The time periods for exchange of written documents relating to disputes over billings for response costs may be extended at the sole discretion of U.S. EPA. An administrative record of any dispute under this Section shall be maintained by U.S. EPA. The record shall include the written notification of such dispute, and the Statement of Position served pursuant to the preceding Paragraph. Upon review of the administrative record, the Director of the Superfund Division, U.S. EPA Region 5, shall resolve the dispute consistent with the NCP and the terms of this Settlement Agreement.

44. Respondent's obligations under this Settlement Agreement shall not be tolled by submission of any objection for dispute resolution under this Section. Following resolution of the dispute, as provided by this Section, Respondent shall fulfill the requirement that was the subject of the dispute in accordance with the agreement reached or with U.S. EPA's decision, whichever occurs.

XVII. FORCE MAJEURE

45. Respondent agrees to perform all requirements of this Settlement Agreement within the time limits established under this Settlement Agreement, unless the performance is delayed by a *force majeure*. For purposes of this Settlement Agreement, a *force majeure* is defined as any event arising from causes beyond the control of Respondent, or of any entity controlled by Respondent, including but not limited to their contractors and subcontractors, which delays or prevents performance of any obligation under this Settlement Agreement despite Respondent's best efforts

to fulfill the obligation. *Force majeure* does not include financial inability to complete the Work or increased cost of performance.

46. If any event occurs or has occurred that may delay the performance of any obligation under this Settlement Agreement, whether or not caused by a *force majeure* event, Respondent shall notify U.S. EPA orally within 24 hours of when Respondent first knew that the event might cause a delay. Within 7 calendar days thereafter, Respondent shall provide to U.S. EPA in writing an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Respondent's rationale for attributing such delay to a *force majeure* event if they intend to assert such a claim; and a statement as to whether, in the opinion of Respondent, such event may cause or contribute to an endangerment to public health, welfare or the environment. Failure to comply with the above requirements shall be grounds for U.S. EPA to deny Respondent an extension of time for performance. Respondent shall have the burden of demonstrating by a preponderance of the evidence that the event is a force majeure, that the delay is warranted under the circumstances, and that best efforts were exercised to avoid and mitigate the effects of the delay.

47. If U.S. EPA agrees that the delay or anticipated delay is attributable to a *force majeure* event, the time for performance of the obligations under this Settlement Agreement that are affected by the *force majeure* event will be extended by U.S. EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the *force majeure* event shall not, of itself, extend the time for performance of any other obligation. If U.S. EPA does not agree that the delay or anticipated delay has been or will be caused by a *force majeure* event, U.S. EPA will notify Respondent in writing of its decision. If U.S. EPA agrees that the delay is attributable to a *force majeure* event, U.S. EPA will notify Respondent in writing of the length of the extension, if any, for performance of the obligations affected by the *force majeure* event.

XVIII. STIPULATED PENALTIES

48. Respondent shall be liable to U.S. EPA for stipulated penalties in the amounts set forth in Paragraphs 49 and 50 for failure to comply with the requirements of this Settlement Agreement specified below, unless excused under Section XVII (Force Majeure). "Compliance" by Respondent shall include completion of the activities under this Settlement Agreement or any work plan or other plan approved under this Settlement Agreement identified below in accordance with all applicable requirements of this Settlement Agreement within the specified time schedules established by and approved under this Settlement Agreement.

49. Stipulated Penalty Amounts - Work.

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 49(b):

Penalty Per Violation Per Day	Period of Noncompliance
$1,000	1st through 14th day
$2,500	15th through 30th day
$5,000	31st day and beyond

b. Compliance Milestones
Designation of Respondent=s Contractor
Designation of Respondent=s Project Coordinator
Submission of Work Plan(s)
Initiation of Work
Completion of Post-Removal Site Controls

50. Stipulated Penalty Amounts - Reports. The following stipulated penalties shall accrue per violation per day for failure to submit timely or adequate reports or other written documents pursuant to Paragraphs 17-22:

Penalty Per Violation Per Day	Period of Noncompliance
$500	1st through 14th day
$1,000	15th through 30th day
$2,500	31st day and beyond

51. All penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs, and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: 1) with respect to a deficient submission under Section VIII (Work to be Performed), during the period, if any, beginning on the 31st day after U.S. EPA's receipt of such submission until the date that U.S. EPA notifies Respondent of any deficiency; and 2) with respect to a decision by the Director of the Superfund Division, Region 5, under Paragraph 41 of Section XVI (Dispute Resolution), during the period, if any, beginning on the 21st day after U.S. EPA submits its written statement of position until the date that the Director of the Superfund Division issues a final decision regarding such dispute. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Settlement Agreement.

52. Following U.S. EPA's determination that Respondent has failed to comply with a requirement of this Settlement Agreement, U.S. EPA may give Respondent written notification of the failure and describe the noncompliance. U.S. EPA may send Respondent a written demand for payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether U.S. EPA has notified Respondent of a violation.

53. All penalties accruing under this Section shall be due and payable to U.S. EPA within 30 days of Respondent's receipt from U.S. EPA of a demand for payment of the penalties, unless Respondent invokes the dispute resolution procedures under Section XVI (Dispute Resolution). Payments to U.S. EPA under this Section shall be made payable to "U.S. EPA Hazardous

Substances Superfund," and shall either be paid electronically as provided in Section XV or by check mailed to:

US Environmental Protection Agency
Superfund Payments
Cincinnati Finance Center
PO Box 979076
St. Louis, MO 63197-9000

Payment shall indicate that the payment is for stipulated penalties, and shall reference the U.S. EPA Site/Spill ID Number B5KG, the U.S. EPA Docket Number, and the name and address of the party making payment. Copies of check(s) paid pursuant to this Section, and any accompanying transmittal letter(s), shall be sent to U.S. EPA as provided in Paragraph 39(b).

54. The payment of penalties shall not alter in any way Respondent's obligation to complete performance of the Work required under this Settlement Agreement.

55. Penalties shall continue to accrue during any dispute resolution period, but need not be paid until 20 days after the dispute is resolved by agreement or by receipt of U.S. EPA's decision.

56. If Respondent fails to pay stipulated penalties when due, U.S. EPA may institute proceedings to collect the penalties, as well as Interest. Respondent shall pay Interest on the unpaid balance, which shall begin to accrue on the date of demand made pursuant to Paragraph 53. Nothing in this Settlement Agreement shall be construed as prohibiting, altering, or in any way limiting the ability of U.S. EPA to seek any other remedies or sanctions available by virtue of Respondent's violation of this Settlement Agreement or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Sections 106(b) and 122(*l*) of CERCLA, 42 U.S.C. §§ 9606(b) and 9622(*l*), and punitive damages pursuant to Section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3). Provided, however, that U.S. EPA shall not seek civil penalties pursuant to Section 106(b) or 122(*l*) of CERCLA or punitive damages pursuant to Section 107(c)(3) of CERCLA for any violation for which a stipulated penalty is provided herein, except in the case of a willful violation of this Settlement Agreement. Should Respondent violate this Settlement Agreement or any portion hereof, U.S. EPA may carry out the required actions unilaterally, pursuant to Section 104 of CERCLA, 42 U.S.C. § 9604, and/or may seek judicial enforcement of this Settlement Agreement pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606. Notwithstanding any other provision of this Section, U.S. EPA may, in its unreviewable discretion, waive in writing any portion of stipulated penalties that have accrued pursuant to this Settlement Agreement.

XIX. COVENANT NOT TO SUE BY U.S. EPA

57. In consideration of the actions that will be performed and the payments that will be made by Respondent under the terms of this Settlement Agreement, and except as otherwise specifically provided in this Settlement Agreement, U.S. EPA covenants not to sue or to take

administrative action against Respondent or its successors or assigns pursuant to Sections 106 and 107(a) of CERCLA, 42 U.S.C. §§ 9606 and 9607(a), for the Work, Past Response Costs, and Future Response Costs. This covenant not to sue shall take effect upon receipt by U.S. EPA of the Past Response Costs due under Section XV (Payment of Response Costs) of this Settlement Agreement and any Interest or Stipulated Penalties due for failure to pay Past Response Costs as required by Sections XV (Payment of Response Costs) and XVIII (Stipulated Penalties) of this Settlement Agreement. This covenant not to sue is conditioned upon the complete and satisfactory performance by Respondent, and its successors or assigns of their obligations under this Settlement Agreement, including, but not limited to, performance of the Work and payment of Future Response Costs pursuant to Section XV (Payment of Response Costs). This covenant not to sue extends only to Respondent and does not extend to any other person.

XX. RESERVATIONS OF RIGHTS BY U.S. EPA

58. Except as specifically provided in this Settlement Agreement, nothing herein shall limit the power and authority of U.S. EPA or the United States to take, direct, or order all actions necessary to protect public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances, pollutants or contaminants, or hazardous or solid waste on, at, or from the Site. Further, nothing herein shall prevent U.S. EPA from seeking legal or equitable relief to enforce the terms of this Settlement Agreement. U.S. EPA also reserves the right to take any other legal or equitable action as it deems appropriate and necessary, or to require the Respondent in the future to perform additional activities pursuant to CERCLA or any other applicable law.

59. The covenant not to sue set forth in Section XIX (Covenant Not to Sue by U.S. EPA) above does not pertain to any matters other than those expressly identified therein. U.S. EPA reserves, and this Settlement Agreement is without prejudice to, all rights against Respondent with respect to all other matters, including, but not limited to:

a. claims based on a failure by Respondent to meet a requirement of this Settlement Agreement;

b. liability for costs not included within the definitions of Past Response Costs or Future Response Costs;

c. liability for performance of response action other than the Work;

d. criminal liability;

e. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

f. liability arising from the past, present, or future disposal, release or threat of release of Waste Materials outside of the Site; and

g. liability for costs incurred or to be incurred by the Agency for Toxic Substance and Disease Registry related to the Site.

XXI. COVENANT NOT TO SUE BY RESPONDENT

60. Respondent covenants not to sue and agree not to assert any claims or causes of action against the United States, or its contractors or employees, with respect to the Work, Past Response Costs, Future Response Costs, or this Settlement Agreement, including, but not limited to:

a. any direct or indirect claim for reimbursement from the Hazardous Substance Superfund established by 26 U.S.C. § 9507, based on Sections 106(b)(2), 107, 111, 112, or 113 of CERCLA, 42 U.S.C. §§ 9606(b)(2), 9607, 9611, 9612, or 9613, or any other provision of law;

b. any claim arising out of response actions at or in connection with the Site, including any claim under the United States Constitution, the Ohio Constitution, the Tucker Act, 28 U.S.C. § 1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, as amended, or at common law; or

c. any claim against the United States pursuant to Sections 107 and 113 of CERCLA, 42 U.S.C. §§ 9607 and 9613, relating to the Site.

These covenants not to sue shall not apply in the event the United States brings a cause of action or issues an order pursuant to the reservations set forth in Paragraphs 59 (b), (c), and (e) - (g), but only to the extent that Respondent's claims arise from the same response action, response costs, or damages that the United States is seeking pursuant to the applicable reservation.

61. Nothing in this Agreement shall be deemed to constitute approval or preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

XXII. OTHER CLAIMS

62. By issuance of this Settlement Agreement, the United States and U.S. EPA assume no liability for injuries or damages to persons or property resulting from any acts or omissions of Respondent. The United States or U.S. EPA shall not be deemed a party to any contract entered into by Respondent or its directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out actions pursuant to this Settlement Agreement.

63. Except as expressly provided in Section XXI (Covenant Not to Sue by Respondent), and Section XIX (Covenant Not to Sue by U.S. EPA), nothing in this Settlement Agreement constitutes a satisfaction of or release from any claim or cause of action against Respondent or any person not a party to this Settlement Agreement, for any liability such person may have under CERCLA, other statutes, or common law, including but not limited to any claims of the United States for costs, damages and interest under Sections 106 and 107 of CERCLA, 42 U.S.C. §§ 9606 and 9607.

64. No action or decision by U.S. EPA pursuant to this Settlement Agreement shall give rise to any right to judicial review, except as set forth in Section 113(h) of CERCLA, 42 U.S.C. § 9613(h).

XXIII. CONTRIBUTION PROTECTION

65.a. The Parties agree that this Settlement Agreement constitutes an administrative settlement for purposes of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2), and that Respondent is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Sections 113(f)(2) and 122(h)(4) of CERCLA, 42 U.S.C. §§ 9613(f)(2) and 9622(h)(4), for "matters addressed" in this Settlement Agreement. The "matters addressed" in this Settlement Agreement are the Work, Past Response Costs, and Future Response Costs.

b. The Parties agree that this Settlement Agreement constitutes an administrative settlement for purposes of Section 113(f)(3)(B) of CERCLA, 42. U.S.C. § 9613(f)(3)(B), pursuant to which the Respondent has, as of the Effective Date, resolved its liability to the United States for the Work, Past Response Costs, and Future Response Costs.

c. Except as provided in Section XXI (Covenant Not To Sue By Respondent), nothing in this Settlement Agreement precludes the United States or Respondent from asserting any claims, causes of action, or demands for indemnification, contribution, or cost recovery against any persons not parties to this Settlement Agreement. Nothing herein diminishes the right of the United States, pursuant to Section 113(f)(2)and (3), 42 U.S.C. § 9613(f)(2) and (3), to pursue any such persons to obtain additional response costs or response action, and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2).

XXIV. INDEMNIFICATION

66. Respondent shall indemnify, save and hold harmless the United States, its officials, agents, contractors, subcontractors, employees and representatives from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, or subcontractors, in carrying out actions pursuant to this Settlement Agreement. In addition, Respondent agrees to pay the United States all costs incurred by the United States, including but not limited to attorneys fees and other expenses of litigation and settlement, arising from or on account of claims made against the United States based on negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, subcontractors and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Settlement Agreement. The United States shall not be held out as a party to any contract entered into by or on behalf of Respondent in carrying out activities pursuant to this Settlement Agreement. Neither Respondent nor any such contractor shall be considered an agent of the United States. The Federal Tort Claims Act (28 U.S.C. §§ 2671, 2680) provides coverage for injury or loss of property, or injury or death caused by the negligent or wrongful act or omission of an employee of U.S. EPA while acting within the scope of his or her employment, under circumstances where U.S. EPA, if a private person, would be liable to the

claimant in accordance with the law of the place where the act or omission occurred.

67. The United States shall give Respondent notice of any claim for which the United States plans to seek indemnification pursuant to this Section and shall consult with Respondent prior to settling such claim.

68. Respondent waives all claims against the United States for damages or reimbursement or for set-off of any payments made or to be made to the United States, arising from or on account of any contract, agreement, or arrangement between Respondent and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays. In addition, Respondent shall indemnify and hold harmless the United States with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between Respondent and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays.

XXV. MODIFICATIONS

69. The OSC may make modifications to any plan or schedule in writing or by oral direction not inconsistent with the NCP. Any oral modification will be memorialized in writing by U.S. EPA promptly, but shall have as its effective date the date of the OSC's oral direction. Any other requirements of this Settlement Agreement may be modified in writing by mutual agreement of the parties.

70. If Respondent seeks permission to deviate from any approved work plan or schedule, Respondent's Project Coordinator shall submit a written request to U.S. EPA for approval outlining the proposed modification and its basis. Respondent may not proceed with the requested deviation until receiving oral or written approval from the OSC pursuant to Paragraph 69.

71. No informal advice, guidance, suggestion, or comment by the OSC or other U.S. EPA representatives regarding reports, plans, specifications, schedules, or any other writing submitted by Respondent shall relieve Respondent of its obligation to obtain any formal approval required by this Settlement Agreement, or to comply with all requirements of this Settlement Agreement, unless it is formally modified.

XXVI. NOTICE OF COMPLETION OF WORK

72. When U.S. EPA determines, after U.S. EPA's review of the Final Report, that all Work has been fully performed in accordance with this Settlement Agreement, with the exception of any continuing obligations required by this Settlement Agreement, including, *e.g.*, post-removal site controls, payment of Future Response Costs, and record retention, U.S. EPA will provide written notice to Respondent. If U.S. EPA determines that any such Work has not been completed in accordance with this Settlement Agreement, U.S. EPA will notify Respondent, provide a list of the deficiencies, and require that Respondent modify the Work Plan if appropriate in order to correct such deficiencies. Respondent shall implement the modified and approved Work Plan and shall

submit a modified Final Report in accordance with the U.S. EPA notice. Failure by Respondent to implement the approved modified Work Plan shall be a violation of this Settlement Agreement.

XXVII. FINANCIAL ASSURANCE

73. Within 30 days of the Effective Date, Respondent shall establish and maintain financial security in the amount of $162,410 in one or more of the following forms:

a. A surety bond guaranteeing performance of the Work;

b. One or more irrevocable letters of credit;

c. A trust fund;

d. A guarantee to perform the Work by one or more parent corporations or subsidiaries, or by one or more unrelated corporations that have a substantial business relationship with Respondent; or

e. A demonstration that Respondent satisfies the requirements of 40 C.F.R. Part 264.143(f). {NOTE: For these purposes, references in 40 C.F.R. § 264.143(f) to the "sum of current closure and post-closure costs estimates and the current plugging and abandonment costs estimates" shall mean the amount of financial security specified above. If a Respondent who seeks to provide a demonstration under 40 C.F.R. § 264.143(f) has provided a similar demonstration at other RCRA or CERCLA sites, the amount for which they are providing financial assurance at those other sites should generally be added to the estimated costs of the Work for this Paragraph.}

74. If Respondent seeks to demonstrate the ability to complete the Work through a guarantee by a third party pursuant to Paragraph 73(d) of this Section, Respondent shall demonstrate that the guarantor satisfies the requirements of 40 C.F.R. Part 264.143(f). If Respondent seeks to demonstrate their ability to complete the Work by means of the financial test or the corporate guarantee pursuant to Paragraph 73(d) or (e) of this Section, it shall resubmit sworn statements conveying the information required by 40 C.F.R. Part 264.143(f) annually, on the anniversary of the Effective Date. In the event that U.S. EPA determines at any time that the financial assurances provided pursuant to this Section are inadequate, Respondent shall, within 30 days of receipt of notice of U.S. EPA's determination, obtain and present to U.S. EPA for approval one of the other forms of financial assurance listed in Paragraph 73 of this Section. Respondent's inability to demonstrate financial ability to complete the Work shall not excuse performance of any activities required under this Settlement Agreement.

75. If, after the Effective Date, Respondent can show that the estimated cost to complete the remaining Work has diminished below the amount set forth in Paragraph 73 of this Section, Respondent may, on any anniversary date of the Effective Date, or at any other time agreed to by the Parties, reduce the amount of the financial security provided under this Section to the estimated cost of the remaining Work to be performed. Respondent shall submit a proposal for such reduction to

U.S. EPA, in accordance with the requirements of this Section, and may reduce the amount of the security upon approval by U.S. EPA. In the event of a dispute, Respondent may reduce the amount of the security in accordance with the written decision resolving the dispute.

76. Respondent may change the form of financial assurance provided under this Section at any time, upon notice to and approval by U.S. EPA, provided that the new form of assurance meets the requirements of this Section. In the event of a dispute, Respondent may change the form of the financial assurance only in accordance with the written decision resolving the dispute.

XXVIII. INSURANCE

77. At least 7 days prior to commencing any on-Site work under this Settlement Agreement, Respondent shall secure, and shall maintain for the duration of this Settlement Agreement, comprehensive general liability insurance and automobile insurance with limits of five million dollars, combined single limit. Within the same time period, Respondent shall provide U.S. EPA with certificates of such insurance and a copy of each insurance policy. In addition, for the duration of the Settlement Agreement, Respondent shall satisfy, or shall ensure that their contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the Work on behalf of Respondent in furtherance of this Settlement Agreement. If Respondent demonstrates by evidence satisfactory to U.S. EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering some or all of the same risks but in an equal or lesser amount, then Respondent need provide only that portion of the insurance described above which is not maintained by such contractor or subcontractor.

XXIX. SEVERABILITY/INTEGRATION

78. If a court issues an order that invalidates any provision of this Settlement Agreement or finds that Respondent has sufficient cause not to comply with one or more provisions of this Settlement Agreement, Respondent shall remain bound to comply with all provisions of this Settlement Agreement not invalidated or determined to be subject to a sufficient cause defense by the court's order.

79. This Settlement Agreement constitutes the final, complete and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Settlement Agreement. The parties acknowledge that there are no representations, agreements or understandings relating to the settlement other than those expressly contained in this Settlement Agreement.

XXX. EFFECTIVE DATE

80. This Settlement Agreement shall be effective upon receipt by Respondent of a copy of this Settlement Agreement signed by the Director, Superfund Division, U.S. EPA Region 5.

The undersigned representatives of Respondent each certify that they are fully authorized to enter into the terms and conditions of this Settlement Agreement and to bind the party they represent to this document.

Agreed this 25 day of OCTOBER, 2007.

For Respondent

By Karen A Healy

Title VP- CORPORATE AFFAIRS, MARKETING + OSC

IN THE MATTER OF:

DELPHI VOC PLUME SITE
DAYTON, OHIO

It is so ORDERED and Agreed this _____ day of _____, 2007.

BY: _____
Richard C. Karl Director
Superfund Division
United States Environmental Protection Agency
Region 5

APPENDIX B

Vapor Intrusion Study Approach, Delphi Home Avenue Facility

Vapor Intrusion Study Approach
Delphi Home Avenue Facility

Overview

A vapor intrusion study will be implemented to evaluate the potential for vapor intrusion into indoor air at properties in the vicinity of the Site. This study will include the use of exterior soil gas surveys to map areas surrounding the Site to focus the subsequent indoor air quality evaluation. Based on the results of the initial soil gas survey, the survey area may be expanded outward from the site. If soil gas concentrations indicate a potential concern associated with the vapor migration pathway, then properties will be identified for supplemental soil gas sampling.

Locations for the initial survey are shown on the attached figure.

Implementation

- Collect soil gas data within neighboring residential areas
- Compare soil gas data with conservative screening criteria
- Based on screening results identify locations for follow-up sampling
    - Gather information on building characteristics & local soil lithology
    - Categorize survey areas into three types: 1) no further action; 2) building characterization required to determine need for further sampling; and 3) supplemental soil gas sampling required.

- Supplemental soil gas sampling will be conducted from immediately adjacent to building foundation, as needed.
- Based on screening results for supplemental soil gas sampling, identify buildings for further evaluation.

Developing Screening Criteria

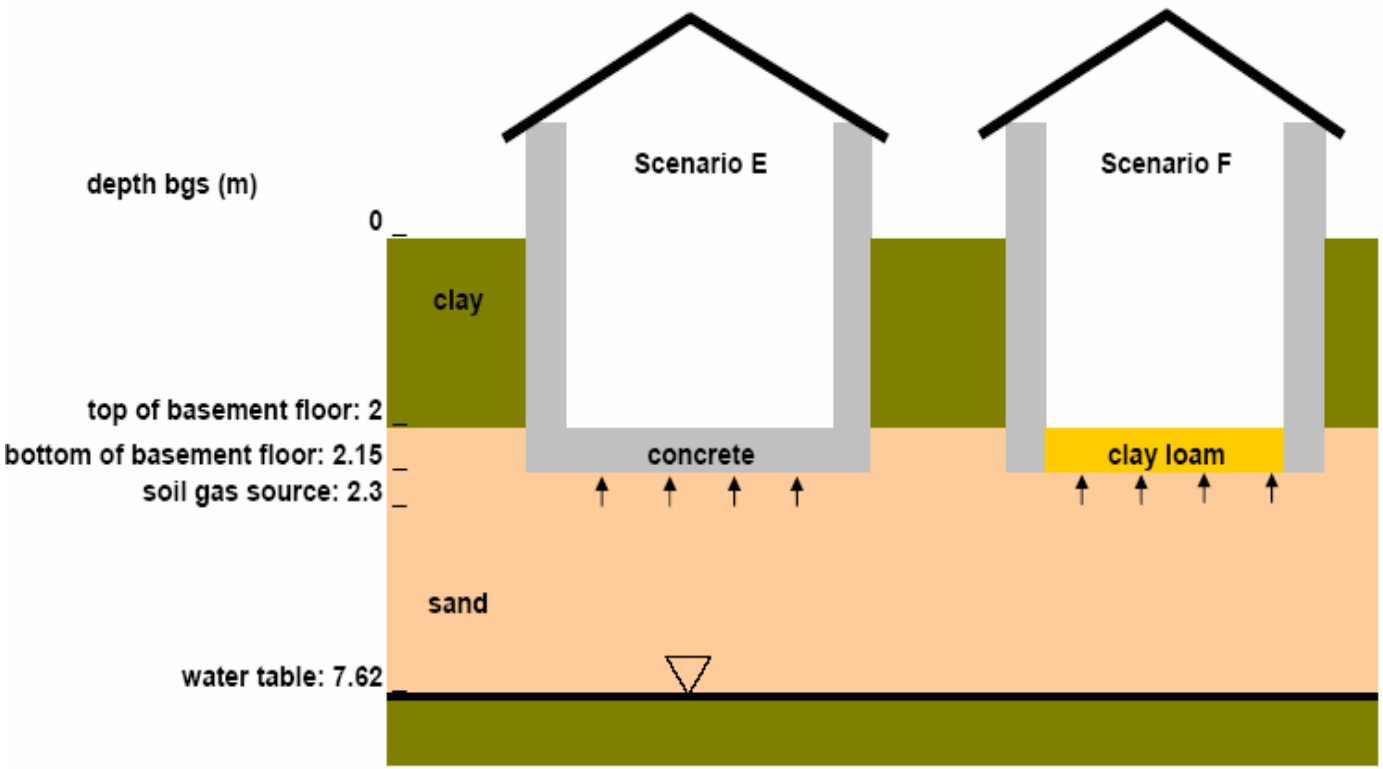
- Develop conservative soil gas screening criteria using the Johnson & Ettinger (J&E) model for predicting the rate of vapor migration into buildings.
- Utilize site-specific information and appropriate default values for input parameters; site information considered:
    - Target constituents detected in on-site soils and groundwater
    - Soil type and lithology
    - Depth to water table
    - Characteristics of buildings (size, age, foundation type, HVAC type)

Soil Gas Screening Levels – Input Parameters for J&E Model

Variable	Symbol	Value (see notes)	Units	Source	Typical range
Permeability to vapor	k_v	(varies) [1]	cm^2	Crack soil properties	site-specific
Building foundation thickness	L_{crack}	0.15	m	MDEQ	
Building foundation length	L	10.56	m	MDEQ	9 to 15
Building foundation width	W	10.56	m	MDEQ	9 to15
Building occupied height (mixing height)	H	4.88	m	MDEQ	2.44 to 4.88
Occupied depth below ground	L_B	2.0	m	MDEQ	
Distance from foundation to source	L_T	0.15 [2]	m	Depth of source - L_B - L_{crack}	site-specific
Bldg area for vapor intrusion	A_B	196.0 (concrete) 111.5 (dirt floor)	m^2	L X W + (2 L + 2 W) x H for concrete basements, L X W for dirt floor basements	152 to 313+
Building occupied volume	$V_{building}$	544.19	m^3	L x W x H	
Air exchange rate	ach	1.0	$hour^{-1}$	MDEQ	0.1 to 1.5
Building ventilation rate	Q_{bldg}	1.31E+04	m^3/day	ach x $V_{building}$	
Indoor/outdoor pressure difference	ΔP	1.0	kg/m-s^2	MDEQ	0 to 15
Viscosity of air	μ	1.8E-05	kg/m-s	MDEQ	
Crack length (bldg perimeter)	X_{crack}	42.24	m	2 L + 2 W	
Crack depth below ground	Z_{crack}	2.15	m	L_B + L_{crack}	
Crack radius	r_{crack}	5E-04	m	MDEQ	5E-4 to 5E-3
Area of cracks	A_{crack}	2.11E-02	m^2	r_{crack} x (2 L + 2 W)	
Soil gas flow rate into building	Q_{soil}	(varies by k_v) [3]	m^3/day	Nazaroff equation	1.4 to 14

Notes:
1: Value range = 9.3E-8 cm^2 for sand, 2.4E-10 cm^2 for clay
2: Depth to source is equal to the target depth for the soil gas sampling. For criteria calculations, the sampling depth is assumed to be immediately below the basement floor (0.15 m).
3: Value range = 1.3 m^3/day if the foundation is in sand layer, 3.4E-3 if the foundation is in the clay layer. For a dirt floor basement scenario, Qsoil is not used in the calculations.

Soil Gas Screening Levels – Source & Lithology Assumptions



NOTES:

- Soil gas is evaluated based on the actual collection depth unless it is shallower than 2.3m, in which case 2.3m is used. For criteria calculations, a depth of 2.3 m is used.
- In soil borings, the upper clay layer, when present, extends down to between 2.13 and 3.9m bgs. To be conservative, the basement is assumed to penetrate the upper clay.

Soil Gas Screening Levels

E

No clay scenario; depth to source 2.3 m (7.5 ft.) - 6 inches below bottom of foundation

			Indoor air criteria		ATSDR Guidelines		Source soil gas criteria		Source soil gas criteria	
Chemical	CASRN	Carc Group	HQ = 1 (mg/m^3)	Risk = 1E-5 (mg/m^3)	Chronic MRL (mg/m^3)	Intermediate MRL (mg/m^3)	HQ = 1 (mg/m^3)	Risk = 1E-5 (mg/m^3)	HQ = 1 (ppmv)	Risk = 1E-5 (ppmv)
Chloroform	67-66-3	B2	5.2E-02	1.1E-03	1.0E-01	2.5E-01	530	11	100	2.1
1,1-Dichloroethene	75-35-4	C	2.1E-01			8.3E-02	2100		510	
cis-1,2-Dichloroethene	156-59-2	D	3.7E-02				370		90	
Tetrachloroethene	127-18-4	C-B2	4.2E-01	8.0E-03	2.8E-01		4200	81	600	11
1,1,1-Trichloroethane	71-55-6	D	2.3E+00			4.0E+00	23000		4100	
Trichloroethene	79-01-6	C-B2		1.4E-02		5.6E-01		140		26
Vinyl Chloride	75-01-4	A	1.0E-01	2.8E-03		8.0E-02	1100	28	400	10

F

Dirt Floor Basement scenario; no clay below basement; depth to source 2.3 m (7.5 ft.)

			Indoor air criteria		ATSDR Guidelines		Source soil gas criteria		Source soil gas criteria	
Chemical	CASRN	Carc Group	HQ = 1 (mg/m^3)	Risk = 1E-5 (mg/m^3)	Chronic MRL (mg/m^3)	Intermediate MRL (mg/m^3)	HQ = 1 (mg/m^3)	Risk = 1E-5 (mg/m^3)	HQ = 1 (ppmv)	Risk = 1E-5 (ppmv)
Chloroform	67-66-3	B2	5.2E-02	1.1E-03	1.0E-01	2.5E-01	9.5	0.19	1.9	0.038
1,1-Dichloroethene	75-35-4	C	2.1E-01			8.3E-02	44		11	
cis-1,2-Dichloroethene	156-59-2	D	3.7E-02				9.4		2.3	
Tetrachloroethene	127-18-4	C-B2	4.2E-01	8.0E-03	2.8E-01		110	2.1	16	0.3
1,1,1-Trichloroethane	71-55-6	D	2.3E+00			4.0E+00	560		98	
Trichloroethene	79-01-6	C-B2		1.4E-02		5.6E-01		3.4		0.62
Vinyl Chloride	75-01-4	A	1.0E-01	2.8E-03		8.0E-02	19	0.5	7	0.19

Application of Screening Criteria

- Locations with soil gas concentrations below the values estimated for Scenarios E and F will be categorized as "no further action."

- Locations with soil gas concentrations between the values estimated for Scenarios E and F will be categorized for follow-up investigation including the collection of additional building characteristics. If the building characteristics do not meet the minimum values used for Scenario E, then it will be identified for supplemental soil gas sampling.

- Locations with soil gas concentrations above the values estimated for Scenario E will be categorized for supplemental soil gas sampling.

APPENDIX C

Ohio Department of Health Letter (June 4, 2007)

OHIO DEPARTMENT OF HEALTH

246 North High Street
Columbus, Ohio 43215

614/466-3543
www.odh.ohio.gov

Ted Strickland/Governor

Alvin D. Jackson, M.D./Director of Health

June 4, 2007

Steven L. Renninger
U.S. Environmental Protection Agency
Emergency Response Section
26 West Martin Luther King Drive (G41)
Cincinnati, OH 45268

Steve,

Per your recent request, presented below are our recommendations for health-based guidance numbers to be used to evaluate the results of sampling of indoor air and sub-slab soil gas media for the volatile chemical compounds Chloroform, Perchloroethylene (PCE), 1,1,1 Trichloroethane, and Trichloroethylene (TCE) in residential and commercial properties in the vicinity of the Delphi Home Avenue site on the west side of the city of Dayton, Montgomery County, Ohio.

The numbers presented are consistent with previous recommendations made for U.S. EPA vapor intrusion investigations at the Springfield Street, Troy VOC Plume, and Behr-Dayton sites over the course of the past year. All of these sites present very similar vapor intrusion exposure scenarios, ie. significant concentrations of VOCs (> 100 ppb) in shallow groundwater; chemicals of concern that are chlorinated solvents; a depth to the water table of less than 25 ft below the ground surface; close proximity (< 1,000 ft) to a likely source; urban density residential areas with a variety of single-family homes; and intervening vadose zone soils that consist of highly porous and permeable sand and gravels. The Delphi site may present a somewhat different picture than these three previous sites due to the presence of a surficial clay layer in the area and a source of vapor-phase solvents that is more likely contaminated soils than contaminated groundwater.

The recommended screening levels presented are based on the understanding that exposures to the below listed chemicals of concern have likely been going on for some period of time and that removal of the source material will likely require an extensive effort that may not be accomplished in the near future. For these reasons, we have applied screening levels that are based more on chronic (longer term) rather than acute exposures to these chemicals. These are provided for residences, schools, public buildings, and commercial buildings. The application of these screening levels is considered by ODH and ATSDR to be protective of public health.

Long-term screening levels are based on a 10^{-4} cancer risk as the threshold for the Emergency Response program to take action. Not meeting this threshold does not mean that no further action should be considered. Properties that exceed 10% of the long-term screening levels should be referred to the remedial programs at US EPA and/or Ohio EPA for further evaluation.

Table 1
Recommended "Action Levels" for Volatile Organic Compounds Residential Structures – Delphi Home Avenue Site, Dayton, Montgomery County, Ohio

Residential	**Short-term Action Level[1] (ppbv)**	**Short-term Action Level (ppbv)**	**Long-term Screening Level[2] (ppbv)**	**Long-term Screening Level (ppbv)**
Chemical	**Indoor Residential**	**Sub-slab Residential**	**Indoor Residential**	**Sub-slab Residential**
Perchloroethylene	200	2,000	12	120
Trichloroethylene	100	1,000	0.4	4.0
Chloroform	50	500	2.2	22
1,1,1 Trichloroethane	700	7,000	400	4,000

ppbv = Parts per billion per volume of air

[1] = The "Short-term Action Levels" are derived from ATSDR Intermediate Environmental Media Evaluation Guide (EMEG) values for these chemicals in air. These "Short-term Action Levels" denote a level that would trigger immediate action to be taken to reduce exposure levels, either through the installation of a sub-slab depressurization system, improved ventilation, or some other action that could be implemented to reduce exposure until the source could be remediated. The "Intermediate" ATSDR EMEG value is used here rather than the "Acute" EMEG as these exposures more than likely represent something greater than 14 days but less than a lifetime (NOTE: Perchloroethylene uses the ATSDR Acute EMEG value). An exceedence of these action levels does not necessarily indicate that the home would be unsafe for occupancy, necessitating the evacuation of the residents. These numbers represent fairly conservative screening criteria.

[2] = The "Long-term Screening Levels" are derived from values given for these specific compounds in the U.S. EPA OSWER Draft Guidance document for Vapor Intrusion (2002). Perchloroethylene, Trichloroethylene, and Chloroform are all considered to be "Probable" human carcinogens by US EPA and described as "Reasonably anticipated to be human carcinogens" by the National Toxicology Program (2005). The values presented for these compounds are based on a calculated 10^{-4} cancer risk number (US EPA, 2002, Table 2a). This calculation is based on a very conservative exposure scenario that assumes an adult resident is exposed to the chemical in air in his residence for 350 days per year over a period of 30 years. 1,1,1 Trichloroethane is

considered to be a non-carcinogen and risk value for this chemical is based on a chronic hazard index of 1.0.

Table 1 presents the action and screening numbers for residential structures. In evaluating the sub-slab air samples, a 10-fold attenuation factor is applied to these values, based on the US EPA OSWER draft Vapor Intrusion Guidance (2002). Sub-slab values here correspond to shallow soil gas values in Table 2a of the Guidance document.

Table 2 provides corresponding values for non-residential commercial structures. These are derived by adjusting the exposure time from the residential values (Table 1). A factor of 4.2 is applied to adjust from a 168-hour week for the residential exposure to a 40-hour work week for the non-residential exposure. These "commercial structures" include public buildings, non-manufacturing businesses, and industries where these chemicals of concern are not used as part of the manufacturing process.

Table 2
Recommended "Action Levels" for Volatile Organic Compounds Commercial Structures – Delphi Home Avenue Site, Dayton, Montgomery County, Ohio

Commercial	**Short-term Action Level (ppbv)**	**Short-term Action Level (ppbv)**	**Long-term Screening Level (ppbv)**	**Long-term Screening Level (ppbv)**
Chemical	**Indoor Commercial**	**Sub-slab Commercial**	**Indoor Commercial**	**Sub-slab Commercial**
Perchloroethylene	840	8,400	50	500
Trichloroethylene	420	4,200	1.7	17
Chloroform	210	2,100	9.2	92
1,1,1 Trichloroethane	2,940	29,400	1,690	16,800

If you have any questions with regard to these values, please contact me (email: bob.frey@odh.ohio.gov or phone: 614-466-1069) or Mark Johnson (email: Johnson.Mark.@epamail.epa.gov or phone 312-353-3436).

Sincerely,

Robert C. Frey, Ph.D.
Chief, Health Assessment Section
Bureau of Environmental Health

cc: Mark Johnson, Ph.D., DABT
Senior Environmental Health Scientist
Agency for Toxic Substances and Disease Registry
Region 5 Office, 77 W. Jackson Blvd.
Chicago, IL 60604

APPENDIX D

Health and Safety Plan (HASP)

HALEY & ALDRICH, INC.
HEALTH & SAFETY PLAN

for

Phase I Indoor Air Sampling and Mitigation

Delphi VOC Plume Site

Delphi Home Avenue Facility

2701 Home Av., Dayton, OH

Project/File No. 26708

Prepared by: _____ Date: April 2007

Revised by: _____ Date: October 2007

APPROVALS: The following signatures constitute approval of this Health & Safety Plan

_____ _____
David Bean - Local H&S Coordinator Date

_____ _____
Susan Hoertt - Project Manager Date

_____ _____
Corporate H&S Manager Date
(Only required per request of LHSCs)

Date printed: 10/12/2007 at 5:52 PM

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

PRE-JOB SAFETY CHECKLIST

The following is a checklist that is designed to help Project Managers prepare for the H&S requirements needed for their projects.

The use of this form should be used during the planning stage of the project and not intended to be used the day before the project. This form is to be attached to the front off all HASPs before it goes to the field.

Please initial in each appropriate box and sign on the bottom of the appropriate box that the required materials, equipment, training, etc., has been procured before commencement of work on a site.

#	Project H&S Requirements	Approval by PM or LHSC (initial each box or place NA)	Date Approved
1.0	HASP and supporting documentation is complete and signed by all members		
2.0	Task Safety Analysis performed and attached to the HASP.		
3.0	All staff scheduled for project current with 40 hour or 8 hour refresher training.		
4.0	Is a Hazwoper site supervisor needed, if so, are they trained?		
5.0	Additional Training Requirements met: e.g.- Site Supervisor training		
6.0	We have met the client's additional H&S requirements above and beyond H&A's requirements. Example: facility safety orientations, safety documentation, meetings, PPE requirements		
7.0	H&A subcontractors have met H&A's minimum requirements, including- - Training - Medical surveillance - Written HASP - Insurance - MSDSs		
8.0	All H&A staff involved in project have met their Medical Surveillance examination requirements.		
9.0	Staff that may be required to wear a respirator, medically qualified and fit test card available.		
10.0	MSDSs on site and available for chemicals on site.		
11.0	Safety equipment available, such as: Flashlights, Telephone for communications, Cones, Barricade tape, Fire extinguisher, First Aid Kit, PPE, Respiratory Protection, Air Instrumentation and Calibrated, Decontamination equipment		

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TABLE OF CONTENTS

		Page
PRE-JOB SAFETY CHECKLIST		19
ISSUANCE AND COMPLIANCE		II
SITE SAFETY OFFICER		II
PRE-WORK HEALTH & SAFETY BRIEFING		IV
1.	PROJECT INFORMATION	1
2.	SITE DESCRIPTION	2
3.	PROJECT TASK BREAKDOWN	4
4.	HAZARD ASSESSMENT	5
5.	PROTECTIVE MEASURES	14
5.1.1	Health and Safety Training	16
5.1.2	40-Hour Health and Safety Training	16
5.1.3	8-hour Annual Refresher Training	16
5.1.4	8-Hour Supervisor Training	16
5.1.5	Additional Training	16
6.	MONITORING PLAN AND EQUIPMENT	18
7.	DECONTAMINATION	19
8.	CONTINGENCY PLANNING	21

Appendix A - HASP Amendment Form

Table 1 – Hazard Monitoring

Table 2 – Monitoring Method, Action Levels and Protective Measures

Figure 1 – Site Plan

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

ISSUANCE AND COMPLIANCE

- This HASP must be signed by all Haley & Aldrich (H&A) staff members who will work on the project, including H&A visitors.
- This HASP or a current signed copy must be retained at the site at all times when H&A staff are present. Senior management does recognize that it is difficult to utilize one HASP when many staff members are involved and there is no stationary location to maintain the HASP.
- Deviations from this HASP are not permitted without prior approval from the above signed. Unauthorized deviations may constitute a violation of H&A company procedures/policies and may result in disciplinary action.
- Revisions to this HASP must be outlined within the contents of the HASP. If immediate or minor changes are necessary, the LHSC and H&A Project Manager may use Appendix A (HASP Amendment Form), located in the back of this HASP. Any revision to the HASP requires employees to be informed of the changes and they understand the requirements of the change.
- This HASP is not for H&A Subcontractor use. Subcontractors must have their own HASP. This HASP will be made available for review by "reference only" to ensure that H&A has properly informed our subcontractors of the hazards associated with the site to the extent we are aware.
- This Site Specific HASP provides only site-specific descriptions and work procedures. General safety and health compliance programs in support of this HASP (e.g., injury reporting, medical surveillance, personal protective equipment (PPE) selection, etc. are described in detail in the H&A Corporate Health and Safety Program Manual and within Standard Operating Procedures (SOPs). Both the manual and SOPs can be located on the Company Intranet. When appropriate, users of this HASP should always refer to these resources and incorporate to the extent possible. The manual and SOPs are available to clients and regulators per request.

SITE SAFETY OFFICER

This project has identified the following person as the site safety officer (SSO): **The highest ranking Haley & Aldrich, Inc. person on site will be the designated site safety officer.** The H&A Project Manager may designate any person as the primary. **A site safety officer must be on site at all times.**

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

Roles and Responsibilities

The SSO is responsible for field implementation of this HASP and enforcement of safety rules and regulations. SSO functions include:

- Act as H&A's liaison for health and safety issues.
- Verify required utility clearance has been performed.
- Oversee day-to-day implementation of the HASP by H&A employees on site.
- Interact with subcontractor project personnel on health and safety matters.
- Verify use of required PPE as outlined in the HASP.
- Inspect and maintain H&A safety equipment, including calibration of air monitoring instrumentation used by H&A.
- Perform changes to HASP and document in Appendix A of the HASP as needed and notify appropriate persons of changes.
- Investigate and report on-site accidents and incidents involving H&A and its subcontractors.
- Verify that site personnel are familiar with site safety requirements (e.g., the hospital route and emergency contact numbers).
- Report accidents, injuries, and near misses to the H&A PM and Local Health and Safety Coordinator (LHSC) as needed.

The SSO will conduct initial site safety orientations with site personnel (including subcontractors and Police personnel) and conduct toolbox and safety meetings thereafter with H&A employees and H&A subcontractors at regular intervals and in accordance with H&A policy and contractual obligations. The SSO will track the attendance of site personnel at H&A orientations, toolbox talks, and safety meetings.

The SSO will report accidents such as injury, overexposure, or property damage to the Local Health and Safety Coordinator, to the Project Manager, and to the safety managers of other on-site consultants and contractors. The SSO will consult with the safety managers of other on-site consultants and subcontractors on specific health and safety issues arising over the course of the project, as needed.

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

PRE-WORK HEALTH & SAFETY BRIEFING

Note: Only H&A employees sign this page.

I have attended a briefing on this Health & Safety Plan prior to the start of on-site work and declare that I understand and agree to follow the provisions and procedures set forth herein while working on this site.

PRINTED NAME	SIGNATURE	DATE

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

1. PROJECT INFORMATION

Name of Project: Phase I Indoor Air Sampling & Mitigation; Delphi Home Avenue Facility	**H&A File No.: 26708**
Location: 2701 Home Avenue, Dayton, Ohio	
Client/Site Contact: John Ridd	**Contact Phone No.: 937-455-0941**
H&A Project Manager: Susan Hoertt	**PM Phone No.: 937-384-9940**

SCOPE OF WORK:

Provide environmental consulting services and assist Delphi Corporation with environmental sampling.

Subcontractor(s) to be involved in on-site activities:
Please refer to the Work Plan for information regarding subcontractors.

Projected Start Date: October 2007

Projected Completion Date: To be determined.

Estimated Number of Days to Complete Field Work: Ongoing

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

2. SITE DESCRIPTION

Check one of the following:

Site classification:	☐ Industrial	☐ Commercial	☑ Other Private Property Locations

General Description

Delphi Corporation – Home Avenue Facility (the "Facility") is located at 2701 Home Avenue SW in Dayton, Montgomery County, Ohio. The Dayton area experiences a humid-continental type climate characterized by large annual and daily temperature fluctuations. Potential heat or cold stresses depend on season. Winds are generally from the southwest, but vary near building spaces.

The Facility covers approximately 67 acres over relatively flat topography with approximately 1.6 million square feet of building space that covers approximately 37 acres. The Facility extends between Upland Avenue (West), McCall Street/US 35 (Home Avenue) (South), Ardmore Avenue (east), and Third Street (North).

Delphi's Home Avenue Facility is located in a mixed industrial, residential, and commercial area in southwest Dayton. The Facility was developed by Inland Manufacturing Division of General Motors Corporation (GM) in 1918 and has continuously operated as an automobile parts manufacturing, shipping, and warehouse facility to the present. In January 1999, Delphi Automotive Systems separated from GM to form a new company. Later the company was renamed Delphi Corporation, with the Facility operating under the Delphi Energy & Chassis (E&C) Systems Division. The Facility currently operates under the Delphi Automotive Holdings Group (DAHG) of Delphi Corporation.

Current and historic products manufactured at the site include:

- Steering Wheels
- Motor Mounts
- Transmission Mounts
- Decorative Trim
- Flexible Body Components
- Weather Strips
- Brake hose
- Liteflex Spring

Processes involved in the manufacturing of these products include:

- Welding
- Metal grinding, sawing, and filing
- Spray painting
- Rubber finishing and adhesive compounds
- Plastic molding and vapor finishing
- Solvent dipping/oven drying of latex weather strips
- Fiberglass resin, epoxy, cutting, and buffing

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

Work Areas

The type of environmental work being conducted includes investigation and monitoring. The activities associated with this work can affect site employees.

Work area(s) will primarily occur at privately owned properties not owned by Delphi Corporation. Activities may include the following:

1. Health and safety briefings.

2. Soil Vapor and Air Sampling.

3. Construction of Foundation Sub-Slab Mitigation Systems.

4. Mitigation System Operation and Maintenance (O&M) Evaluation.

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

3. PROJECT TASK BREAKDOWN

List and describe each distinct work task below:

Task No.	Detailed Task Description	Employee(s)	Work Date(s) or Duration
1	Health and Safety Briefing: Review known and suspected health and safety concerns with applicable site personnel. At minimum, personnel will include Haley & Aldrich, Inc. field personnel and Dayton Police personnel. Briefings will be conducted at the Delphi Corporation Home Avenue Facility West 3rd. Street entrance.	Haley & Aldrich, Inc. Staff	Ongoing
2	Soil Vapor and Air Sampling Activities: As needed, install Soil Vapor Monitoring points, adjacent to structures, or through a foundation slab. Canisters used to collect ambient air will be set in locations determined by current wind direction. Activities will be performed in Level D or Level C based on real time air monitoring or established protection levels.	Haley & Aldrich, Inc. Staff	Ongoing
3	Mitigation Construction Activities: As identified by analytical data, homes may require a mitigation system be constructed and installed. Activities will be performed in Level D or Level C based on real time air monitoring or established protection levels.	Haley & Aldrich, Inc. Staff	Ongoing
4	Mitigation Systems Operation and Maintenance (O&M) Evaluation: Following the installation of a mitigation system and at predetermined intervals, the system will be inspected to ensure it is functioning properly. At this time, maintenance issues, if any, will be addressed.	Haley & Aldrich, Inc. Staff	Ongoing

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

4. HAZARD ASSESSMENT

Chemical Hazards

Material Safety Data Sheets (MSDS) of hazardous materials used during the execution of work shall be available on site. MSDSs are required for chemicals used to prepare samples, calibration gases, etc.

Note: MSDSs are not required for waste materials.

Potential **physical state** of the hazardous materials that may be encountered (mark all that apply).

- ☑ Gas/Vapor
- ☐ Sludge
- ☐ Liquid
- ☐ Solid/Particulate

Anticipated/actual **class of compounds** (mark all that apply).

- ☐ Asbestos
- ☐ Inorganics
- ☐ BTEX
- ☐ Pesticides
- ☑ Chlorinated Solvents
- ☐ Petroleum products
- ☐ Heavy Metals
- ☐ Other

Impacted environments (indicate the primary media(s) in which contamination is expected):

- ☑ Air
- ☐ Groundwater
- ☐ Soil
- ☐ Sediment
- ☐ Surface water
- ☐ Other

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

Estimated concentrations/medium of major chemicals expected to be encountered by onsite personnel:

Work Activity	Media	Chemical	Anticipated Concentration
Task 1: Health and safety briefings.	Air	VOC	Low
Task 2: Soil Vapor and Air Sampling	Air	VOC	Low to Moderate
Task 3: Mitigation Construction Activities	Air	VOC	Low to Moderate
Task 4: Mitigation System Operation and Maintenance	Air	VOC	Low to Moderate

Please indicate the major chemicals of concern and include a description of each.

Chloroform:
Chloroform is a clear, colorless, and mobile liquid with a pleasant, sweet odor. Air odor threshold concentrations ranging from 85 to 307 parts per million (ppm) parts of air have been reported for chloroform.

Trichloroethylene (TCE):
Trichloroethylene (TCE) is a colorless, nonflammable, non-corrosive liquid has a “sweet” odor characteristic of some chlorinated hydrocarbons.

Tetracloroethylene (PCE):
Tetrachloroethylene (PCE) is a colorless, nonflammable, non-corrosive liquid has a “sweet” odor characteristic of some chlorinated hydrocarbons.

Physical Hazards

Is any site work area(s) to be entered for this project considered a confined space? ☐ Y ☑ N

If yes, indicate which area(s) and why:

NOTE: ALL CONFINED SPACE ENTRY PROJECTS REQUIRE SPECIAL PROCEDURES, PERMITS AND TRAINING AND MUST BE APPROVED BY THE CORPORATE HEALTH & SAFETY MANAGER.

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

Physical Hazard Checklist

Indicate all hazards that may be present for each task. If any of these potential hazards are checked, it is the project manager's responsibility to determine how to eliminate/minimize the hazard to protect onsite personnel. Note: Task numbers refer to those identified in Section 3.

Potential Job Hazards	Task 1	Task 2	Task 3	Task 4
Underground utilities		✓	✓	✓
Overhead utilities			✓	
Heavy equipment			✓	
Drilling hazards (Hammer Drill)		✓		
Noise (above 85 dBA)	✓	✓	✓	
Traffic concerns	✓	✓	✓	
Extreme weather conditions	✓	✓	✓	✓
Heavy lifting (more than 50 lbs)		✓	✓	
Poisonous insects or plants	✓	✓	✓	✓
Lockout/Tagout requirements			✓	✓
Cold or Heat Stress	✓	✓	✓	✓
Severe Weather	✓	✓	✓	✓

Precautions to be taken with respect to the hazards checked above:

WORKING AROUND HEAVY EQUIPMENT

Site personnel must be especially careful and alert when working with contractors who use heavy equipment, since equipment failure or breakage can lead to accidents and worker injury. Lifting devices and equipment for drilling, pile driving, test pitting and coring are of special concern. Should these devices fail during operation the likelihood of worker injury is high. Equipment of this nature should be visually inspected and checked for proper working order prior to the commencement of fieldwork. Those that operate heavy equipment must meet all of the requirements to operate heavy equipment. Persons that supervise projects or are associated with such high-risk projects that involve digging should use diligence when working with a construction firm.

COLD STRESS

Persons working outdoors in low temperatures, especially at or below freezing are subject to cold stress. Exposure to extreme cold for a short time may cause severe injury to the surface of the body, or result in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible.

Two factors influence the development of a cold injury: ambient temperature and the speed of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10° F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.

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As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. In addition, water conducts heat 240 times faster than air. Thus when chemical-protective equipment is removed the body cools suddenly if the clothing underneath is perspiration soaked. Warm, dry clothing must be available and donned as soon as possible when these conditions are present.

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

Frost nip or incipient frostbite: sudden blanching or whitening of the skin.

Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

Deep frostbite: tissues are cold, pale, and solid; extremely serious injury.

To administer first aid for frostbite, bring the victim indoors and rewarm the areas quickly in water between 102 and 105 degree F. (39 and 41 degree C). Never place frostbitten tissue in hot water as the area will have a reduced heat awareness and such treatment could result in burns. Give a warm drink - not coffee, tea or alcohol. The victim should not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws. Then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

After thawing, the victim should try to move the injured areas slightly, but no more than can be done alone, without help.

Do not rub the frostbitten area, use ice, snow, gasoline or anything cold on frostbite, use heat lamps or hot water bottles to rewarm the frostbitten area, place the frostbitten area near a hot stove.

Hypothermia
Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

- shivering;
- apathy, listlessness, sleepiness, and rapid cooling of the body to less than 95°F.
- unconsciousness, glassy stare, slow pulse, and slow respiratory rate;
- freezing of the extremities;
- death.

The ultimate responsibility for postponing or delaying work at a site due to inclement weather rests with the Project Manager.

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HEAT STRESS

If activities occur during the summer, heat stress is a major concern. Heat stress on hazardous waste sites or construction sites usually is a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated ambient temperatures. Because heat stress is one of the most common and potentially serious illnesses associated with hazardous waste site work, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat the various forms of heat stress.

The best approach is preventative heat stress management. In general:

- Workers should drink 16 ounces of water before beginning work, such as in the morning or after lunch. The water should be maintained at 50 to 60°F. Workers should drink 1 to 2 4-ounce cups of water every 30-60 minutes. A cool area for rest breaks should be designated, preferably air-conditioned. The use of alcohol during non-working hours and the intake of caffeine during working hours can lead to an increase in susceptibility to heat stress. Monitor for signs of heat stress.
- Workers should acclimate to site work conditions by slowly increasing workloads, i.e., do not begin site work activities with extremely demanding activities. This acclimation process may require up to two weeks for completion.
- Cooling devices should be used to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. An example of a cooling aid is long underwear that acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Installed mobile showers and/or hose-down facilities should be used to reduce body temperature and cool protective clothing in serious heat stress situations.
- In hot weather, field activities should be conducted in the early morning or evening.
- Adequate shelter should be available to protect personnel from heat, as well as cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. Set up a command post in the shade or erect temporary shade at the work station if practical.
- In hot weather, rotate shifts of workers with potential heat stress exposure.
- Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who develop skin problems should immediately consult medical personnel.

Effects of Heat Stress

If the body's physiological process fails to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal.

Heat-related problems are:

Heat Stroke: An acute and dangerous reaction to heat exposure caused by failure of heat regulating mechanisms of the body; the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- Symptoms: Red, hot, dry skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory

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and pulse rate; unconsciousness or coma.

- Treatment: Cool the victim quickly and obtain immediate medical assistance. If the body temperature is not brought down fast, permanent brain damage or death may result. Soak the victim in cool but not cold water, sponge the body with rubbing alcohol or cool water, or pour water on the body to reduce the temperature to a safe level (102°F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

Heat Exhaustion: A state of definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- Symptoms: Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.
- Treatment: Remove the person to a cool place, loosen clothing, place in a head-low position. Provide bed rest. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 to 2 cups water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

Heat Cramps: Caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

- Symptoms: Acute painful spasms of voluntary muscles (e.g., abdomen and extremities).
- Treatment: Remove the victim to a cool area and loosen clothing. Have the patient drink 1 to 2 cups water immediately, and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

Heat Rash: Caused by continuous exposure to heat and humid air and aggravated by chaffing clothes. Decreases ability to tolerate heat.

- Symptoms: Mild red rash, especially in areas of the body on contract with protective gear.
- Treatment: Decrease amount of time in protective gear, and provide powder to help absorb moisture and decrease chaffing.

SEVERE WEATHER

Below is a short guideline to assist those in the field to make better decisions when dealing with lightening. This information shall be used as needed when in the field and lightning is approaching.

Anticipating Lightning: Lightning always accompanies thunderstorms, so your first line of defense is to keep an eye and ear to the sky.

- Equate thunder with lightning, even if lightning is not visible where you are. If you can hear thunder, you are close enough to be struck by lightning.
- Even if you can't hear thunder, you might nonetheless be at risk. The first bolts from a towering cloud overhead can catch you by surprise, and so-called "bolts from the blue" can extend way out from the edge of a thunderstorm and strike a point well

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away from where most of the thunder and lightning is occurring.

How Close Is the Lightning? You can do a rough calculation this way:

- When you see the flash, begin to count the seconds until you hear the thunder. Divide this number by 5. The number you get is the approximate distance of the lightning in miles. For example, if you count nine seconds between the flash and the thunder, the lightning struck just less than two miles away.

How Will You Be Warned? There are no watches or warnings issued for lightning per second. Though severe thunderstorms can certainly contain a lot of lightning, not all of them do, and many thunderstorms laden with lightning occur without being designated "severe" and without any watches or warnings in effect.

- Severe thunderstorms are defined as those which produce hail 3/4" in diameter or larger, wind gusts 58 mph or greater, and/or tornadoes.
- Severe Thunderstorm Watch conditions are conducive to the development of severe thunderstorms in and close to the watch area.
- Severe Thunderstorm Warning a severe thunderstorm has actually been observed by spotters or indicated on radar, and is occurring or imminent in the warning area.

If you are on a project and a lightning storm is approaching:

- Always pay attention to the weather conditions. You are responsible for your own safety. Use common sense and do not feel pressure to continue to work if you feel there is a threat and others don't, such as contractors and co-workers.
- If you are using conductive tools and equipment, separate yourself from them as far as practical.
- If you are near a drilling rig, lower the mast and move away from the rig.
- Rule of thumb- wait until 30 minutes after the last observed lightning strike or thunderclap before resuming your outdoor activities, warns the National Lightning Safety Institute.
- Protect yourself by taking cover in the best shelter you can find.
- For shelter, if choosing between a building on the Facility or an off site building, choose a building off site.
- If choosing between an off site building and a car, choose the off site building.
- If choosing between a hardtop and a convertible, choose the hardtop.
- If you're in a car, keep the windows closed.
- If there is no shelter, find a low-lying, open place that is a safe distance from trees, poles, or metal objects that can conduct electricity. Make sure it is not likely to flood. Assume a tucked position: Squat low to the ground. Place your hands on your knees with your head tucked between them. Try to touch as little of your body to the ground as possible.
- Do not lie flat on the ground, as your fully extended body will provide a larger surface to conduct electricity. Stay in a tuck position well after the storm passes.
- Watch for local flooding you may have to move if water begins to accumulate.
- If you feel your hair stand on end in a storm, drop into the tuck position immediately. This sensation means electric charges are already rushing up your body from the ground toward an electrically charged cloud. Minimize your contact with the ground to minimize your injury.

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Hazardous Energy

Lockout/tagout (LOTO) refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities. For the activities discussed herein, H&A staff members will not facilitate the LOTO Program, the facilities existing LOTO Program will be used. H&A staff will be operating within Delphi's LOTO Program and therefore must be aware of the LOTO Program requirements.

Delphi will provide information on how H&A staff will be trained in their program. It is the PM's responsibility to ensure that authorized staff members receive the training and that proof of the training in written form is provided.

Staff members who participate in a LOTO Program are required to fully understand the theory behind the LOTO Program. Isolation points must be locked out and tagged out before an individual performs service or maintenance activities where unexpected energization, startup, or release of energy or hazardous material could cause injury or damage equipment. LOTO Programs must comply with the OSHA requirements specified in 29 CFR 1910.147.

Staff members are required to comply with the restrictions and limitations imposed upon them during the use of the Facilities LOTO Program. All employees, upon observing a machine or piece of equipment which is locked out to perform servicing or maintenance shall not attempt to start, energize, or use that machine or equipment. The PM, or authorized designee, shall notify staff when it is safe to properly operate the equipment.

Electrical Hazards

Electrical current exposes personnel to an occupational hazard. Electrical injuries consist of four main types: electrocution (fatal), electric shock, burns, and falls caused as a result of contact with electrical energy. Every individual who works with or around electrical energy should be familiar with LOTO Program emergency procedures. This includes knowing how to de-energize the electrical system before rescuing or beginning resuscitation on a worker who remains in contact with an electrical energy source.

Noise

When employees are subjected to sound exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of table of Permissible Noise Exposure shown below, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.

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PERMISSIBLE NOISE EXPOSURES (1)

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Footnote(1) When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C(1)/T(1) + C(2)/T(2) C(n)/T(n) exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

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5. PROTECTIVE MEASURES

Personal Protective Equipment Requirements

Required PPE	Task 1	Task 2	Task 3	Task 4
Steel-toe footwear	✓	✓	✓	✓
Hearing protection (plugs, muffs)		✓(1)	✓(1)	
Leather work gloves			✓ (2)	✓ (2)
Outer gloves - Nitrile		✓		
High-Visibility Safety Vest (in traffic areas)		✓	✓	
Lockout/Tagout Procedure			✓ (2)	✓ (2)
Respirator		✓ (3)	✓(3)	✓(3)

✓**(1):** When using a generator or other loud equipment (drill)
✓**(2):** During installation & maintenance activities (i.e., not during operation)
✓**(3):** As determined by real time air monitoring.

The PPE checked in any box above must be on site during the task being performed. Work shall not commence unless the PPE is present.

In the event of respirator use, H&A staff that may be required to wear a respirator must be:

- Medically qualified
- Fit tested
- Fresh shaven with no facial hair that will interfere with the seal. This includes one day hair growth or more, beards, excessive long side burns, and goatees.

Personal Hygiene Safeguards

Describe any additional safeguards other than basic decontamination procedures for personal hygiene. The following safeguards, at a minimum, shall be adhered to:

1. No Smoking or tobacco products
2. No eating or dinking in exclusion (hot) zones; and
3. It is especially important to wash your hands before eating, smoking, taking medication, chewing gum/tobacco, using the restroom, or applying cosmetics and before you leave the site for the day. It is recommended that personnel present on site shower or bathe at home at the end of each day of working on the site.

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Site Safety Equipment

Check all items that are required to be on site:

☐ Fire Extinguisher	☑ First Aid Kit	☑ Flashlight
☐ Air horn/signaling device	☑ Cellular Phone	☐ Duct tape
☐ Ladder	☐ Barricade tape	☐ Drum dolly
☐ Two-way radio	☑ Safety cones	☐ Harness/Lanyard
☑ Other City of Dayton Police Officer		

The equipment checked in any box above must be on site during the task being performed. Work shall not commence unless the equipment is present.

Site Security & Work Area Controls

Access to each work area will be controlled during on-site activities as follows:
Consider protection of both project and non-project personnel (e.g., general public).

Work areas will be designated and established in areas identified by Haley & Aldrich personnel in conjunction with applicable home owners.

The "buddy system" is to be enforced at a minimum while work is being conducted at a private property. The "buddy system" will also be enforced when circumstances arise that warrant it's use and after consultation with the Project Manager. When working under the "buddy system", personnel are to:

- never work alone;
- provide their partner with assistance;
- observe partner for signs of over-exposure/temperature stress;
- check integrity of partner's protective clothing;
- notify others if emergency help is needed; and
- when wearing respiratory protective equipment, personnel must maintain visual contact with their buddy.

Sampling at a private property may proceed only after the owner has been contacted, and provided a signed authorization to proceed. Additionally, investigation and/or construction work will neither commence nor continue unless a City of Dayton Police Officer is present at the property. If at any time the City of Dayton Police officer must leave the property, the Haley & Aldrich, Inc. personnel and subcontractors must also leave until such time an Officer is able to return.

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Training Requirements

5.1.1 Health and Safety Training

Personnel will not be permitted to supervise or participate in field activities until they have been trained to a level required by their job function and responsibility. H&A staff members, contractors, subcontractors, and consultants who have the potential to be exposed to contaminated materials or physical hazards must complete the training described in the following sections.

The H&A Project Manager/LHSC will be responsible for maintaining and providing to the client/site manager documentation of H&A staff members' compliance with required training as requested. Records shall be maintained per OSHA requirements.

5.1.2 40-Hour Health and Safety Training

The 40-Hour Health and Safety Training course provides instruction on the nature of hazardous waste work, protective measures, proper use of personal protective equipment, recognition of signs and symptoms which might indicate exposure to hazardous substances, and decontamination procedures. It is required for all Haley & Aldrich, Inc. personnel working on-site, such as equipment operators, general laborers, and supervisors, who may be potentially exposed to hazardous substances, health hazards, or safety hazards consistent with 29 CFR 1910.120.

5.1.3 8-hour Annual Refresher Training

Personnel who complete the 40-hour health and safety training are subsequently required to attend an annual 8-hour refresher course to remain current in their training. When required, site personnel must be able to show proof of completion (i.e., certification) at an 8-hr refresher training course within the past 12 months.

5.1.4 8-Hour Supervisor Training

On-site managers and supervisors directly responsible for, or who supervise staff members engaged in hazardous waste operations, should have eight additional hours of Supervisor training in accordance with 29 CFR 1910.120. Supervisor Training includes, but is not limited to, accident reporting/investigation, regulatory compliance, work practice observations, auditing, and emergency response procedures.

5.1.5 Additional Training

H&A personnel will ensure their personnel have received additional training on specific instrumentation, equipment, confined space entry, construction hazards, etc., as necessary to perform their duties. This specialized training will be provided to personnel before engaging in the specific work activities. Any staff member engaging in the following activities will be required to have additional training:

- Client specific training or orientation
- Competent person excavations

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- Confined space entry (entrant, supervisor, and attendant)
- Heavy equipment including aerial lifts and forklifts
- First aid/ CPR
- Diving
- Use of fall protection
- Commercial Drivers License
- Use of Nuclear Density Gauges
- Asbestos

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6. MONITORING PLAN AND EQUIPMENT

Do any activities require air/**exposure monitoring** during work for personal protection? ☑ Y ☐ N

Is **perimeter monitoring** required for community protection? ☐ Y ☑ N

Monitoring/Screening Equipment

- ☑ HNu analyzer (PID) ☐ 10.2eV ☑ 11.7eV
- ☐ Organic vapor monitor (FID)
- ☐ Photovac Micro Tip, 10.6eV
- ☐ Photovac GC
- ☐ Other
- ☐ Combustible Gas Indicator (CGI) (LEL)
- ☐ Multiple Gas Detector-LEL/O_2/H_2S/CO
- ☐ Dust Monitors (RAMs)
- ☐ Colorimetric tubes

Standard Action Levels And Required Responses

For readings obtained with a multiple gas detector or an individual monitoring instrument are listed in Table 2. Specific Ionization potentials and exposure limits are listed in Table 1.

Description of Monitoring Requirements (include frequency and location by Task):

Monitoring Plan for Task Number(s):	2,3	Frequency	1	times per	Hour

Notes: Exposure Guidelines for common contaminants are listed in **Table 1**
Requirements for PPE upgrades based on monitoring are in **Table 2**

Record monitoring data and PPE upgrades on **Record of Field Monitoring** form **http://intranet/Health_Safety/590/1874/Frm_4003%20Field%20Monitor%20Record.xls**; maintain with project files.

Calibration and use of Equipment

Calibrate all monitoring equipment in accordance with manufacturers requirements and site specific requirements (e.g., at the beginning and end of each work day).

Air monitoring for exposure should be based on the frequency established above (see Section 6.2). If action is required record time, location, results of monitoring and actions taken based upon the readings.

Use the H&A established SOPs for equipment calibration in the H&A SOPs located on the Intranet.

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7. DECONTAMINATION

Personnel Decontamination

Are **decontamination procedures** required for personnel working on site? ☑ Y ☐ N
Large or heavy equipment is not expected to be utilized for any tasks associated with this project. Therefore, all decontamination activities of small equipment and containerization of small quantities of waste are expected to be able to be performed at the work location. Disposal of wastes shall be performed as described below.

Decontamination procedures required for personnel working on site:

1. Every site worker who comes in contact with soil during site activities must wash their hands before eating, drinking, or smoking or when leaving each work area. Hand washing facilities (soap, potable water, and towels) must be provided at the decon station at each work location. Potable drinking water, stationed at a support vehicle, will be provided near each work location.

2. All disposable PPE will be removed with care, not exposing any part of the body to the contaminants. They will be discarded in to a suitable container for proper disposal.

3. All non-disposable PPE such as respirators will be cleaned with soap (non-phosphate) and water to the degree that is necessary to remove visible contamination.

4. No disposable PPE will be used the following day, new disposable PPE will be used daily. If cartridges are used for respirators, they must be discarded daily and new ones used.

5. All workers must wash their hands and any other body part that has come in contact with soil after each time they remove their PPE. If an employee's personal clothing is soiled by soil the clothing should not be worn again until it has been laundered. Contaminated clothing should be laundered separately.

Location of decontamination station: Building 16, Home Avenue Facility

Disposal of PPE: Dispose of all PPE in disposal bags. PPE is to be bagged, labeled, and turned over to the Facility for profiling, manifesting, and disposal. No PPE will be disposed of in a non-Delphi owned private property refuse container.

Tools & Equipment Decontamination

All decon should be conducted at the Delphi Home Avenue Facility and not at the office or a non-Delphi owned property. If decon of small equipment must be performed at the work location, all decon materials and PPE must be containerized and transported to the Delphi Home Avenue Facility for profiling and disposal.

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Check all **equipment and materials needed for decontamination** of tools and other equipment:

☐ Acetone	☐ Distilled water	☐ Poly sheeting
☑ Alconox soap	☑ Drums for water	☐ Steam cleaner
☑ Brushes	☐ Hexane	☑ Tap water
☑ Disposal bags	☐ Methanol	☑ Washtubs
☑ Other Paper Towels		

Outline the **equipment decontamination procedures** for this project:

1. Contractors are responsible to decontaminate their own equipment.

   - Exploration equipment must be decontaminated prior to initiating site activities, in between exploration locations to minimize cross-contamination potential, and prior to mobilizing off site after completion of site work. Heavy equipment is generally best deconned with a combination of steam-cleaning equipment and detergent scrubbing. Particular attention should be paid to parts in direct contact with contaminants, e.g., shovels, tires, augers, drilling decks, etc.
   - Contractors are responsible for the construction/destruction of an appropriate decontamination pad. Decontamination activities will occur on this pad.

2. Prior to leaving the work area, personnel handling equipment or soils will be required to wash their hands with soap and water.

Disposal methods for contaminated decontamination materials (e.g., wash water, rags, brushes, poly sheeting) will consist of:

The wash water will be containerized in a suitable container (drum, frac tank) on-site. Other decontamination-spent materials will be containerized in drums and labeled appropriately.

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8. CONTINGENCY PLANNING

How H&A responds to an emergency depends on whether we are at an active facility or another other location. **Many active facilities have very stringent requirements for the mitigation of emergencies.** Therefore, the PM is responsible for identifying any specific requirements from the client contact.

As a rule of thumb, the following are H&A's basic responses to handling Emergencies. Typically, H&A does not mitigate emergencies. When Clients request or require specific functions such as First Aid/CPR trained personnel on site, we typically conform. Before any Project Manager or LHSC agrees to something more stringent, many issues should be considered such as training, safety, feasibility of an adequate response, insurance requirements, and much more.

Fire

- Major Fires - Major fires will be mitigated by the local fire departments or by client's on-site fire/emergency response departments.
- Incipient Stage Fires -Incipient stage fires will be extinguished by on-site personnel using fire extinguishers. Only those who have received annual training in the use of a fire extinguisher may use an extinguisher.

Medical

All H&A employee injuries and illnesses will be documented using the Supervisor's Accident / Injury / Near Miss Report (SAIR). This form is available on the Intranet.

- First Aid - First aid will be addressed using the on-site first aid kit. H&A employees are *not required or expected* to administer first aid/CPR to any H&A, Contractor, or Civilian personnel at any time and it is H&A's position that those who do are doing it on their behalf and not as a function of their job.
- Trauma - Based upon the nature of the injury, the injured party may be transported to the nearest hospital or emergency clinic by on-site personnel or by ambulance. First response to a trauma incident is to call 911 or Facility security. H&A staff members are expected to assist in ancillary roles only such as directing ambulances to the scene. It is the discretion of the staff member on site whether an ambulance should be procured in remote locations where ambulance services will not be effective.

Hazardous Materials Spill

- Small incidental spills (e.g.- pint of motor oil) caused by H&A employees and/or by the contractor will be mitigated by the H&A staff member and/or the contractor.
- Large spills (e.g.- large leak from heavy equipment fuel tank) The contractor is responsible for cleanup. In the event that it posses a serious human or environmental threat, the local Fire Department and/or client emergency response department will be contacted. Once emergency has been mitigated typically clean up will be provided by a vendor.

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Rescue

H&A employees will not enter any confined spaces for rescue purposes. In the event of electrocution or electrical shock and prior to initiating a recovery/rescue, assure equipment is de-energized or the person is not in contact with the power source.

Weather Related Emergencies

H&A employees and their subcontractors should be aware of potential health effects and/or physical hazards of working during inclement weather. If applicable, the effects and hazards of heat stress, cold stress, frostbite, thunderstorms, lightning, etc., should be outlined in Section 4.0, or the H&A SOP should be included if one exists.

Emergency Alarming and Communication

In the event of an emergency, on site H&A personnel and Subcontractors shall assemble in a designated area. Role shall be completed by the SSO or senior-most H&A person present. No personnel shall leave the assembly area unless directed to do so by Project management, the SSO, or recognized emergency response agency (e.g., police, fire department).

Evacuation alarms and/or emergency information will be communicated among personnel on site by the following means: Verbal communication or hand signals.

Emergency services will be summoned: Via on-site cellular phone.

The **site evacuation plan** is as follows:

Evacuation to the nearest Hospital:

Miami Valley Hospital
One Wyoming St.
Dayton, Ohio 45409
(937) 208 8000

(Approximate Distance 3.5 miles)

Hospital Evacuation Route from Site

- Go South on Inland Ave toward McCall St.
- Turn Left onto McCall St.
- Turn Left onto S James H. McGee Blvd.
- Merge onto US-35 E via the ramp on left
- Merge onto I-75 N toward Toledo
- Take the OH 49/First St exit (exit #53B) toward SALEM AVE
- Take the First St. ramp toward DOWNTOWN
- Turn slight right onto W 1st ST.
- Turn right onto N Main St/OH-4 S

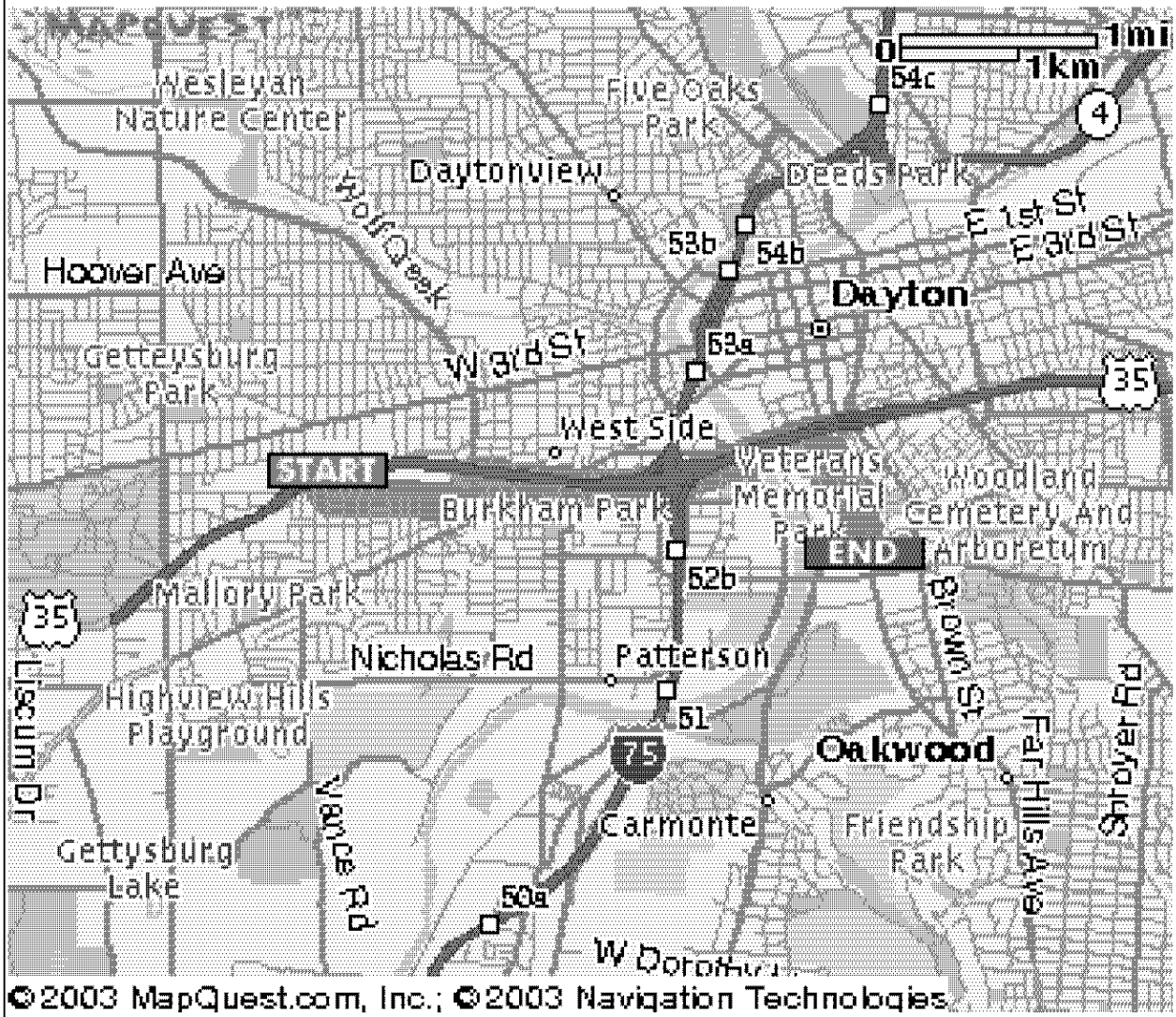
Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

EMERGENCY RESPONSE RESOURCES

Nearest Hospital: (see attached map) Address: Phone Number:	Miami Valley Hospital One Wyoming Street 937-208-8000
Emergency Response Number:	**911**
Local Emergency Response Number (if not on 911 system):	N/A
Other Ambulance, Fire, Police, or Environmental Emergency Resources:	Fire: 937-333-3473 Police: 937-333-2677
H&A Project Manager: Phone Number: Emergency Phone Number: Client Contact/Project Manager: Phone Number: Emergency Phone Number:	Sue Hoertt 937-384-9940 937-620-3799 (cell) John Ridd 937-455-0941 937-901-3755 (cell)
Other Entity: Address: Phone Number:	

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

(**Route to Hospital Highlighted)**



Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

APPENDIX A
HASP Amendment Form

This Appendix is to be used whenever there is an immediate change in the project scope that would require an amendment to the HASP. For project scope changes associated with "add-on" tasks, the changes must be made in the body of the HASP. Before changes can be made, a review of the potential hazards must be initiated by the H&A Project Manager.

Amendment No.	
Site Name:	
Work Assignment No.:	
Date:	
Type of Amendment:	
Reason for Amendment:	
Alternate Safeguard Procedures:	
Required Changes in PPE:	

Project Manager Signature: _____ Date: _____

Local Health and Safety Coordinator : _____ Date: _____

This original form must remain on site with the original HASP. If additional HASPs are in the field, it is the PMs responsibility to forward a signed copy of this amendment to those who have copies.

Response Engineering and Analytical Contract

STANDARD OPERATING PROCEDURES

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

CONTENTS

1.0 SCOPE AND APPLICATION

2.0 METHOD SUMMARY

3.0 EQUIPMENT/APPARATUS

4.0 PROCEDURE FOR PROBE ASSEMBLY AND INSTALLATION

5.0 PROCEDURE FOR SAMPLING SETUP

6.0 PROCEDURE FOR REPAIRING A LOOSE PROBE

7.0 APPENDICES

APPENDIX E

Standard Operating Procedures for Construction and Installation of Permanent Sub-slab Soil Gas Wells

1.0 SCOPE AND APPLICATION

Soil gas monitoring provides a quick means of detecting volatile organic compounds (VOCs) in the soil subsurface. Using this method, underground VOC contamination can be identified, and the source, extent, and movement of pollutants can be traced.

This standard operating procedure (SOP) outlines the methods used for the construction and installation of permanent sub-slab soil gas wells. The wells are utilized to sample the gas contained in the interstitial spaces beneath the concrete floor slab of dwellings and other structures. The thickness of a concrete slab may vary from structure to structure. A structure may have a single slab where the thickness varies. The type of equipment described in this standard operating procedure (SOP) may be purchased at a local home center or hardware store and should allow the installation of a soil gas well in a slab up to 8-inches thick. Equipment can be purchased to drill thru a slab of greater thickness, however this equipment may not be available locally. These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Using an electric Hammer Drill or Rotary Hammer, an inner or pilot hole is drilled into the concrete slab to a depth of approximately 2 inches (") with the 3/8" diameter drill bit. Using the pilot hole as the center, drill an outer hole to an approximate depth of 1 3/8" using the 1" diameter drill bit. Replacing the 3/8" diameter drill bit continue to drill the pilot hole thru the slab and several inches into the sub-slab material. Once drilling is completed, a stainless steel probe is assembled and inserted into the pre-drilled hole. The probe is mounted flush with the surrounding slab so it will not interfere with pedestrian or vehicular traffic and cemented into place. A length of Teflon® tubing is attached to the probe assembly and to a sample container or system. Sample collection may now begin.

3.0 EQUIPMENT/APPARATUS

Hammer Drill or Rotary Hammer
AC extension cord
AC generator (if AC power is not available on site)
Hammer or Rotary Hammer drill bit, 3/8"diameter
Hammer or Rotary Hammer drill bit, 1"diameter
Portable vacuum cleaner
(1) 3/4" open end wrench or (1) medium adjustable wrench
(2) 9/16" open end wrenches or (2) small adjustable wrenches
Hex head wrench, 1/4"
Tubing cutter

Bucket
Trowel or putty knife
Swagelok® SS-400-7-4 Female Connector, 1/4"NPT to 1/4" Swagelok® connector
Swagelok® SS-400-1-4 Male Connector, 1/4"NPT to 1/4" Swagelok® connector
1/4"NPT flush mount hex socket plug, Teflon® coated
1/4"OD stainless steel tubing, pre-cleaned instrument grade
1/4"OD Teflon® tubing
Teflon® thread tape
Anchoring cement (requires water for mixing)
Modeling clay

4.0 PROCEDURE FOR PROBE ASSEMBLY AND INSTALLATION

- Drill a 3/8"diameter inner, or pilot hole to a depth of 2". (Figure 1)
- Using the 3/8" pilot hole as your center, drill a 1" diameter outer hole to a depth of 1 3/8". (Figure 2)
- Vacuum out any cuttings from the hole.
- Continue drilling the 3/8" inner, or pilot hole thru the slab and a few inches into the sub-slab material. (Figure 3)
- Figure 4 details installed probe assembly.
- Vacuum out any cuttings from the outer hole.
- Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, thru the slab, and into the open cavity below the slab. To avoid obstruction of the probe tube, insure that it does not contact the sub-slab material. Cut the tubing to the desired length.
- Attach the measured length of 1/4"OD stainless tubing to the female connector with the Swagelok® nut. Tighten the nut.
- Insert the 1/4" hex socket plug into the female connector. Tighten the plug. **Do not over tighten**. If excessive force is required to remove the plug during the sample set up phase the probe may break loose from the anchoring cement.
- Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole.
- Mix a small amount of the anchoring cement. Fill the space between the probe and the outside of the

outer hole. Allow the cement to cure according to manufacturers instructions before sampling.

5.0 PROCEDURE FOR SAMPLING SETUP

Complete the sampling setup (Figure 5) as follows:

- Wrap one layer of Teflon® thread tape onto the NPT end of the male connector.
- Remove the 1/4" hex socket plug from the female connector. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.
- Screw and tighten the male connector into the female connector. **Do not over tighten**. This may cause the probe to break loose from the anchoring cement during this step or when the male connector is removed upon completion of the sampling event. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.
- Attach a length of 1/4"OD Teflon® tubing to the male connector with a Swagelok® nut. The Teflon® tubing is then connected to the sampling container or system to be utilized for sample collection.
- After sample collection remove the male connector from the probe and reinstall the hex socket plug. **Do not over tighten** the hex socket plug. If excessive force is required to remove the plug during the next sampling event the probe may break loose from the anchoring cement .Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.

6.0 PROCEDURE FOR REPAIRING A LOOSE PROBE

- If the probe breaks loose from the anchoring cement while removing or installing the hex head plug, or the male connector, lift the probe slightly above the surface of the concrete slab.
- Hold the female connector with the 3/4"open end wrench.
- Complete the step being taken during which the probe broke loose, following the instructions contained in the standard operating procedure (SOP). (i.e. **Do not over tighten** the hex socket plug or male connector)
- Push the probe back down into place and reapply the anchoring cement.
- Modeling clay may be used as a temporary patch to affect a seal around the probe until the anchoring cement can be reapplied.

APPENDIX F

Standard Operating Procedure for Indoor/Outdoor Ambient Air Sampling Indoor

INDOOR/OUTDOOR AMBIENT AIR SAMPLING

INTRODUCTION

This operating procedure explains the procedure to be followed for the collection of indoor or outdoor air for laboratory analysis in accordance with USEPA Method TO-15.

SUPPLIES/ EQUIPMENT REQUIREMENTS

- Vacuum canister with tag
- Laboratory Calibrated Flow controller
- Pressure gauge
- Garbage bags
- Pocketknife
- Nitrile gloves
- Adjustable wrench
- Tape measure
- Camera/batteries
- Watch
- FID or PID

OUTDOOR OR INDOOR AIR SAMPLING

Personal protective equipment will be donned in accordance with the requirements of the Project Health and Safety Plan.

Verify the sampling location and assign a unique identification. Observe the area immediately surrounding the proposed location and note the presence of any potential sources of VOCs present (i.e. open paint cans, gasoline cans, lawn mower etc.). If approved by the homeowner and/or tenant, remove potential sources prior to sampling. If unapproved, locate an alternate suitable location for sample collection and note reason for change.

INDOOR OR OUTDOOR AIR SAMPLING

Equipment calibration, field documentation, sampling, and chain of custody procedures will be conducted in accordance with the Project Work Plan (WP) and Quality Assurance Project Plan (QAPP). Personal protective equipment will be donned in accordance with the requirements of the Project Health and Safety Plan.

1. For indoor air sample locations, the canister should be placed 2-4 feet from the floor in the "breathing zone".
2. Outdoor sample locations will be selected after reviewing factors such as wind direction, weather, safety and proximity to soil vapor sample location.
3. Attach the gauge to the canister and open the valve approximately 1¼ turn. Record the initial vacuum, close the valve, and attach the flow controller.
4. If separate flow controller and vacuum gauges are provided, be sure to select the appropriate flow controller for the location.
5. Open the valve on the canister and record the sample start time on the sampling record.
6. At the conclusion of the designated sample duration, record the final time and vacuum and close the valve.
7. Remove the vacuum gauge and flow controller and replace the ¼" cap on the canister inlet. Label the canister sample tag with a unique ID.
8. Fill-in the Chain of Custody (COC) with appropriate information. Minimum information required on the COC is noted below. Retain copies of the COC record and relevant shipping information in the project files. Place canisters back into their original boxes and ship them to the laboratory.

    - Sample number/ID
    - Date and time
    - Parameters to be analyzed
    - Project Number
    - Sampler's initials

FIELD NOTES

Field notes are intended to document events, equipment used, and measurements collected during the sampling activities. Field forms may include the following information:

- Identification of soil vapor well point location
- Soil vapor well point depth
- Purge volume and pumping rate
- The amount of time required to purge the point
- Purge/sampling device used
- Sample identification

- Parameters requested for analysis
- Laboratory to which samples were shipped
- Chain of custody number for shipment to laboratory
- Field observations on sampling event
- Name of sample collector(s)
- Climatic conditions including air temperature
- Problems encountered and any deviations made from the established sampling protocol.
- Sample Identification Key

REFERENCES

1. U.S.E.P.A., Soil Gas Sampling SOP# 2042, 1 June 1996, REV. #: 0.0

2. Compendium of Methods for the Determination of Organic Compounds in Ambient Air, EPA/625/R-96/010a, 2nd Edition, June 1999, USEPA ORD, Washington DC.

3. USEPA RCRA Groundwater Monitoring: Draft Technical guidance (EPA/530-R-93-001).

4. New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York", October 2006.

5. USEPA "DRAFT Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion)", 2002.

APPENDIX G

Air Assessment Questionnaire and Building Inventory for Residential Structures

INDOOR AIR ASSESSMENT QUESTIONNAIRE AND BUILDING INVENTORY FOR RESIDENTIAL STRUCTURES

Form Completed by: _____
Date/Time Initial Call/Visit: _____
Date/Time Follow-up Call/Visit:_____

1. OWNER OR LANDLORD _____(Check if same as occupant)
Interviewed: Y/N

First Name: _____ Last Name: _____

Address:_____

Contact information:
Home Phone: _____ Cell Phone: _____
Work Location/Phone:_____

Preferred means and time(s) to contact:
In person _____ At Home by Phone _____
At Work by Phone _____By Cell Phone _____

How long have you owned the house?_____

Number of Occupants/persons at this location: _____
Age of Occupants: _____

Permission to contact the current tenants? **Y/N**

How long have current tenants lived in the house (per unit, if multiple units)?_____
_____

If property is occupied by the owner and is a single-family house, skip to Question 3.

If property is a rental house, get contact information for tenants and contact them to answer Question 2.

Comments:
_____
_____
_____
_____
_____
_____
_____
_____
_____

2a. RENTER/OCCUPANT: [Note: for multi-tenant structures, please collect information for each address as possible] Interviewed: Y/N

Name: _____

Address:_____

Home Phone: _____ Office Phone: _____Cell Phone: _____

Preferred means and time(s) to contact:
_____In person _____Home Phone
_____Office Phone _____Cell Phone

How long have you lived there?_____ Number living at this location: _____
Age of Occupants: _____

2b. RENTER/OCCUPANT:
Interviewed: Y/N

Name: _____

Address:_____

Home Phone: _____ Office Phone: _____Cell Phone: _____

Preferred means and time(s) to contact:
_____In person _____Home Phone
_____Office Phone _____Cell Phone

How long have you lived there?_____ Number living at this location: _____
Age of Occupants: _____

2c. RENTER/OCCUPANT:
Interviewed: Y/N

Name: _____

Address:_____

Home Phone: _____ Office Phone: _____Cell Phone: _____

Preferred means and time(s) to contact:
_____In person _____Home Phone
_____Office Phone _____Cell Phone

How long have you lived there?_____ Number living at this location: _____
Age of Occupants: _____

3. RESIDENTIAL STRUCTURE CHARACTERISTICS

Residential type: (Circle appropriate responses)

Ranch	Multi-story	Multi-Family	
Raised Ranch	Apartment	Modular	Townhouse/Condo
Split Level	Mobile Home		

If structure includes multiple units, number of units: _____
Number of stories: _____
Comments:_____
Any historic use of structure:_____

If the property is also or has been used as a commercial establishment, what type?
Business Type(s) _____

4. RESIDENTIAL STRUCTURE CONSTRUCTION

House construction: wood frame concrete stone brick
Comments:_____

Year Constructed _____

Is there an attic: **Yes / No**
Is the attic occupied? **Yes / No** Comments_____

Is there a basement: **Yes / No**
Is the basement occupied? **Yes / No** Comments:_____
_____

Is there a crawl space: **Yes / No** Where located? _____
Construction: (Circle appropriate responses) Dirt Gravel Plastic lining Insulation

5. OCCUPANCY

Level	General Use of Each Floor (e.g., family room, bedroom, laundry, workshop)
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

6. BASEMENT CHARACTERISTICS (circle all that apply)

a. Insulation: Describe: _____

b. Basement type: NA full partial unfinished partially finished finished
Comments: _____

c. Basement floor: concrete dirt stone
Comments: _____

d. Concrete floor: unsealed sealed carpet painted
Generally describe condition (e.g. cracks, damaged areas):_____
_____

e. Describe the condition of the basement floor: (circle any relevant key words that describe the response)
Good (no cracks or very minor cracking)
Fair (numerous small cracks, chips in several areas)
Poor (many cracks 1/8" or greater, heaved in areas)
Comments:_____

f. The condition of the basement is: (circle any relevant key words that describe the response)
Dry regardless of rainfall
Damp (feels humid, moisture evident on walls and floor, moldy, musty odor)
Leaks/Seeps (water enters only during heavy rain events)
Wet (small pools/puddles/streams of water most of the time, water seepage through floors and or walls)
Comments:_____

g. Most recent weather or sewer related flood event, if any _____
h. Sump present? **Yes / No** Location _____
i. Water in sump? **Yes / No** **NA**
j. Foundation walls: poured block stone other _____
k. Foundation walls: unsealed sealed/painted:_____

7. HEATING, VENTING and AIR CONDITIONING (circle all that apply)

Type of heating system(s) used in this building: (circle all that apply - note primary)

Hot air circulation	Heat pump	Hot water baseboard
Space Heaters	Steam radiation	Radiant floor
Electric baseboard	Wood stove/Fireplace	Outdoor wood boiler

Other_____

The primary type of fuel used is: Natural Gas Electric Fuel Oil Kerosene Propane Solar Wood Coal

Where is the hot water tank located? _____
Fueled by: _____

Where is the boiler/furnace located?: _____

Air conditioning: Central Air Window units None

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY
(Circle appropriate responses. Provide comments and or specify where response is "other")

a. Is there smoking in the residence? Yes / No

b. Has the residence ever had a fire? Yes / No
When/Cause_____

c. Is there a garage? Yes / No Attached Detached Outbuilding
Garage Use: _____
Outbuilding Use: _____

d. If an attached garage:
Is it heated? Yes / No NA
How heated? Furnace (Electric/Natural Gas) Stove (Wood/Pellets/Coal/Other)
Space Heater (Electric/Kerosene/Propane) Boiler (Natural Gas/Other)
Comments: _____
Are petroleum-powered machines or vehicles stored in it? (lawnmower, ATV, car)
Yes / No NA Comments_____
Has the attached garage had a fire? Yes / No NA
When/Cause_____

e. Is there a workshop or hobby craft area in the house or attached garage? Yes / No
Where_____
How used_____

f. Has there been any painting, furniture refinishing or staining in the house or attached garage in the past 6 months? Yes / No Where/When/Type (latex, oil, solvent)_____
_____

g. Has any new carpet, drapes or other textiles been installed in the past several months?
Yes / No Where/When/Type_____

h. Do you have a kitchen exhaust fan? Yes / No If yes, where vented_____

i. Do you have bathroom exhaust fan(s)? Yes / No If yes, where vented (e.g. attic, outside)?_____

j. Do you have a clothes dryer? Yes / No If yes, where vented? _____

k. Have any pesticides been used at the house? Yes / No Describe:_____
_____

l. Do you notice any odors in the building? Yes / No Describe_____
_____

m. Do any of the building occupants use solvents at work? Yes / No
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, nail technician, hair stylist, other)

Types of solvents used/comments: _____
_____
If yes, are their clothes washed at work? Yes / No

n. Do any of the building occupants regularly use or work at a dry-cleaning service? (circle appropriate response)

No
Yes, use dry-cleaning regularly (weekly)
Yes, use dry-cleaning infrequently (monthly or less)
Yes, work at a dry-cleaning service

o. Is there a radon mitigation system built for the building structure? Yes / No
Date of Installation:_____
Is the system active or passive? Active/Passive
Comments:_____

p. Have cleaning products been used recently? Yes / No
When/Type_____

q. Have cosmetic products been used recently? Yes / No
When/Type_____

r. Do you regularly use air fresheners? Yes / No Describe where/type/frequency_____
_____

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well
Other:_____
If groundwater well, location and depth:_____

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well
Other:_____

10. PRODUCT INVENTORY – Request information concerning the types, quantities, and locations of household and other chemicals and petroleum-type products that may be located at the residence and document information, below. Additional information concerning chemical/product inventory is to be documented based upon on-site observations.

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size(units)	Condition[1]	Chemical Ingredients

Location	Product Description	Size(units)	Condition[1]	Chemical Ingredients

Notes: 1. Describe the condition of the containers as Closed (C), Open (O), new or used (N or U), or Deteriorated (D).

11. ADDITIONAL NOTES

12. FLOOR PLANS – TO BE COMPLETED ON-SITE, BY SAMPLING TEAM

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

BASEMENT:

FIRST FLOOR:

13. OUTDOOR PLOT:

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system (if applicable), and a qualifying statement to help locate the site on a topographic map.

APPENDIX H

Examples of Community Outreach Documents and Access Agreement Forms

DELPHI

Southwest Priority Board
STRIVING FOR HUMAN ADVANCEMENT

April 2, 2007

Dear Resident,

As you probably know, the Delphi plant on Home Avenue has been conducting environmental testing on its property and in your neighborhood during the past few years. Delphi has conducted the testing voluntarily and shared this information with the Southwest Priority Board and public officials from the City of Dayton, the Ohio Environmental Protection Agency, and the U.S. Environmental Protection Agency. The testing has been done in the ground under parts of the plant, and in the neighborhood beneath city streets, right-of-way areas, and alleys. Delphi has done this work to find out if there are any environmental impacts — both on its property and on neighboring property — related to past operations at the plant.

As a next step, Delphi would like to collect samples from some private properties near the Home Avenue plant, with owner permission. We will contact you directly (or your landlord if you are renting the house) within the next 1-2 weeks if this property is selected for testing. If you happen to be contacted, we will fully explain why Delphi thinks this sampling is important, what it entails, and what it could mean to you as a resident. The testing will probably take place in April and May. We are sending you this letter to make you aware of this next step in the study before you see the sampling team and equipment in the neighborhood.

The Priority Board believes the residential testing is important, and has given its support for the work by joining Delphi in sending out this letter. Both Delphi and the Priority Board greatly appreciate your cooperation to help us complete this effort safely.

You can call Delphi toll-free at 1-866-4-DELPHI or the Priority Board at 937-333-8262 if you have any questions about the study or the upcoming sampling event.

Sincerely,

Larry Johnson, Delphi Plant Manager

Simenola Meriner, Acting Chairperson
Southwest Priority Board

DELPHI

Southwest Priority Board
STRIVING FOR HUMAN ADVANCEMENT

April 2, 2007

Dear Landlord,

As you probably know, the Delphi plant on Home Avenue has been conducting environmental testing on its property and in the adjacent neighborhood during the past few years. Delphi has conducted the testing voluntarily and shared this information with the Southwest Priority Board and public officials from the City of Dayton, the Ohio Environmental Protection Agency, and the U.S. Environmental Protection Agency. The testing has been done in the ground under parts of the plant, and in the neighborhood beneath city streets, right-of-way areas, and alleys. Delphi has done this work to find out if there are any environmental impacts — both on its property and on neighboring property — related to past operations at the plant.

As a next step, Delphi would like to collect samples from several private properties near the Home Avenue plant, with homeowner permission. We will contact you directly within the next 1-2 weeks if your property is selected for testing and fully explain why Delphi thinks this sampling is important, what it entails, and what it could mean to you and your tenants. The testing will probably take place in April and May. We are sending you this letter to make you aware of this next step in the study because you own property in the area and may see the sampling team and equipment in the neighborhood.

The Priority Board believes the residential testing is important, and has given its support for the work by joining Delphi in sending out this letter. Both Delphi and the Priority Board greatly appreciate your cooperation to help us complete this effort safely.

You can call Delphi toll-free at 1-866-4-DELPHI or the Priority Board at 937-333-8262 if you have any questions about the study or the upcoming sampling event.

Sincerely,

Larry Johnson, Delphi Plant Manager

Simenola Meriner, Acting Chairperson
Southwest Priority Board

DELPHI

PROPERTY ACCESS AND ACTIVITY AGREEMENT

This Agreement is made between _____, whose mailing address is _____, hereinafter referred to as "Owner" and Delphi Corporation ("Delphi") whose mailing address is Delphi, c/o Manager, Global Remediation Services, Operations Support Group, 5825 Delphi Drive, Mail Code 480-410-186, Troy, MI, 48098.

1. Owner grants access to Delphi, its agents, representatives, employees, contractors, subcontractors and Delphi invitees to the property located at _____ ("Property") at reasonable times and at reasonable notice for the purpose of:

   a. Inspecting, investigating, documenting and photographing the property and collecting certain environmental samples inside, on, about, beneath, or adjacent to the Property, including, but not limited to, indoor air sampling and sub-slab sampling, in accordance with all applicable laws, rules and/or regulations governing same; and
   b. Installing, operating, maintaining and removing as necessary environmental testing, recovery and treatment systems at the Property.

2. For purposes of providing notice under this Agreement, the contact person for the Owner is _____, phone number _____. The contact person for Delphi is Manager, Global Remediation Services, Operations Support Group, phone number (248) 813 Pri... 28; fax number (248) 813 Pri... 33.

3. The cost of all environmental testing, recovery and treatment system installation and maintenance, and any related restorative work conducted on this Property shall be borne solely by Delphi.

4. Delphi shall provide Owner with a plan outlining the installation of any recovery and/or treatment systems.

5. Ownership of any recovery and/or treatment system shall vest with the Owner of the Property upon installation. Delphi shall not retain any ownership rights of the recovery and treatment system.

6. Prior to installing any environmental testing, recovery and/or treatment system, Delphi shall notify and obtain all necessary approvals from public agencies.

7. All work by Delphi or its employees, contractors or subcontractors pursuant to this Agreement shall be conducted in such a manner as to minimize any disruption or interference to the Owner and tenant, if applicable. No work shall be undertaken which will materially damage buildings, improvements, equipment, or personal property on the Property without prior approval from the Owner.

8. Owner agrees that they will not take, or cause to be taken, any action, which would interfere with or adversely affect the environmental testing, recovery and treatment system or activities on this Property pursuant to this Agreement.

9. Delphi, by entering into this Agreement, assumes no obligation to the Owner to implement and/or continue the activities described in this Agreement.

10. Delphi shall provide $150 to the Owner or Tenant of the Property (whoever has responsibility for utilities) for electrical charges incurred as a result of the operation of the recovery and/or treatment system for the period of one year following installation. On or before completion of the 11th month of operation, Delphi and the Owner or Tenant shall re-evaluate electrical charges and reasonably adjust future payments by Delphi for same. Delphi shall not be responsible for any interruption of the treatment system caused by an interruption of the electrical service, by any means, to the Property.

11. This Agreement is intended to be and shall be construed as a grant of temporary right of access and not an interest in the Property.

12. The results of testing performed at the house will be provided to the Owner as soon as possible. Results will also be shared with environmental agencies such as the Ohio Department of Health and other governmental agencies as appropriate. Owner agrees that Delphi and its representatives may contact Owner's tenants to coordinate sampling.

13. This Agreement is governed by Michigan law.

14. This Agreement shall be effective on the first date it is fully executed and expires whenever the environmental testing, recovery and/or treatment system is no longer required as determined by the U.S. EPA or Delphi.

15. If this Agreement is executed in duplicate, both are deemed originals.

16. This Agreement may not be modified or amended except by a written agreement duly executed by the parties hereto or by their respective successors.

OWNER

By: _____

Date: _____

DELPHI CORPORATION

By: _____

Title: _____

Date: _____

Example of Access Agreement – Owner Occupied
Voluntary Sampling Program
April/May 2007

DELPHI

PERMISSION TO ENTER AND PERFORM SAMPLING

Property Address: _____

_____

I, _____, own the property specified above, and have the authority to provide access to it.

By my signature below, I hereby grant to Delphi Corporation, its contractor Haley & Aldrich, Inc., and the employees, contractors, agents and representatives of each company, permission to enter upon my property at the address specified above for the following purposes, to be performed at Delphi's expense:

- To collect one or more samples of indoor air, involving the use of one or more canisters to be left in place for a 24 hour period.
- To collect one or more samples of soil vapors from beneath the house by drilling a 1 to 2 inch wide hole in the basement floor.
- To collect one or more samples of soil vapors from the ground outside the house by making a 2 to 3 inch wide hole in the ground next to the foundation of the house.
- To photograph and otherwise document the sampling, both inside and outside the house.

I understand that in preparing to collect the outdoor sample(s), a visual inspection of the exterior area will be made to determine and mark the location of underground utilities.

Any disturbances to the property caused by the sampling, which we anticipate to be minor, will be repaired, including patching a concrete floor and back filling holes made in the lawn.

The results of testing performed at the house will be provided to you as soon as possible. Note that results will also be shared with environmental agencies such as the Montgomery County Combined Health District and other governmental agencies as appropriate.

Property Owner Name (printed) _____

Property Owner Name (signature) _____ Date: _____

Phone Number (home) _____ (cell) _____

Example of Access Agreement – Rental Properties
Voluntary Sampling Program
April/May 2007

DELPHI

PERMISSION TO ENTER AND PERFORM SAMPLING

Property Address: _____

_____

I, _____, own the property specified above, and have the authority to provide access to it.

By my signature below, I hereby grant to Delphi Corporation, its contractor Haley & Aldrich, Inc., and the employees, contractors, agents and representatives of each company, permission to enter upon my property at the address specified above for the following purposes, to be performed at Delphi's expense:

- To collect one or more samples of indoor air, involving the use of one or more canisters to be left in place for a 24 hour period.
- To collect one or more samples of soil vapors from beneath the house by drilling a 1 to 2 inch wide hole in the basement floor.
- To collect one or more samples of soil vapors from the ground outside the house by making a 2 to 3 inch wide hole in the ground next to the foundation of the house.
- To photograph and otherwise document the sampling, both inside and outside the house.

I understand that in preparing to collect the outdoor sample(s), a visual inspection of the exterior area will be made to determine and mark the location of underground utilities.

Any disturbances to the property caused by the sampling, which we anticipate to be minor, will be repaired, including patching a concrete floor and back filling holes made in the lawn.

The results of testing performed at the house will be provided to you as soon as possible. Note that results will also be shared with environmental agencies such as the Montgomery County Combined Health District and other governmental agencies as appropriate. Your signature below indicates that you have granted Delphi and its representatives permission to contact your tenants to coordinate sampling.

Property Owner Name (printed) _____

Property Owner Name (signature) _____ Date: _____

Property Owner Phone Number (home) _____ (cell) _____

Tenant Name(s) _____ (phone) _____

TRYING TO REACH
YOU FLYER
OCTOBER 2007

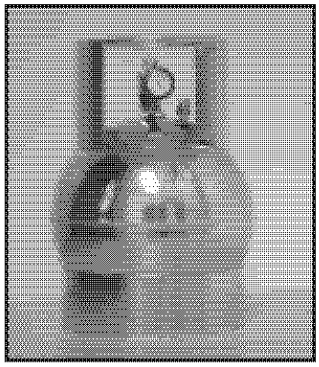
DELPHI

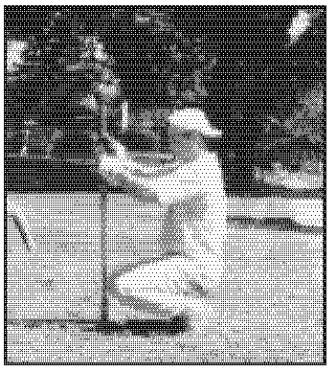
RESIDENTIAL TESTING REQUEST

We have been trying to reach the owner of this property regarding the environmental study we are conducting at our facility on Home Avenue and in this neighborhood. If you are the homeowner or know how he or she may be reached, please contact us toll-free at 1-866-4-DELPHI (1-866-433-5744).

We would like to collect environmental samples inside and outside of this house. This testing is important to determine if there is an impact to indoor air quality at this house related to past operations at the Delphi plant.

Delphi and the Southwest Priority Board greatly appreciate your cooperation to help us complete the sampling.





Equipment like this will be used to collect the samples.

APPENDIX I

Quality Assurance Project Plan (QAPP)

QUALITY ASSURANCE PROJECT PLAN

PHASE I INDOOR AIR SAMPLING AND MITIGATION

DELPHI VOC PLUME SITE
DAYTON, OHIO

REVISION NUMBER: 0

REVISION DATE:
October 2007

PREPARED BY:
HALEY & ALDRICH INC.

Approved By: _____ Date: _____
Program Coordinator – Haley & Aldrich

Approved By: _____ Date: _____
Quality Assurance Officer – Haley & Aldrich

Approved By: _____ Date: _____
Project Manager – Haley & Aldrich

Approved By: _____ Date: _____
Laboratory QA Officer – Columbia Analytical Services – Simi Valley, CA

Approved By: _____ Date: _____
U.S. EPA Region 5 On-Scene Coordinator

Approved By: _____ Date: _____
U.S. EPA Region 5 Quality Assurance Reviewer

TABLE OF CONTENTS

Page

1. INTRODUCTION 1

2. PROJECT ORGANIZATION 2

2.1 Quality Assurance Responsibilities 2
2.2 Field Quality Assurance Responsibilities 5
2.3 Laboratory Responsibilities 5
2.4 Special Training/Certification Requirements 6
2.5 Project Quality Assurance (QA) Team Organization 6

3. PROBLEM DEFINITION 7

3.1 Problem Definition 7
3.2 Project/Task Description 7
3.3 Project Schedule 7

4. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA 8

4.1 Data Quality Objectives (DQO) 8
4.1.1 Soil Vapor and Indoor Air Sampling and Analysis 8
4.2 Measurement Performance Criteria 9
4.2.1 Precision 10
4.2.2 Accuracy 10
4.2.3 Representativeness 11
4.2.4 Comparability 11
4.2.5 Completeness 12
4.2.6 Sensitivity 13
4.3 Special Training/Certification Requirements 13
4.4 Documentation and Records 13
4.4.1 Field and Laboratory Records 13
4.4.2 Data Reporting Format 14
4.4.3 Data Archiving and Retrieval 15

5. DATA GENERATION AND ACQUISITION 16

5.1 Sampling Process Design 16
5.1.1 Sampling Methods 16
5.1.2 Field equipment and Sample Container Cleaning Procedures 16
5.1.3 Field Equipment Maintenance, Testing, and Inspection Requirements 16
5.1.4 Inspection and Acceptance Requirements for Supplies and Sample Containers 16
5.2 Sample Handling and Custody Requirements 17
5.2.1 Sample Handling 17
5.2.2 Sample Custody 18
5.3 Analytical Method Requirements 21

5.3.1 Field Analytical Methods 21
5.3.2 Laboratory Analytical Methods 21
5.4 Quality Control Requirements 21
5.4.1 Field Sampling Quality Control 21
5.4.2 Analytical Quality Control 21
5.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements 22
5.5.1 Field Instrument Maintenance 22
5.5.2 Laboratory Instrument Maintenance 22
5.6 Calibration Procedures and Frequency 22
5.6.1 Field Instruments/Equipment 22
5.6.2 Laboratory Instruments 24
5.7 Inspection/Acceptance Criteria for Supplies and Consumables 24
5.7.1 Field Supplies and Consumables 24
5.7.2 Laboratory Supplies and Consumables 25
5.8 Data Acquisition Requirements 25
5.9 Data Management 25
5.9.1 Data Recording 25
5.9.2 Data Validation 25
5.9.3 Data Transformation/Data Reduction 26
5.9.4 Data Transmittal/Transfer 26
5.9.5 Data Analysis 26
5.9.6 Data Assessment 26
5.9.7 Data Storage and Retrieval 27
5.9.8 Data Security 27

6. ASSESSMENT/OVERSIGHT 28

6.1 Assessments and Response Actions 28
6.2 Reports 30

7. DATA VERIFICATION/VALIDATION AND USABILITY 31

7.1 Data Review, Verification, and Validation Requirements 31
7.2 Verification and Validation Methods 31
7.3 Usability/Reconciliation with Data Quality Objectives 32
7.3.1 Precision 32
7.3.2 Accuracy/Bias 32
7.3.3 Sample Representativeness 33
7.3.4 Completeness 33
7.3.5 Comparability 34
7.3.6 Sensitivity and Quantitation Limits 34
7.3.7 Data Limitations and Actions 34

LIST OF TABLES

Table No.	Title
TABLE 4.1	TARGET COMPOUND LIST AND LABORATORY REPORTING LIMITS
TABLE 5.1	SUMMARY OF ANALYTICAL METHODS -CONTAINER, PRESERVATION, SHIPPING AND PACKAGING REQUIREMENTS

LIST OF FIGURES

Figure No.	Title
FIGURE 2.1	PROJECT ORGANIZATION – QUALITY ASSURANCE TEAM

LIST OF ATTACHMENTS

ATTACHMENT 1 EXAMPLE FIELD FORM

ATTACHMENT 2 LABORATORY STANDARD OPERATING PROCEDURES

QAPP DISTRIBUTION LIST

Name/Organization

Steve Renninger– U.S. EPA Region 5

James Little– Haley & Aldrich, Inc

Denis Conley – Haley & Aldrich of New York

Susan Hoertt – Haley & Aldrich, Inc.

John Ridd – Delphi Corporation

Alyson Fortune – Columbia Analytical Services

LIST OF ACRONYMS AND SHORT FORMS

AOC	Administrative Order on Consent
BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CRADA	Cooperative Research and Development Agreement
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
FID	Flame Ionization Detector
GC/MS	Gas Chromatography/Mass Spectroscopy
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO	Health and Safety Officer
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PE	Performance Evaluation
PID	Photoionization Detector
PPE	Personal Protective Equipment
RSD	Relative Standard Deviation
QA	Quality Assurance
QA Officer	Quality Assurance Officer
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SDG	Sample Delivery Group
SOPs	Standard Operating Procedures
SRM	Standard Reference Materials

U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1. INTRODUCTION

Haley & Aldrich, Inc. (Haley & Aldrich) has developed this Quality Assurance Project Plan (QAPP) to establish quality assurance/quality control (QA/QC) procedures for implementation of the Phase I Indoor Air Sampling and Mitigation Work Plan (Haley & Aldrich, August 2007). The Phase I Indoor Air Sampling and Mitigation Work Plan (Work Plan) presents the scope of work to be executed in the installation and monitoring of soil vapor mitigation systems, and the collection and analysis of soil vapor and indoor air samples in structures located in the vicinity of the Delphi Automotive Holdings Group Home Avenue Operations (the Facility) located at 2701 Home Avenue, Dayton, Montgomery County, Ohio.

This QAPP has been developed in accordance with the U.S. EPA guidance documents; "EPA Requirements for Quality Assurance Project Plans", EPA QA/R-5, March 2001; "EPA Guidance for Quality Assurance Project Plans"; EPA QA/G-5, February 1998, and the "EPA Region 5 Instructions on the Preparation of a Superfund Division Quality Assurance Program Plan, Revision 0, June 2000.

The overall goal of the Phase I sampling and mitigation program is to address volatile organic compounds (VOCs) detected in soil vapor in the vicinity of the Facility. The Phase I sampling and mitigation program is designed to collect data of sufficient quality and quantity to support an assessment of potential current and future risks to human health in structures adjacent to the Facility.

To accomplish these goals, the Phase I sampling and mitigation program will utilize the sampling and analysis of subsurface soil vapor and indoor air samples to be collected from beneath and within the occupied spaces of structures adjacent to the Facility. These techniques will include:

- Off-site laboratory analysis of Chemicals of Potential Concern (COPC) in accordance with procedures promulgated by the U.S. EPA “Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air”, EPA625/R-96/010b, as revised January 1999.

2. PROJECT ORGANIZATION

Haley & Aldrich has been designated as the consultant for the development and implementation of the sampling program at the Site.

2.1 Quality Assurance Responsibilities

The project team consists of a Project Coordinator, Project Manager, Quality Assurance Officer (QA Officer), Laboratory QA Officer, Data Validation Staff, Health and Safety Officer (HSO), EPA Region 5 Quality Assurance Reviewer (QAR), and various task leaders and field personnel.

Personnel responsibilities specifically related to QAPP activities are as follows:

James Little – Project Coordinator

The Project Coordinator will be responsible for administration of the Respondent's actions required by the Administrative Order on Consent (AOC). The Project Coordinator is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The Project Coordinator's primary function is to ensure that technical, financial and scheduling objectives are achieved successfully. The Project Coordinator will provide the major point of contact and control matters concerning the project. The Project Coordinator will assist in defining project objectives and schedules, and will establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.

The Project Coordinator will provide final review of all submittals to U.S. EPA and will participate in all technical meetings. The Project Coordinator will ensure that overall technical quality is maintained and has overall responsibility for ensuring that the project meets the plan objectives.

Susan Hoertt - Project Manager

The Project Manager will assist the Project Coordinator in day-to-day project management. The Project Manager will be responsible for coordinating all field activities and the procurement of project subcontractors. Additional responsibilities include assisting in monitoring the progress and quality of investigative collection, preparing and reviewing interim data reports, and providing technical support of project activities.

Denis Conley - Haley & Aldrich Quality Assurance Officer (QA Officer)

The Quality Assurance Officer will be responsible for overseeing the review of field and laboratory produced data for:

- Assuring the application and effectiveness of the QAPP by the analytical laboratory and the project staff;
- Conducting internal quality checks of the sampling program activities; and
- Providing input to the Project Manager as to corrective actions required resulting from the above-mentioned evaluations.

Data Validation Staff

The Haley & Aldrich QA Officer will be assisted by internal Data Validation Staff in the evaluation and validation of field and laboratory generated data. The QA Officer and Data Validation Staff will monitor the activities of the contract laboratories to ensure that the Data Quality Objectives (DQOs) for the project are met. The data validator will have sole responsibility for review and validation of the analytical laboratory data. The data validator will be a professional independent of the laboratory and familiar with the analytical procedures performed.

The data validation services will utilize the EPA's "National Functional Guidelines for Organic Data Review", EPA 2/99. The validation will include a review of each validation criterion as prescribed by the guidelines and be presented in a Data Usability Summary Report (DUSR) from the review of each analytical data package.

Steve Renninger – U.S. EPA Region 5 On-Scene Coordinator

The U.S. EPA On-Scene Coordinator is responsible for U.S. EPA's overview of this project. Mr. Renninger is responsible for approval of the QAPP and submitting this QAPP and any subsequent revisions or amendments to the appropriate U.S. EPA personnel for review and approval..

U.S. EPA Region 5 Quality Assurance Reviewer (QAR)

The U.S. EPA QAR responsibilities include the following, as detailed in the Quality Management Plan for the Region 5 Superfund Program Office:

- Ensures that all environmental information collection activities are covered by appropriate quality system documentation;
- Ensures that sampling and analytical methods for routine operations are well-documented through SOPs;

- Assists in determining the need for, type, and frequency of performance evaluation and reference samples; and
- Assists in solving QA-related problems.

2.2 Field Quality Assurance Responsibilities

The Project Manager or his designee is responsible for field quality assurance. Depending on the task, appropriately experienced personnel will be assigned as Field Team Leaders. The field team leader is responsible for the overall operation of the field team. The field team leader will facilitate communication and coordinating efforts between the site manager and the field team members.

Field Team Personnel involved in the sampling program are responsible for:

- Performance of field activities as detailed in the Work Plan and in compliance with the data quality objectives (DQO) outlined in this document; and
- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees and immediately reporting any accidents and/or unsafe conditions to the Health and Safety Officer (HSO).

2.3 Laboratory Responsibilities

Soil vapor and indoor air samples will be analyzed for in accordance with U.S. EPA Method TO-15. Specific information regarding the sampling and analysis program is provided in the Laboratory Standard Operating Procedure (SOP) provided in Attachment 2.

The specific responsibilities of laboratory personnel involved in the project are as follows:

Laboratory Project Manager

The Laboratory Project Manager will report directly to the Haley & Aldrich Project Manager and will be responsible for ensuring all resources of the laboratory are available on an as-required basis. The Laboratory Project Manager will also sign all final laboratory data reports provided from the analysis of the project samples and will provide Case Narrative descriptions of any data quality issues encountered during the analyses conducted by the laboratory.

Laboratory QA Officer

The Laboratory QA Officer will have sole responsibility for review and validation of the analytical laboratory data generated as part of the indoor air sampling and mitigation program activities. The QA Officer will also define appropriate QA procedures, overview QA/QC documentation, and the approval of the final analytical reports.

The Laboratory QA Officer will conduct internal audits of the laboratory procedures and recommend appropriate corrective actions. The Laboratory QA Officer reports directly to Laboratory Management and will provide written communications to the Haley & Aldrich QA

Officer for any anomalies or corrective actions implemented that affect the reported results for the project samples.

Sample Custodian Staff

The sample custodian staff will receive and inspect the incoming sample containers, record the condition of the incoming sample containers and sign COC documentation. The custodian will notify the project manager of any non-conformances identified during sample receipt and inspection and assign a unique identification number to each sample. After log-in, the sample custodian will initiate transfer of the samples to appropriate laboratory sections and monitor access/storage of samples and extracts.

2.4 Special Training/Certification Requirements

Field sampling team members have received the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) safety training and annual 8-hour refresher courses required by 29 CFR Parts 1910 and 1926.

Each subcontractor will be responsible for compliance of their personnel with applicable training requirements.

The laboratory performing sample analyses for the indoor air sampling and mitigation program is accredited for each parameter of analysis by the National Environmental Laboratory Approval Program (NELAP).

2.5 Project Quality Assurance (QA) Team Organization

The organizational structure for the QA Team is provided in Figure 2.1.

3. PROBLEM DEFINITION

3.1 Problem Definition

The purpose of the Phase I indoor air sampling and mitigation program is to address volatile organic compounds (VOCs) detected in soil vapor in the vicinity of the Facility. The Phase I sampling and mitigation program is designed to collect data of sufficient quality and quantity to support an assessment of potential current and future risks to human health in structures adjacent to the Facility.

These objectives will be accomplished by:

- Conducting indoor air and sub-slab sampling at the structures identified for inclusion in the quarterly sampling program; and
- Conducting indoor air and sub-slab sampling at the structures in which mitigation systems have been installed.

3.2 Project/Task Description

This QAPP has been prepared to prescribe sampling procedures, sample custody, analytical procedures, data reduction validation and reporting, and personnel requirements to ensure that the data are of sufficient quality and quantity to adequately characterize the site conditions.

3.3 Project Schedule

The schedule of activities will be dependent upon the timeframe in which permission to access the structures for sampling and installation of mitigation systems is obtained from the property owners.

4. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

4.1 Data Quality Objectives (DQO)

DQO are qualitative and quantitative statements derived from the outputs of each step of the investigative process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity and quality of environmental data used in decision making are appropriate for the intended application. The DQO process consists of the following seven iterative steps:

- Step One – State the Problem;
- Step Two – Identify the Goal of the Study;
- Step Three – Identify the information Inputs;
- Step Four – Define the Boundaries of the Study;
- Step Five – Develop the Analytical Approach;
- Step Six – Specify Performance or Acceptance Criteria; and
- Step Seven – Develop the Detailed Plan for Obtaining Data.

The analyses to be completed, as a part of the indoor air sampling and mitigation program activities, will include the chemicals of potential concern (COPC) listed in Table 4.1.

4.1.1 Soil Vapor and Indoor Air Sampling and Analysis

The primary goal of the sampling and analysis activities is to determine the concentrations of the COPC present in the soil vapor beneath and/or within residential structures neighboring the Facility to determine if

- Indoor air within the occupied spaces of the structures exceeds U.S. EPA screening levels; and
- Measures to mitigate VOCs in indoor air within the occupied spaces of the structures are effective..

The information inputs include data collected from this indoor air sampling and mitigation program, and data from previous soil vapor studies completed at residential structures in the vicinity of the Facility and in the public right of ways.

The spatial boundaries are defined by future and past sampling activities. The temporal boundary for the sampling program is the date/time of sampling. The

practical constraints for the sampling program are the location and length of time of sample collection, and subsurface conditions.

The analytical approach:

- Assumes that historical data are correct,
- Evaluating the accuracy of sampling and analysis information from the historical soil vapor sampling activities; and
- Collecting new soil vapor and indoor air data in accordance with this QAPP.

The performance criteria for the sampling program include the following:

Type I decision error (false rejection error):

- Conclude that indoor air quality has been impacted, when in fact it has not;
- Decision is to unnecessarily conduct additional monitoring activities and/or implement mitigation of soil vapor; and;
- Consequences involve the unnecessary expenditure of resources to further investigate soil vapor, indoor air and /or implement soil vapor mitigation activities at locations that have not been impacted.

Type II decision error (false acceptance error):

- Conclude that subsurface soil vapor and indoor air quality does not require further monitoring when in fact these media do require further monitoring and/or mitigation;
- Decision is to not monitor soil vapor, indoor air and/or install mitigation systems at locations that have been impacted; and
- Consequences involve repeated sampling to achieve characterization and unnecessary exposure to the COPC.

4.2 Measurement Performance Criteria

The QAPP program is designed to produce data of the quality necessary to achieve project objectives and meet or exceed the minimum standard requirements for field and analytical methods.

The QAPP program will include:

- A mechanism for ongoing control of measurement data and evaluation of data quality; and,

- A measure of data quality in terms of precision, accuracy, representativeness, completeness and comparability.

The following is a general discussion of the criteria used to measure the DQO, including field and laboratory analytical data quality. Field data collection and associated quality assurance will be the responsibility of Haley & Aldrich and its subcontractors.

Laboratory data quality assurance described herein will be the responsibility of the contract analytical laboratory.

4.2.1 Precision

Precision determines the reproducibility of measurements under a given set of conditions or is a quantitative measure of the variability of a group of measurements compared to their average value. Precision will be stated in terms of relative percent difference (RPD) expressed as a percentage of the mean, and a relative range.

The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision. There are more historical data related to individual method performance and the sample "universe" is limited to the samples received within a laboratory. In contrast, sampling precision is unique to each site.

4.2.1.1 Laboratory Precision Criteria

Laboratory precision will be assessed through the calculation of RPD for replicate/duplicate sample analyses performed as laboratory control sample/laboratory control sample duplicate (LCS/LCSD) sample analyses.

The equation to be used to determine precision is presented in Section 7.3.

4.2.2 Accuracy

Accuracy relates to the bias in a measurement system. Bias is the difference between the average value of observed measurements and the "true" value. Sources of error are the sampling process, field contamination, preservation techniques, sample handling, sample matrix, sample preparation and analytical techniques.

4.2.2.1 Laboratory Accuracy Criteria

Analytical accuracy will be assessed through the use of known laboratory control samples and laboratory control sample duplicate analyses (LCS/LCSD). LCS analyses will be performed with each analytical batch of project samples to determine the accuracy of the analytical system.

4.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, a parameter variation at a sampling point or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program.

The representativeness criterion is best satisfied selecting sampling locations properly and ensuring that a sufficient quantity of samples is collected. Representativeness will be addressed by describing sampling techniques and the rationale used to select sampling locations. Sampling locations may be biased (based on existing data, instrument surveys, observations, etc.) or unbiased (completely random or stratified-random approaches) depending on the situation.

4.2.3.1 Field Representativeness Criteria

Representativeness is dependent upon the proper design of the sampling program. The sampling programs are designed to provide data representative of site conditions. For this sampling program, sampling will be biased to areas of known impact based on prior facility operation and/or prior soil vapor sampling activities.

4.2.3.2 Laboratory Representativeness Criteria

The representativeness criteria for laboratory data will be to ensure that the proper analytical procedures are used for sample preparation and analysis and that sample holding times are met. Additionally, the accuracy and precision of the laboratory data affect representativeness. The laboratory representativeness criteria will include achieving the instrument calibration and verification accuracy and precision criteria for the sample analyses.

4.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through using standard operating procedures (SOP) to collect and analyze representative samples and the reporting of analytical results.

4.2.4.1 Field Comparability Criteria

Comparability of data will be based on the use of Standard Reference Materials (SRM) obtained from either EPA Cooperative Research and Development Agreement (CRADA) suppliers or the National Institute of

Standards and Technology (NIST) for field instrument initial calibration and continuing calibration verification.

4.2.4.2 Laboratory Comparability Criteria

Laboratory instruments will be calibrated and verified using SRM traceable to NIST materials. The reported analytical data will be in standard units of mass of contaminant within a known volume of environmental media. Soil vapor concentrations will be reported in milligrams per cubic meter (mg/M^3).

4.2.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is essentially the same for all data uses: that a sufficient amount of valid data is generated.

4.2.5.1 Field Completeness Criteria

The criteria for field completeness will be that greater than 90 percent (%) of all the proposed field sampling locations provide data deemed to be valid. The procedure for determining field data validity is provided in Section 5.9. The equation for calculating completeness is presented in Section 7.3.

4.2.5.2 Laboratory Completeness Criteria

The criteria for laboratory completeness will be that a minimum of 90% of the laboratory data are determined to be valid (usable) for the intended purpose. Analytical data generated by the contract laboratory will be validated by a professional independent of the contract laboratory, experienced in the analytical procedures performed.

- Guidance for the data validation will be derived from the "National Functional Guidelines for Organic Data Review", (2/99).

The evaluation of the data completeness will be performed at the conclusion of the sampling and analysis effort. Corrective actions such as revised sample handling procedures will be implemented if problems are noted. The procedure for determining laboratory data validity is provided in Section 5.9. The equation for calculating completeness is presented in Section 7.3.

4.2.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect a parameter to be measured at a level of interest.

4.2.6.1 Field Sensitivity Criteria

The sensitivity of field instruments used to screen samples for VOCs will be less than the background readings of ambient air. The field sensitivity of field equipment used for Helium detection is presented below:

Instrument	Parameter	Sensitivity
Helium Leak Test RDC Model 2002 Detector (or equivalent)	Helium	< 10 µg/L of Air

4.2.6.2 Laboratory Sensitivity Criteria

The method reporting limits for the sample analyses are provided in Table 4.1

4.3 Special Training/Certification Requirements

Special training/certification requirements for this project were provided in Section 2.

4.4 Documentation and Records

The documents, records, and reports generated during the indoor air sampling and mitigation program are identified in the following subsections.

4.4.1 Field and Laboratory Records

Documents and records generated during the project include sample collection records, QC sample records, field measurement records, laboratory records and data handling records.

Sample collection records that will be used during the sampling activities include field logbooks or standard field forms. Field measurements of organic vapors will be recorded in bound logbooks or on standard field forms. Calibration data, where applicable, will also be recorded in these logbooks or field forms.

Laboratory records that will be maintained for the project include sample receipt documentation, field and laboratory COC documentation, sample container cleanliness certifications, reagent and SRM certifications, sample preparation records, sample

analysis records (e.g., run logs), instrument/raw data, QC data, calibration data, corrective action reports and final reports.

4.4.2 Data Reporting Format

Field data will be recorded in bound logbooks or on standard forms (e.g., soil vapor/ indoor air sampling logs). Field data primarily will be from direct-reading meters (e.g., PID) or field observations. These data will be tabulated and included in project reports or submittals, as appropriate.

The laboratory Project Manager will perform a final review of the QC data summary packages and case narratives to determine whether the report meets the project requirements. In addition to the record of the COC, the final laboratory data report format shall consist of the following:

Title Page
- Project name and number;
- Laboratory project or lot number;
- Signature of the Laboratory Project Manager or his/her designee; and
- Date issued.

Table of Contents - laboratory report contents

Case Narrative
- Number of samples and respective matrices;
- Laboratory analysis performed;
- Any deviations from intended analytical strategy;
- Definition of data qualifiers used;
- QC procedures utilized and references to the acceptance criteria;
- Condition of samples "as received";
- Discussion of whether or not sample holding times were met;
- Discussion of technical problems or other observations which may have created analytical difficulties; and
- Discussion of laboratory QC checks which failed to meet project criteria.

Analytical Methods Summary - methods of sample preparation and analyses for samples.

Analytical Sample Summary - cross-reference table of laboratory sample to project sample identification numbers.

Shipping and Receiving Documents:
- Sample container documentation; and
- Sample reception information and original chain of custody record.

Chemistry Data Package by Analysis

- Sample Results:
  - Sample quantitation (report) limits (RL), reporting MDL and estimated values between the RL and MDL;
  - Methods of sample preparation and analyses for samples; and
  - Raw data for sample results (dated chromatograms, parameter specific quantitation reports, mass spectra and instrument printouts).

- QC Summary Data with Current Control Limits:
  - LCS, method blank results, GC/MS tuning results, and internal standards (organics); and
  - method blank results.

- Standard Data:
  - Initial calibration data, initial calibration checks, continuing calibration verification/check standards;
  - Initial and continuing calibration blanks; and
  - Raw data for calibration data (dated chromatograms, parameter specific quantitation reports, mass spectra and instrument printouts).

- Raw QC Data - dated chromatograms, parameter specific quantitation reports, mass spectra and instrument printouts of QC samples.

- Miscellaneous Data:
  - Instrument run logs;
  - Sample preparation records; and
  - Instrument conditions.

4.4.3 Data Archiving and Retrieval

All records will be maintained in accordance with the Contract Terms and Conditions established between Haley & Aldrich and its client, Delphi Corporation.

5. DATA GENERATION AND ACQUISITION

The design and implementation of the measurement systems that will be used, including sampling procedures, analytical procedures, and data handling and documentation are detailed in the following subsections.

5.1 Sampling Process Design

The rationale for the sampling is provided in the Phase I Indoor Air Sampling and Mitigation Work Plan.

5.1.1 Sampling Methods

Sampling methods for the collection of soil vapor and indoor air are provided in the Work Plan.

5.1.2 Field equipment and Sample Container Cleaning Procedures

The laboratory will provide sample containers. All containers will be pre-cleaned in accordance with the U.S. EPA Method TO-15. Certification for each batch of containers will be provided by the laboratory.

5.1.3 Field Equipment Maintenance, Testing, and Inspection Requirements

Prior to use in the field, the equipment will be calibrated, and the performance information will be recorded in the field logbook or daily field form. Any required maintenance will be performed and documented prior to the equipment being returned to service.

Critical spare parts for field equipment and replacement field equipment will be available and can be shipped for overnight delivery, or delivered to the field, if necessary. Alternately, field equipment vendors can provide replacement equipment if needed. The replacement equipment can be shipped for overnight delivery as necessary.

5.1.4 Inspection and Acceptance Requirements for Supplies and Sample Containers

The Project Coordinator is responsible for ensuring that the field supplies for the project are acceptable. The field supplies for the sampling activities will include:

- Calibration standards for field instrument calibration and calibration checks, as appropriate;
- Detergent (Alconox) for equipment cleaning; and

- Distilled water for sample collection equipment decontamination.

5.2 Sample Handling and Custody Requirements

The procedures for sample handling, labeling, shipping, and COC documentation are provided in the subsections that follow.

Table 5.1 contains sample container, preservation, shipping and packaging requirements.

5.2.1 Sample Handling

The procedures used to collect and label the indoor air and soil vapor samples are provided in the SOPs. The sample numbering system for the project has been designed to uniquely identify each sample from each sampling program and event.

Example Sample Name: P1SS04Q2-01

Dashes must separate each code section.

P1 - The first and second characters indicate the associated project phase. All samples collected as part of the Phase I activities will begin with 'P1', sample collected as part of the Phase II activities will begin with 'P2' and so forth.

SS - The third and fourth characters indicate the media sampled as follows:
SG- Soil Gas sample
SS – Sub-Slab sample
IA – Indoor Air sample
AA – Outdoor Ambient sample

04 - The fifth and sixth characters are the unique address identification number. All addresses will be assigned a numerical ID when the scope of the Phase is determined. For example, if 20 addresses are identified to be sampled during a project phase, all 20 addresses will be assigned a number prior to initiating activities to obtain access.

Q2 - The seventh and eighth characters indicate the type of sample event. Quarterly events will be designated with a Q and the applicable quarter. Quarter designations will not repeat such that following the fourth quarter will be fifth quarter and so forth until sampling is terminated. Mitigation monitoring samples will begin with an M and count numerically until sampling enters a quarterly monitoring program. Baseline samples will be designated as B1.

-01 - The ninth and tenth characters identify the sample as normal or a quality assurance sample. All normal samples will be designated as -01 and duplicates samples will be designated -02. No other quality assurance samples will be collected as part of this project.

A field code will be written in capital letters in the comments section of the Chain-of-Custody for each sample. The field code will not be part of the sample name. Listed below are appropriate field codes.

N Field Sample
D Duplicate

A Sample Identification Key will be used to associate the sample name with the sample location. The Sample Identification Key will be updated upon completion of each sample and will contain additional information regarding the sample (i.e., filtered versus unfiltered, soil versus groundwater, etc.). The information on the Sample Identification Key will exactly match information on sample bottles and the Chain-of-Custody (i.e. date, time, etc.). One Sample Identification Key will be completed for each Chain-of-Custody and will be submitted to the Haley & Aldrich Project Manager.

The samples will be shipped to the laboratory via an overnight courier service. The laboratory will group the samples in sample delivery groups (SDG). An SDG is a group of 20 or fewer field samples (including field QC samples) received by the laboratory within 7 calendar days.

5.2.2 Sample Custody

Custody of a sample begins when it is collected by or transferred to an individual and ends when that individual relinquishes or disposes of the sample. A sample is under an individual's custody if:

1. The item is in actual possession of a person;

2. The item is in view of the person after being in actual possession of the person;

3. The item was in actual possession but is stored to prevent tampering; or

4. The item is in a designated and identified secure area.

5.2.2.1 Field Custody Procedures

The quality of data can be affected by sample collection activities. If the integrity of collected samples is in question, the data, regardless of its analytical quality, will also be in question. Field sampling standard operating procedures will provide for the collection of samples representative of the matrix being investigated.

The following procedures will be used to maintain the integrity of the samples:

- Upon collection, samples are placed in the proper containers.
- Samples will be assigned a unique sample number and will be affixed to a sample label. The information to be placed on the sample label includes: the sample ID number, the sample type, the sampler's name, date collected, and analytical parameter and method to be performed. Information on the labels will be completed with indelible ink.

- Appropriate volumes will be collected to insure that method limits (or quantification limits) can be successfully obtained and that the required level of quality control relative to both precision and accuracy can be completed.

- A COC record will be completed during sample collection. The COC records will accompany the samples to the laboratory. The field personnel collecting the samples will be responsible for the custody of the samples until the samples are relinquished to the laboratory. Sample transfer will require the individuals relinquishing and receiving the samples to sign, date and note the time of sample transfer on the COC record.

- Samples will be shipped or delivered in a timely fashion to the contract laboratory so that holding-times and/or analysis times as prescribed by the methodology can be met.

Field personnel will keep written records of field activities on applicable preprinted field forms. These records will be written legibly to record field data collection activities. Field data sheets will include the following information:

- Project number;
- Project name;
- Date of entry

All field forms entries will be made in ink and dated. If an incorrect entry is made, the incorrect information will be crossed out with a single strike mark, initialed and dated by the person making the correction. The correct information will be entered adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded on the standard field form. Photographs taken at a location, if any, will also be noted using a standard field form. All equipment used to obtain field measurements will be recorded using a standard field form. In addition, the calibration data for all field measurement equipment will be recorded.

The equipment used to collect samples, time of sample collection, sample description, volume, number of containers and preservatives added (if applicable) will be recorded as applicable using standard field forms.

5.2.2.2 Laboratory Custody Procedures

It will be the responsibility of the laboratory sample custodian staff to receive all incoming samples. Once received, the custodian will document that each sample is received in good condition, that the associated paperwork, such as COC forms, have been completed and will sign the COC forms. The custodian will also document that sufficient sample volume has been received to complete the analytical program. The sample custodian will then place the samples into secure, limited access storage.

Consistent with the analyses requested on the COC form, analyses by the contract laboratory's analysts will begin in accordance with the appropriate methodologies. Samples will be removed from secure storage only after internal COC sign-out procedures have been followed.

5.2.2.3 Final Project Files Custody Procedures

The final project file for the project will be maintained by Haley & Aldrich and will consist of the following:

1. Project plan;
2. Project log books;
3. Field data records;
4. Sample identification documents;
5. COC records;
6. Correspondence;

7. References, literature;
8. Final laboratory reports;
9. Miscellaneous - photos, maps, drawings, etc.; and
10. Final reports.

The final project file materials will be the responsibility of the Haley & Aldrich Project Manager.

5.3 Analytical Method Requirements

The field and laboratory analytical methods that will be used during the sampling program are detailed in the following subsections.

5.3.1 Field Analytical Methods

The data from field analyses will be used to determine when the soil vapor sampling point is suitable for the collection of representative samples. Field-portable meters will be used to analyze the soil vapor to demonstrate sample port suitability.

5.3.2 Laboratory Analytical Methods

The analytical methodology that will be used for the analysis of soil vapor and indoor air samples are based on the requirements of EPA Method TO-15. The laboratory SOP is included as Attachment 2.

5.4 Quality Control Requirements

The field and laboratory QC requirements are discussed in the following subsections. Specific QC checks and acceptance criteria are provided in the field and laboratory SOPs presented in the Work Plan.

5.4.1 Field Sampling Quality Control

Field QC requirements include analyzing reference standards for instrument calibration and for routine calibration checks. The evaluation of field QC data is provided in Section 5.9.

5.4.2 Analytical Quality Control

All analytical procedures are documented in the laboratory SOP which addresses the minimum QC requirements for the procedure. The internal quality control checks will include the following QC requirements:

i) Instrument Performance Checks;
ii) Initial and Continuing Calibration Checks;
iii) Internal Standard Performance;
iv) Method Blank Samples;
v) LCS and QC Check Samples; and
vi) Blind Check Samples.

All data will be properly recorded. The data package will include a summary of QC data. Any samples analyzed in nonconformance with QC criteria will be re-analyzed by the laboratory, if sufficient volume is available.

5.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The procedures used to verify that instruments and equipment are functional and properly maintained are described in the following subsections.

5.5.1 Field Instrument Maintenance

The field equipment for this project includes field-portable photoionization detector. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use.

5.5.2 Laboratory Instrument Maintenance

As part of its QA/QC program, the laboratory will conduct routine preventive maintenance program to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance that is performed will be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

5.6 Calibration Procedures and Frequency

The procedures for maintaining the accuracy for all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses are described in the following subsections. These instruments and equipment will be calibrated prior to each use or according to a periodic schedule.

5.6.1 Field Instruments/Equipment

Instruments and equipment used to gather environmental data will be calibrated as specified by the manufacturer’s specifications. Field instruments will be used for

screening for both on-site health and safety air monitoring and soil vapor sampling point leak tests.

5.6.2 Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibration, initial calibration verification and continuing calibration verification. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution.

The use of materials of known purity and quality will be utilized for the analysis of environmental samples. The laboratory will carefully monitor the use of all laboratory materials including solutions, standards and reagents through well-documented procedures.

All solid chemicals and acids/bases used by the laboratory will be reagent grade or better. All gasses will be high purity or better. All Performance Evaluation (PE) Materials will be obtained from approved vendors of the NIST (formerly National Bureau of Standards), the U.S. EPA Environmental Monitoring Support Laboratories or reliable CRADA certified commercial sources.

All materials including standards or standard solutions will be dated upon receipt, and will be identified by material name, lot number, purity or concentration, supplier, receipt/preparation date, recipient/preparer's name, expiration date and other pertinent information.

5.7 Inspection/Acceptance Criteria for Supplies and Consumables

The procedures that will be used to ensure that supplies and consumables used in the field and laboratory will be available as needed and free of contaminants are detailed in the following subsections.

5.7.1 Field Supplies and Consumables

Supplies and consumables for field measurements and sampling will be obtained from various vendors. Sample containers will be obtained from the analytical laboratory. , Additional field supplies and consumables include tubing, detergent and water for equipment decontamination, and personal protective equipment (PPE).

Sample point tubing will be constructed of pre-cleaned high-density polyethylene. This material will not introduce contaminants into the samples or interfere with the analyses. All field supplies will be consumed or replaced with sufficient frequency to prevent deterioration or degradation that may interfere with the analyses.

5.7.2 Laboratory Supplies and Consumables

The Laboratory QA Officer is responsible for the ensuring the acceptability of supplies and consumables.

5.8 Data Acquisition Requirements

Historical data for the site generated during previous studies and monitoring events will be evaluated for comparability prior to incorporation into the data set derived from this sampling program.

5.9 Data Management

The procedures for managing data from generation to final use and storage are detailed in subsections that follow.

5.9.1 Data Recording

Field data will be recorded in field logbooks or on standard forms and consist of measurements from direct reading instruments or direct measurements. Field staff will be responsible for recording field data and the QA Officer is responsible for identifying and correcting recording errors.

Laboratory data are recorded in a variety of formats. The laboratory SOP in Attachment 2 provides the data recording requirements for the analytical method.

5.9.2 Data Validation

Validation of field data for this project will primarily consist of checking for transcription errors and review of data recorded in field logbooks or on standard forms. Data transcribed from the field logbook or standard forms into summary tables for reporting purposes will be verified for correctness by the QA Officer or his designee. Any limitations on the use of field data will be included in the project reports.

The completeness of each data package will be determined by the Data Validator. Completeness checks will be administered on all data to determine whether all required deliverables specified in the QAPP are present. At a minimum, deliverables will include sample COC forms, analytical results, QC summaries and supporting raw data from instrument printouts. The review will determine whether all required items are present and request copies of missing deliverables.

Validation of the analytical data will be performed by the QA Officer or their designee based on the evaluation criteria outlined in "U.S. EPA Contract Laboratory

Program National Functional Guidelines for Organic Data Review", EPA 540/R-99/008, October 1999.

5.9.3 Data Transformation/Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting as direct read instrumentation will be employed in the field. The readings collected in the field will be generated following calibration per the manufacturer's recommendations. Data will be written into field logbooks or standard forms immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field team member, and corrected in a space adjacent to the original entry.

Quality control data will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QA Officer for review. If approved, data will be logged into the project database format. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits and any other anomalous conditions encountered during sample analysis.

5.9.4 Data Transmittal/Transfer

The Haley & Aldrich QA Officer or their designee is responsible for verifying the correctness of the field data after the data are transferred to a spreadsheet and/or database format. The chemical analysis data are maintained in a database that is described below.

Laboratory data will be provided as electronic data deliverables (EDD). The laboratory data will be downloaded into the EDD directly from the laboratory information management system (LIMS).

5.9.5 Data Analysis

The data from the sampling program will be used to delineate the source, nature, and extent of COPC and to delineate affected media. Fate and transport mechanisms for the COPC will also be evaluated.

5.9.6 Data Assessment

Data assessments include determining the mean, standard deviation, (RSD), percent difference, (RPD) and percent recovery for laboratory control sample analyses. The statistical equations to determine percent recovery, RPD and percent completeness are provided in Section 7.3.

5.9.7 Data Storage and Retrieval

Laboratory data will be stored by Haley & Aldrich in hardcopy format. Data will be archived for a period of 5 years. Electronic instrument data are maintained on magnetic media (i.e., compact disc) for this same time period.

Field logbooks will be maintained between sampling events. Upon completion of the sampling program, the final evidence file will be archived.

5.9.8 Data Security

Archived data will not be accessed without authorization. The name of personnel accessing archived data will be recorded.

6. ASSESSMENT/OVERSIGHT

The following subsections describe the procedures used to ensure proper implementation of this QAPP and the activities for assessing the effectiveness of the implementation of the project and associated QA/QC activities.

6.1 Assessments and Response Actions

Assessments consisting of internal and external audits may be performed during the project. Internal technical system audits of both field and laboratory procedures will be conducted to verify that sampling and analysis are being performed in accordance with the procedures established in the Work Plan. External field and laboratory audits may be conducted by U.S. EPA.

Internal audits of field activities include the review of sampling and field measurements conducted by the Haley & Aldrich QA Officer or their designee. The audits will verify that all procedures are being followed. Internal field audits will be conducted once during each phase of the sampling and at the conclusion of the project. The audits will include examination of the following:

i) Field sampling records, screening results, instrument operating records;
ii) Sample collection;
iii) Handling and packaging in compliance with procedures;
iv) Maintenance of QA procedures; and
v) COC reports.

Follow up audits will be conducted to correct deficiencies and to verify that procedures are maintained throughout the sampling program.

Corrective action resulting from internal field technical system audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA Officer will identify deficiencies and recommended corrective action to the Project Manager. The Field Task Leaders and field team will perform implementation of corrective actions. Corrective action will be documented in the field logbook and/or the project file. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in this QAPP are maintained throughout the project.

U.S. EPA Region 5 personnel, any time during the field operations, may conduct an external field technical system audit. These audits may or may not be announced and are conducted at the discretion of U.S. EPA Region 5.

The laboratory QA Officer or their designee will conduct an internal laboratory technical system audit. The laboratory technical system audit is conducted on an annual basis and

includes examining laboratory documentation regarding sample receiving, sample log-in, storage and tracking, COC procedures, sample preparation and analysis, instrument operating records, data handling and management, data tracking and control and data reduction and verification. The laboratory QA Officer will evaluate the results of the audit and provide a final report to section managers and the Operations Manager that includes any deficiencies and/or noteworthy observations.

Corrective action resulting from deficiencies identified during the internal laboratory technical system audit will be implemented immediately. The Project Manager or section leaders, in consultation with the laboratory supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The laboratory QA Officer will ensure implementation and documentation of the corrective action. All problems requiring corrective action and the corrective action taken will be reported to the laboratory Project Manager. Follow-up will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in the QAPP are maintained throughout the project.

External audits will be conducted as required, by appropriate QA personnel of the U.S. EPA Region 5 and may be conducted at least once prior to sampling and analysis activities. External audits may include any of the following:

i) Review of laboratory analytical procedures;
ii) Laboratory on-site visits; and/or
iii) Submission of performance evaluation samples for analysis.

Failure of any of the above audit procedures can lead to laboratory disqualification, and another suitable laboratory will have to be chosen. An on-site review can consist of:

i) Sample receipt procedures;
ii) Custody, sample security, and log-in procedures;
iii) Review of instrument calibration logs;
iv) Review of QA procedures;
v) Review of log books;
vi) Review of analytical SOPs; and/or
vii) Personnel interviews.

A review of a data package from samples recently analyzed by the laboratory can include (but not be limited to) the following:

i) Comparison of resulting data to the SOP or method;
ii) Verification of initial and continuing calibrations within control limits;
iii) Verification of surrogate recoveries and instrument timing results;
iv) Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable; or
v) Assurance that samples are prepared and analyzed within holding times.

6.2 Reports

A summary of data quality information be included with the Work Plan summary report. The Haley & Aldrich QA Officer will be responsible within the organizational structure for preparing the summary of data quality information, and will provide it to the Project Manager for distribution with the Work Plan summary report.

7. DATA VERIFICATION/VALIDATION AND USABILITY

The QA activities that will be performed to ensure that the data are properly documented, of known quality and meet the project objectives are described in the following sections.

7.1 Data Review, Verification, and Validation Requirements

All field and laboratory data will be reviewed and verified/validated. The procedures and criteria used to verify and validate field and laboratory data will consist of evaluating the data to the measurement performance criteria in Section 4.2 of this QAPP. Field data and logbooks will be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling procedures and sample handling, were fulfilled.

Sample collection procedures will be reviewed for compliance with the requirements of the QAPP. If alternate sampling procedure were used, the acceptability of the procedure will be evaluated to determine the affect on the usability of the data.

Sample handling records will be reviewed to ensure that sample integrity remained intact from collection to laboratory receipt. COC documentation and sample condition upon laboratory receipt will be reviewed. The data from samples for which the COC or sample identification cannot be verified will be rejected. Data qualification will be consistent with the action specified in the National Functional Guidelines. Field and laboratory data will be verified to ensure that the methods used to analyze the samples were consistent with the requirements of this QAPP. QC data that do not meet the acceptance criteria will result in sample data qualification.

7.2 Verification and Validation Methods

Field data will be verified by reviewing field documentation and COC records. Data from any direct-reading instruments used during sampling events will be internally verified by reviewing calibration and operating records.

The data verification/validation procedure will identify data as being acceptable, of limited usability (qualified as estimated), or rejected. The results of the data verification/validation will be provided in the data quality summary.

Data determined to be unusable may require corrective action. Potential types of corrective action may include re-sampling by the field team or reanalysis of samples by the laboratory.

7.3 Usability/Reconciliation with Data Quality Objectives

The overall usability of the data will be assessed by evaluating the PARCCS of the data set to the measurement performance criteria in Section 4.2 using basic statistical quantities as applicable. The procedures and statistical formulas to be used for these evaluations are presented in the following subsections.

7.3.1 Precision

Project precision will be evaluated by assessing the RPD data from duplicate samples. Analytical precision will be evaluated by assessing the RPD data from either duplicate spiked sample analyses or duplicate sample analyses. The RPD between two

$$RPD = \frac{|R1 - R2|}{R1 + R2 / 2} X100\%$$

measurements is calculated using the following simplified formula:

where: R_1 = value of first result
R_2 = value of second result

Overall precision for the sampling program will be determined by calculating the mean RPD for all laboratory duplicates. The mean RPD will provide an evaluation of the overall variability attributable to the sampling procedure, sample matrix, and laboratory procedures in each sampling program.

The overall precision requirement will be the same as the project precision. The calculation of the mean RPD will only include the RPD values for laboratory duplicate sample data that are greater than or equal to 5 times the quantitation limit for an analysis.

7.3.2 Accuracy/Bias

The data from method and preparation blank and LCS samples will be used to determine accuracy and potential bias of the sample data.

The data from method/preparation blank samples provide an indication of laboratory contamination that may result in bias of sample data. Sample data associated with method/preparation blank contamination will be identified during the data verification/validation process. Sample data associated with method/preparation blank contamination will be evaluated during the data validation procedure to determine if

analytes detected in the samples and the associated method/preparation blanks are the result of laboratory contamination. The affected sample data will be qualified in accordance with the procedures prescribed in the National Functional Guideline.

Analytical accuracy/bias will be determined by evaluating the percent recovery data of LCS analyses. LCS will be prepared and analyzed in the same manner as the field samples. The data from LCS analyses will provide an indication of the accuracy and bias of the analytical method for each target analyte.

Percent recovery is calculated for LCS using the following formulas:

LCS:

$$\%R = SSR / SA \times 100$$

where: SSR = Spiked Sample Result
SA = Spike Added

The percent recovery is determined by dividing the measured value by the true value and multiplying by 100.

Overall accuracy/bias for the sampling events will be determined by calculating the percent of accuracy measurements that meet the measurement performance criteria specified in Attachment 2.

7.3.3 Sample Representativeness

Representativeness of the samples will be assessed by reviewing the results of field audits. Overall sample representativeness will be considered acceptable if the results of field audits indicate that the approved sampling methods or alternate acceptable sampling methods were used to collect the samples and the field duplicate RPD data are acceptable for at least 90% of the samples.

7.3.4 Completeness

Completeness will be assessed by comparing the number of valid (usable) sample results to the total possible number of results within a specific sample matrix and/or analysis. Percent completeness will be calculated using the following formula:

$$\%\ \text{Completeness} = \frac{\text{Number of Valid (usable) measurements}}{\text{Number of Measurements Planned}} \times 100$$

Overall completeness will be assessed by calculating the mean percent completeness for the entire set of data obtained for each sampling program. The overall

completeness for the sampling program will be calculated when all sampling and analysis is concluded. Overall completeness will be considered acceptable if at least 90% of the data planned for collection are determined to be valid.

7.3.5 Comparability

The comparability of data sets will be evaluated by reviewing the sampling and analysis methods used to generate the data for each data set. Project comparability will be determined to be acceptable if the sampling and analysis methods specified in this QAPP.

7.3.6 Sensitivity and Quantitation Limits

The quantitation limits for the sample data will be reviewed to ensure that the sensitivity of the analyses was sufficient to achieve the action levels identified in the Work Plan.

The method/preparation blank sample data and LCS percent recovery data will be reviewed to assess compliance with the measurement performance criteria specified in Attachment 2.

7.3.7 Data Limitations and Actions

Data use limitations will be identified in data quality assessment reports. Data that do not meet the measurement performance criteria specified in this QAPP will be identified and the impact on the project quality objectives will be assessed and discussed in these reports. Specific actions for data that do not meet the measurement performance criteria depends on the use of the data, and may require that additional samples be collected or the use of the data be restricted. Data quality assessment reports will be prepared at the conclusion of each sampling event.

TABLE 4.1
TARGET COMPOUND LIST[1] AND LABORATORY REPORTING LIMITS[2]
DELPHI HOME AVENUE FACILITY
PHASE I INDOOR AIR SAMPLING & MITIGATION
QUALITY ASSURANCE PROJECT PLAN (QAPP)

CAS ID	Compound	ug/m3		ppbv	
		MRL[3]	MDL[4]	MRL	MDL
71-55-6	1,1,1-Trichloroethane	1.0	0.046	0.18	0.0084
79-34-5	1,1,2,2-Tetrachloroethane	1.0	0.083	0.15	0.012
79-00-5	1,1,2-Trichloroethane	1.0	0.11	0.18	0.019
75-34-3	1,1-Dichloroethane	1.0	0.084	0.25	0.021
75-35-4	1,1-Dichloroethene	1.0	0.069	0.25	0.018
106-93-4	1,2-Dibromoethane	1.0	0.068	0.13	0.0088
95-50-1	1,2-Dichlorobenzene	1.0	0.079	0.17	0.014
107-06-2	1,2-Dichloroethane	1.0	0.049	0.25	0.012
78-87-5	1,2-Dichloropropane	1.0	0.044	0.22	0.0096
541-73-1	1,3-Dichlorobenzene	1.0	0.12	0.17	0.019
106-46-7	1,4-Dichlorobenzene	1.0	0.13	0.17	0.022
78-93-3	2-Butanone	1.0	0.16	0.34	0.054
591-78-6	2-Hexanone	1.0	0.035	0.24	0.0084
108-10 Pri...	-Methyl-2-Pentanone	1.0	0.080	0.24	0.020
67-64-1	Acetone	5.0	0.20	2.1	0.081
71-43-2	Benzene	1.0	0.081	0.31	0.026
75-27-4	Bromodichloromethane	1.0	0.072	0.15	0.011
75-25-2	Bromoform	1.0	0.053	0.097	0.0051
74-83-9	Bromomethane	1.0	0.15	0.26	0.038
75-15-0	Carbon Disulfide	1.0	0.050	0.32	0.016
56-23-5	Carbon Tetrachloride	1.0	0.061	0.16	0.0097
108-90-7	Chlorobenzene	1.0	0.055	0.22	0.012
75-00-3	Chloroethane	1.0	0.15	0.38	0.057
67-66-3	Chloroform	1.0	0.062	0.20	0.013

CAS ID	Compound	ug/m3		ppbv	
		MRL	MDL	MRL	MDL
74-87-3	Chloromethane	1.0	0.16	0.48	0.075
156-59-2	cis-1,2-Dichloroethene	1.0	0.047	0.25	0.012
10061-01-5	cis-1,3-Dichloropropene	1.0	0.067	0.22	0.015
124-48-1	Dibromochloromethane	1.0	0.081	0.12	0.0095
100-41-4	Ethylbenzene	1.0	0.067	0.23	0.016
179601-23-1	m,p-Xylenes	1.0	0.13	0.23	0.029
1634-04-4	Methyl tert-Butyl Ether	1.0	0.053	0.28	0.015
75-09-2	Methylene Chloride	1.0	0.15	0.29	0.041
95-47-6	o-Xylene	1.0	0.048	0.23	0.011
100-42-5	Styrene	1.0	0.058	0.23	0.014
127-18-4	Tetrachloroethene	1.0	0.060	0.15	0.0089
108-88-3	Toluene	1.0	0.026	0.27	0.0067
156-60-5	trans-1,2-Dichloroethene	1.0	0.038	0.25	0.0096
10061-02-6	trans-1,3-dichloropropene	1.0	0.065	0.22	0.015
79-01-6	Trichloroethene	1.0	0.11	0.19	0.019
75-69-4	Trichlorofluoromethane	1.0	0.077	0.18	0.014
76-13-1	Trichlorotrifluoroethane	1.0	0.16	0.13	0.020
108-05-4	Vinyl Acetate	1.0	0.37	0.28	0.11
75-01-4	Vinyl Chloride	1.0	0.066	0.39	0.026

Notes:

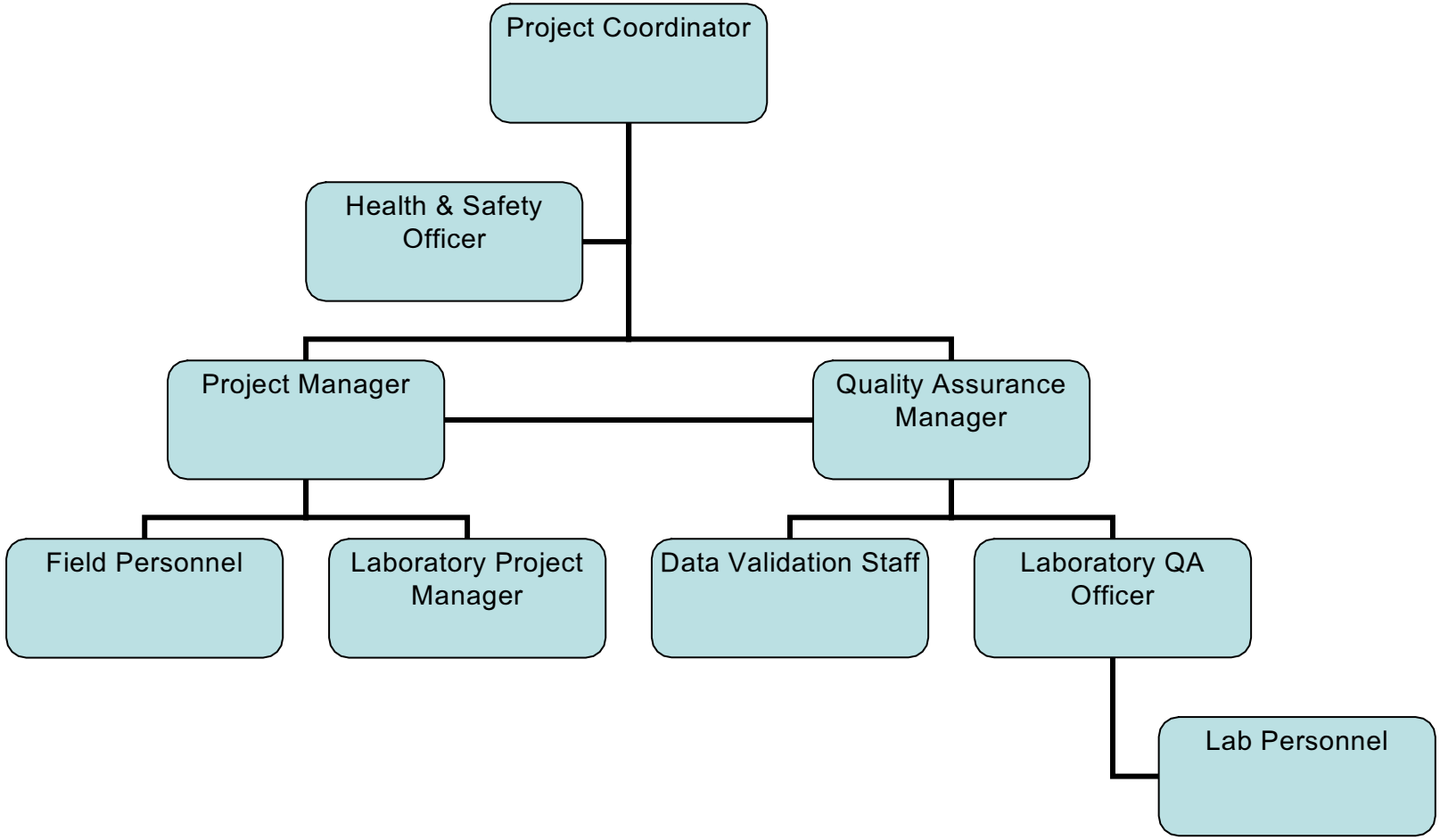
1. Columbia Analytical Laboratory's Standard 43 Compound Target List for analysis of Volatile Organic Compounds (VOCs), EPA Method TO-15. Information provided by Columbia Analytical Services, Inc., Air Quality Laboratory, Simi Valley, CA.
2. Actual reporting limits will be higher depending on the canister dilution factor and sample matrix effects.
3. Method Reporting Limits (MRLs). Method Reporting Limits (MRLs) assume a 1 L sample volume.
4. Method Detection Limits (MDLs)

TABLE 5.1
SUMMARY OF ANALYTICAL REQUIRMENTS AND CONTAINER, PRESERVATION, PACKAGING AND SHIPPING REQUIREMENTS
DELPHI HOME AVENUE FACILITY
INDOOR AIR SAMPLING AND MITIGATION
QUALITY ASSURANCE PROJECT PLAN (QAPP)

Analysis	Parameters	Sample Container	Holding Time*	Shipping and Handling
TO-15**	Volatile Organic Compounds	6 Liter SUMMA® Canister	30 Days	48 hour delivery - **Do not chill samples.**

References:
* Columbia Analytical Services Simi Valley Air Quality Laboratory Standard Operating Procedure
** Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, USEPA 1999, EPA/625/R-96/010b

FIGURE 2.1
PROJECT ORGANIZATION – QUALITY ASSURANCE TEAM
DELPHI HOME AVENUE FACILITY
INDOOR AIR AND MITIGATION SAMPLING
QUALITY ASSURANCE PROJECT PLAN (QAPP)



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Soil Gas SUMMA® Canister Sampling Form

Page of

PROJECT	Phase I Indoor Air Sampling and Mitigation, Delphi Home Avenue	H&A FILE NO.	26708
LOCATION/ADDRESS		PROJECT MGR.	S. Hoertt
CLIENT	Delphi Automotive Holdings Company, LLC.	FIELD REP	
CONTRACTOR		DATE	

Sampling Data:

Well ID:	N/A	Canister ID:	See Below	Purging Device:		Wind Direction/Speed:	
Start time:	See Below	Collection Can Volume:	6L	Purge Rate:	See Below ml/min	Source:	
Finish Time	See Below	Flow Controller ID:	See Below	Purge Time:	See Below min	Ambient Air T	deg F

Sample Location	Start Date (MM/DD/YY)	Start Time (24hrs)	Can ID Number	Pressure Gauge ID Number	Critical Orifice Number	Initial Vacuum (in Hg)	End Date (MM/DD/YY)	End Time (24 hrs)	End Vacuum (inHg)	Purge Time (min) and Rate (ml/Min)	Comments

Named as: "XXX Address - Type" Egs: Delphi - A-1; 52 S. Smith Ave -SS-1
Types: "A" - Ambient "InA" Indoor Ambient "S" Soil Gas "SS" Sub-Slab

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11.12 Manual Integration

The integration for each peak shall be checked to ensure that it has been integrated properly. Assuming an incorrect automatic integration the analyst shall conduct the manual integration in accordance with the *SOP for Manual Integration of Chromatographic Peaks* including all documentation and reviews associated with the process. The review shall include the analyst and reviewer initialing and dating the manual integration as an indication of acceptability and approval.

11.13 Storing Electronic Data

The initial calibration data must be stored in a quantitation method (on the server) using a unique filename and may not be overwritten at any time in order to maintain an accurate audit trail. There are multiple quantitation methods, which are subsets of the compound list in Table 2. Therefore, files will be named with an eight-character notation indicating the compound list and the date of the corresponding initial calibration. In addition, all data files including method blanks, continuing calibration verification, laboratory control samples and client submitted samples files are saved in a unique sub-directory on the server.

12.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

This section of the standard operating procedure contains technical acceptance criteria and references to preferred corrective actions per the guidelines of the specified test method. Corrective actions shall follow the procedures outlined in the *SOP for Nonconformity and Corrective Action Documentation*, where appropriate. Refer to Section 16.0 for requirements and guidelines for reporting out of control results.

To the extent possible, samples shall be reported only if all of the quality control measures are acceptable. If a quality control measure is found to be out of control, and the data must be reported, all samples associated with the out of control quality control measure shall be reported with the appropriate data qualifier(s).

12.1 Instrument Performance Check

The GC/MS system must meet the mass spectra ion abundance criteria listed in Table 1 (if referencing TO-15) or Table 1A (for TO-14A). The appropriate corrective action is described in Section 15.1. Results of the BFB tune check as well as any actual tuning must be recorded and a copy of the tune report maintained on file.

12.2 Initial Instrument Calibration

Initial calibration requirements are as follows:

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1. A minimum of 5 concentrations must be used to calculate the calibration curve.
2. Highest concentration, together with the lowest concentration, defines the calibration range.
3. Lowest concentration must be at or below the method reporting limit.
4. A blank should be analyzed prior to beginning the analysis of the calibration standards.
5. The initial calibration event may not be interrupted by maintenance.
6. Only one value per concentration may be used.
7. Analyze calibration standards from low to high concentration.
8. All ICAL analyses must be completed within the 24-hour tune window.
9. If 5 calibration standards are in the ICAL, one standard may be re-analyzed. If 6 to 10 calibration standards are in the ICAL, two calibration standards may be re-analyzed.
10. Point dropping policy
    - Minimum of 5 consecutive concentrations must be used to calculate the calibration curve.
    - Lowest concentration must be at or below the MRL and may not be dropped unless the MRL is changed to the concentration of the remaining lowest standard.
    - Points at the high end may be dropped, but doing so lowers the calibration range.
    - Points may not be dropped from the interior of the curve unless an assignable cause (i.e., gross dilution error, missing internal standards, purge malfunction, standard preparation error, or instrument malfunction) is accounted for and documented. In these instances, all the analytes in that calibration standard must be dropped from the calibration curve as the corrective action.
    - If a point or a calibration standard is dropped, the reason must be documented (and the results maintained with the documentation for the final ICAL).
    - A calibration standard may be re-analyzed if the first analysis of the standard has been dropped and other requirements in this policy are met (i.e., still within 24 hours).
    - Once the ICAL has been used to calculate and report sample results, it is not to be changed.

12.2.1 <u>Acceptance Criteria</u> Refer to the following acceptance criteria for the initial calibration.

- The RRT for each target compound at each calibration level must be within 0.06RRT units of the mean RRT for the compound.
- The calculated %RSD for the RRF for each compound in the calibration standard must be less than 30% with at most two exceptions up to a limit of 40% (this may not be true for all projects).

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- For each Internal Standard the area response (Y) at each calibration level must be within 40% of the mean area response $\overline{Y}$ over the initial calibration range.
- The retention time shift for each of the internal standards at each calibration level must be within 20s of the mean retention time over the initial calibration range for each internal standard.
- All of the following information must be retained to permit reconstruction of the initial instrument calibration: calibration date, test method, instrument, analysis date, analyte identification, analyst's initials, concentration and responses, and response factors.
- All initial instrument calibrations must be verified with an acceptable ICV (refer to Section 12.3.1).

12.2.2 Corrective Action See Figure 1 and Section 15.2.

12.3 Initial Calibration Verification

All compounds must be evaluated prior to rounding (for reporting purposes).

12.3.1 Acceptance Criteria The percent recovery for each compound in the ICV must be between 70%-130%.

12.3.2 Corrective Action Refer to Figure 1 and Section 15.3.

12.4 Continuing Calibration Verification

All compounds must be evaluated prior to rounding (for reporting purposes).

12.4.1 Acceptance Criteria The percent difference for each target analyte must be within plus or minus 30% of the initial calibration average RRFs.

12.4.2 Corrective Action Refer to Figure 2 and Section 15.4.

12.5 Method Blank

12.5.1 Acceptance Criteria

- The area response for each internal standard in the blank must be within ±40 percent of the area response for each internal standard in the mid-level standard of the ICAL if the method blank follows the ICAL. If the method blank follows a CCV then the area response for each internal standard in the blank must be within ±40 percent of the area response of the CCV.
- The retention time for each internal standard in the blank must be within ±0.33 minutes of the retention time for each internal standard in the mid-level

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standard of the ICAL if the method blank follows the ICAL. If the method blank follows a CCV then the retention time for each internal standard in the blank must be within ±0.33 minutes of the retention time of the CCV.

- The method blank result for any target analyte should not be greater than the reporting limit and should not contain additional compounds with elution characteristics and mass spectral features that would interfere with identification and measurement of a method analyte.

12.5.2 Corrective Action Refer to Section 15.6.

12.6 Laboratory Duplicate

12.6.1 Acceptance Criteria Samples selected for duplicate analysis shall be rotated among client samples. The relative percent difference must fall within ±25%.

12.6.2 Corrective Action Refer to Section 15.8.

12.7 Sample Analysis

Sample results must be quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification. Samples out of holding time must be handled according to Section 15.10.

12.7.1 Acceptance Criteria

The following are the technical acceptance criteria for sample analysis:

- The field sample must be analyzed on a GC/MS system meeting the BFB tuning, initial calibration, initial calibration verification technical acceptance criteria described in Sections 12.1 through 12.3.
- All target analyte peaks must be within the initial calibration range (Section 16.7.3) or reported with the appropriate data qualifier.
- The retention time for each internal standard must be within ±20 seconds of the retention time of the internal standard in the most recent valid calibration.
- Acceptable surrogate recoveries are based on a fixed window at 70 - 140%.
- The area response for any internal standard must be within the range of 60 - 140% of the area of the most recent valid calibration (CCV or mid-point from the initial calibration, whichever is most current).

Note 1: If the most recent valid calibration is an initial calibration, internal standard area responses and retention times in the sample are evaluated against the corresponding internal standard area responses and RTs in the mid level standard of the initial calibration.

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Note 2: Surrogate compound recoveries are requested by a number of clients, but are more appropriately used as system monitoring compounds. This is due to the fact that the compounds are introduced directly into the analytical system and not into the canisters or bags. It is for this reason that these are not considered to be true surrogates and a fixed window is applied.

12.7.2 Corrective Action Refer to Figure 4 and Section 15 for the corresponding corrective actions. .

12.8 Laboratory Control Sample

Round all results to the nearest whole number prior to determining if the acceptance criteria have been met.

12.8.1 Acceptance Criteria

The percent recoveries must be within the laboratory-generated limits specified in Attachment D of this document.

12.8.2 Corrective Action Refer to Figure 3 and Section 15.7.

12.9 Method Detection and Reporting Limits

Method detection limit studies shall be performed annually on each instrument for which this method is performed. The MDL shall be performed in accordance with the procedure outlined in the *SOP for the Determination of Method Detection Limits* and the higher detection limit (from all of the instruments where this method is to be performed) for each analyte must be selected and used as the uniform method detection limit for that analyte regardless of the instrument of analysis. The quantitation limit or reporting limit for this method shall be at or above the concentration of the lowest initial calibration standard.

13.0 DATA REDUCTION AND REPORTING

The essential information to be associated with analysis, such as computer data files, run logs, etc. shall include: Sample ID code, date and time (if the holding time is 72 hours) of analysis, instrument operating conditions/parameters (or reference to such data), analysis type, all manual calculations including dilutions and manual integrations, analyst's initials, sample preparation (pressure readings and balance gas if pressurized with helium), standard and reagent origin, receipt, preparation, and use, as well as calibration criteria, frequency and acceptance criteria, data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions.

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13.1 Initial Calibration

- Calculate the RRF for each target compound relative to the appropriate internal standard (refer to Table 2) using equation number 1 in Section 13.7.1.
- Calculate the mean RRF (using equation number 2) for each compound by averaging the values obtained from each concentration.
- Using RRFs from the initial calibration, calculate the %RSD for all target compounds using the equations 3 & 4 in Sections 13.7.3 and 13.7.4.
- Calculate the RRT for each compound over the initial calibration range using equation number 10 in Section 13.7.10.
- Calculate the mean RRT for each analyte target compound over the initial calibration range using equation number 11 in Section 13.7.11.
- Tabulate the area response (Y) of the primary ions listed in Table 2 and the corresponding concentration for each compound and internal standard.
- Calculate the mean area response $\overline{Y}$ for each internal standard compound over the initial calibration range using equation number 12 in Section 13.7.12.
- Calculate the mean of the retention times for each internal standard over the initial calibration range using equation number 13 in Section 13.7.13.

Refer to Section 12.2.1 for the acceptance criteria.

13.2 Continuing Calibration Verification

- The area response of the primary quantitation ion is used unless interference is observed. Calculate the relative response factor (RRF) of each target compound using equation number 1.
- Calculate the percent difference (%D) in the RRF of the CCV compared to the mean RRF in the most recent initial calibration using equation number 5 in Section 13.7.5.

Refer to Section 12.4.1 for the acceptance criteria.

13.3 Initial Calibration Verification and Laboratory Control Sample

- Calculate the percent recovery using equation number 14 (13.7.14). Refer to Section 12.3.1 for the acceptance criteria for the ICV and 12.8.1 for the LCS criteria.

13.4 Duplicate Analysis

- The relative percent difference must be calculated using equation number 15 (13.7.15). Refer to Section 12.6.1 for the acceptance criteria.

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13.5 Sample Analysis

- Calculate the retention time difference.
- Calculate surrogate recoveries using equation number 14.
- Calculate the change in area response using equation number 15.
- Calculate analyte concentrations (ng on column) using equation number 7 in Section 13.7.7.
- Calculate the final sample concentration using equation numbers 8 and 9 in Sections 13.7.8 and 13.7.9.

13.6 Method Blank

- Calculate the retention time difference
- Calculate the change in area response using equation number 15.
- Calculate analyte concentrations (ng on column) using equation number 7 in Section 13.7.7.
- Calculate the final sample concentration using equation numbers 8 and 9 in Sections 13.7.8 and 13.7.9.

13.7 Calculations

13.7.1 Equation Number 1

Relative Response Factor (RRF):

$$\text{RRF} = \frac{A_x C_{is}}{A_{is} C_x}$$

where:

A_x	is the area response of the analyte quantitation ion.
A_{is}	is the area response of the corresponding internal standard quantitation ion.
C_{is}	Internal standard concentration, ng.
C_x	Analyte concentration, ng.

Note: The equation above is valid under the condition that the volume of internal standard spiking mixture added in all field and QC samples is the same from run to run.

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13.7.2 Equation Number 2

Average (or Mean) RRF:

$$\overline{RRF} = \frac{\sum_{i=1}^{N} RRF_i}{N}$$

where:

RRF_i are the individual RRFs from each concentration level in the initial calibration curve.
N is the number of calibration concentration levels.

13.7.3 Equation Number 3

Standard Deviation, SD:

$$\text{SD} = \sqrt{\sum_{i=1}^{N} \frac{\left(RRF_i - \overline{RRF}\right)^2}{N-1}}$$

where:

RRF_i are the individual RRFs from each concentration level in the initial calibration curve.
$\overline{RRF}$ Average (or Mean) RRF of all concentration levels in the initial calibration curve.
N total number of calibration concentration levels

13.7.4 Equation Number 4

Percent Relative Standard Deviation, %RSD:

$$\%\text{RSD} = \frac{SD}{\overline{RRF}}(100)$$

where:

SD Standard Deviation calculated in equation number 3
$\overline{RRF}$ Average or Mean RRF

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13.7.5 Equation Number 5

Percent Difference, %D (CCV)
The %D is used for evaluating CCV RRFs vs. the initial calibration $\overline{RRF}$:

$$\%D = \frac{RRF_{CCV} - \overline{RRF}}{\overline{RRF}}(100)$$

where, for any given analyte:

RRF_{CCV} is the RRF from the CCV being evaluated.
$\overline{RRF}$ is the mean RRF from the current calibration curve.

13.7.6 Equation Number 6

Pressure Dilution Factor, PDF, for samples collected in Summa canisters:

$$PDF = \frac{P_{atm} + P_f}{P_{atm} + P_i}$$

where:

P_{atm} is the ambient atmospheric pressure, 14.7 psi at sea level.
P_f is the final sample canister pressure, in psig.
P_i is the initial sample canister pressure, in psig. This will most often be a negative value (sub-ambient initial pressure.)

13.7.7 Equation Number 7 For calculating analyte concentrations in a sample, the starting point is the nanogram amount generated by the HP Enviroquant software, which appears on the quantitation report. The equation used is:

$$ng_x = \frac{A_x ng_{is}}{A_{is}\overline{RRF}}$$

where:

ng_x is the nanogram amount of analyte x.
A_x is the area response of the analyte's quantitation ion.
A_{is} is the area response of the corresponding internal standard's quantitation ion.
ng_{is} is the internal standard amount, in nanograms.
$\overline{RRF}$ is the average or mean RRFs

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13.7.8 Equation Number 8 The final analyte concentration, C_x, in units of micrograms per cubic meter (µg/m^3), is then calculated from the following:

$$C_x = \left(\frac{ng_x PDF}{V}\right)\left(\frac{1\mu g}{1000ng}\right)\left(\frac{1000l}{1m^3}\right)$$

where:

V is the sample volume analyzed, in liters.
PDF is the sample canister pressure dilution factor.

13.7.9 Equation Number 9 To convert to units of parts per billion volume (ppbv), the equation is:

$$C_{ppbv} = C_x\left(\frac{24.46}{FW}\right)$$

where:

FW is the formula weight of the analyte, in g/mole.
24.46 is the molar volume of an ideal gas at 298 K (25 °C) and 760 mmHg (1 atm), in liters per mole (l/mol).
C_x the final analyte concentration in micrograms per cubic meter.

Refer to Table 2 for the appropriate molecular weights.

13.7.10 Equation Number 10

Relative Retention Time (RRT)

$$RRT = \frac{RT_C}{RT_{is}}$$

where:

RT_C Retention time of the target compound, seconds.
RT_{is} Retention time of the internal standard, seconds.

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13.7.14 Equation Number 14

Percent Recovery (%R):

%R = X/TV x 100

where

X = Concentration of the analyte recovered
TV = True value of amount spiked

13.7.15 Equation Number 15

Relative Percent Difference (RPD)

$$\frac{x_1 - x_2}{\bar{x}} (100)$$

where:

x_1	First measurement value
x_2	Second measurement value
$\bar{x}$	Average of the two values

13.8 Data Review

The analyst must review data on a real time basis for all calibration and QC data. The QC data must be evaluated by analytical sequence following the data review checklist in Attachment C. The data shall be reviewed and the sample results calculated and assessed by one analyst and reviewed by a second qualified analyst (Refer to Section 10.0). The data review checklist is used to document the reviews and once it has been completed, initialed and dated it must be filed with each job file.

Initial calibrations must be reviewed in the same manner as QC data with all ICAL documentation retained in a separate file organized by instrument and date. Refer to the initial calibration checklist in Attachment B for the review guideline. The ICAL file must contain all the pertinent information stated in Section 11.6.6.

13.9 Reporting

The results of each test shall be reported clearly, unambiguously and objectively, and shall include all the information necessary for the interpretation of the test results and all information required by CAS policy, National Environmental Laboratory Accreditation

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Conference (NELAC) standards, client projects, and the TO-15 method including modifications, observances, data qualifiers, and certification information.

13.9.1 Analysis Observations / Case Narrative Summary Form

This form, which is included in the *SOP for Sample Analysis, Storage and Tracking*, must be generated when there are specific sample composition information or analysis issues and/or observations. In addition, during the analysis, specific identification information or problems, interferences, calibration issues, flags, and additional/expanded explanation of flags should be added to the form. This form may be modified as long as the sections and basic concepts are reserved.

This form is necessary as a means for documentation. This form, among other information, will be reviewed when compiling the final report and case narrative. All information regarding the job shall remain in the file, in order that sufficient documentation is available to recreate the job from sample receipt through analysis, data reduction, and reporting.

13.9.2 NELAC Requirements The following items do not comply with NELAC standard requirements and must be reported accordingly. A statement, however worded, must be included in the final report indicating that data reported does not fall under the laboratory's NELAC certificate of approval.

- Reporting any compound which is not included in the second source standard (ICV or LCS).
- Reporting analytes corresponding to a continuing calibration verification that was biased low for that analyte.

In addition, a report that contains a compound not included on the NELAC certificate of approval must also include the statement listed above.

13.9.2.1 Modifications

Method modifications are also not allowed under NELAC; therefore, a statement, however worded, must be included in the final report indicating that data reported does not fall under the laboratory's NELAC certificate of approval. In addition, the following items are considered to be method modifications and must be reported accordingly.

- Sample collection in gas collection bags
- The pressurization of canisters with helium (if EPA Method 3C is requested)

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13.9.3 Surrogates Only report surrogates at the request of the client. If any surrogate is out of control, all samples results (with surrogates requested) associated with the surrogate must be reported with the appropriate data qualifier.

14.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

All waste disposals shall be carried out in accordance with the requirements detailed in the *SOP for Waste Disposal.* In addition, canisters must be cleaned in accordance with the requirements detailed in the *Standard Operating Procedure for Cleaning and Certification of Summa Canister and Other Specially Prepared Canisters.*

15.0 CORRECTIVE ACTIONS FOR OUT-OF-CONTROL DATA

Any maintenance which may alter instrument sensitivity or linearity must result in the re-analysis of the entire sequence including the tune compound, ICAL or CCV.

15.1 Tune Does Not Meet Criteria

Perform auto tune or manual tune and then re-analyze BFB. If the BFB acceptance criteria are still not met, the MS must be retuned according to the procedure outlined in the instrument users manual. Perform necessary maintenance and make notations in the instrument maintenance logbook. It may be necessary to clean the ion source, or quadrupole, or take other necessary actions to achieve the acceptance criteria.

15.2 Initial Calibration Does Not Meet Calibration Criteria

See Figure 1. Follow the initial calibration guidelines detailed in Section 12.2 for information on re-analyzing or dropping points and the restriction of maintenance performed during the analysis of the initial calibration standards. If the criteria are not met it may be necessary to perform maintenance, if this is the case then all calibration points must be re-analyzed.

15.3 Initial Calibration Verification Does Not Meet Criteria

See Figure 1. If the initial calibration verification technical acceptance criteria are not met, reanalyze and if it still fails prepare a new canister and analyze. If the criteria are still not met inspect the system for possible sources and perform any necessary maintenance and make a notation in the maintenance logbook of any steps taken. It may be necessary to clean the ion source or change the column. Perform a new initial calibration if any performed maintenance has altered instrument linearity and/or sensitivity. A demonstration of an acceptable ICV is required.

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15.4 Continuing Calibration Verification Results Do Not Meet Calibration Criteria

See Figure 2. If the continuing calibration verification technical acceptance criteria are not met, reanalyze and if it still fails prepare a new canister and analyze. If the criteria are still not met inspect the system for possible sources of the problem and perform any necessary maintenance and make a notation in the maintenance logbook of any steps taken. It may be necessary to clean the ion source or change the column.
If any corrective action and/or reanalysis fails to produce continuing calibration verification within acceptance criteria (analyzed immediately following the initial failure), then either two consecutive successful verifications must be performed following corrective action or a new initial calibration must be performed. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

> *When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. If however, the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, and there are associated samples that are non-detects, then those non-detects may be reported with the reporting limit adjusted to the next level in the calibration curve (typically 5 times higher) to prove the nonexistence of a false negative. Otherwise the sample affected by the unacceptable CCV shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.*

Note: *If the CCV is out of control (bias high or low) for any particular analyte and that analyte is detected in a sample then that sample must be re-analyzed.*

15.5 Internal Standards Do Not Meet Criteria

15.5.1 Internal Standard Responses If the problem is with the instrument, perform maintenance. If the problem is with a sample, check for interferences. If the response is high, it is likely that interference is present. In this case, lower the volume or aliquot of the sample and re-analyze. If the problem persists, report the results with the best quality and qualify the results. If the problem is corrected with the lower volume analysis, report those results.

15.5.2 Internal Standard Retention Times If the retention time for any internal standard within the sample changes by more than 20 sec from the latest daily calibration or initial calibration mid-point standard, the GC/MS system must be inspected for

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malfunctions, and maintenance performed as required. Repeat sample analysis where required.

15.6 Method Blank (MB) Results Do Not Meet Criteria

If the analyte concentration results in the blank do not meet the acceptance criteria repeat analysis with remaining QC canisters until results are acceptable or prepare a canister per Section 11.9.2. If the analyte results in the blank still do not meet the acceptance criteria the source of the problem must be investigated and measures taken to eliminate the source. Determine whether the contamination is from the instrument or due to contamination in the blank container (if results from the new can are not acceptable then the system is probably contaminated). Regardless, appropriate corrective measures must be taken and documented before sample analysis proceeds. However, if this is not a possibility and the results must be reported follow the reporting requirements stated in Section 16.2.

If the requirements for the internal standard are not met then follow the corrective action detailed in Section 15.5.

15.7 Laboratory Control Sample (LCS) Results Do Not Meet Criteria

If the LCS criteria are not met, determine whether the cause is instrumentation or the result of a poor injection. If the problem is instrumentation, perform maintenance and if the problem is with the injection re-analyze the LCS. Also, see Figure 3 for additional information and follow reporting requirements in Section 16.3.

15.8 Laboratory Duplicate Results Do Note Meet Criteria

If the duplicate results do not meet the technical acceptance criteria, perform another duplicate analysis. If the results are still unacceptable and the associated samples are not reanalyzed then all of the sample results in the associated batch must be flagged accordingly.

15.9 Sample Results Do Not Meet Criteria

- If the retention time for any internal standard within the sample changes by more than 20 sec from the latest daily calibration or initial calibration mid-point standard, the GC/MS system must be inspected for malfunctions, and maintenance performed as required. Repeat sample analysis as needed.
- If the area for any internal standard changes by more than ±40 percent between the sample and the most recent calibration, check for possible matrix interferences and re-analyze at a greater dilution. If the requirement is still not met and matrix interference

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is not detected the GC/MS system must be inspected for malfunction and maintenance made where necessary.

- When corrective actions are made, samples analyzed while the instrument was not functioning properly must be re-analyzed or the appropriate data qualifiers must be attached to the results.

To the extent possible, samples shall be reported only if all of the quality control measures are acceptable. If a quality control measure is found to be out of control, and the data must be reported, all samples associated with the out of control quality control measure shall be reported with the appropriate data qualifier(s). See Figure 4

15.10 Sample Holding Time Expired

The customer is to be notified that the sample's holding time was missed and the customer is to decide if the sample analysis is to continue. The documentation of missed holding time and the client's decision to proceed must be included in the corresponding job file. A statement dictating all holding time occurrences must accompany the sample results in the final report.

15.11 Surrogate Results Do Not Meet Criteria

Poor surrogate recovery should be followed by re-analyzing a smaller aliquot to mitigate any matrix interferences. Refer to Section 12.7.1 (Note 2) for specific information on the use of surrogates.

16.0 CONTINGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

The following is specific information on how to report unacceptable data. If the data requires a data qualifier flag, as specified in this SOP, refer to Appendix D of the most recent version of the Quality Assurance Manual.

Note: *No analyte results may be reported with an unacceptable initial calibration or initial calibration verification standard. However, any analyte not meeting such requirements (and the initial calibration is to be used) must be eliminated from the reporting list and any action taken fully documented.*

16.1 Continuing Calibration Verification

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported without a qualifier.

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- If however, the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, and there are associated samples that are non-detects, then those non-detects may be reported with the reporting limit adjusted to the next level in the calibration curve (typically 5 times higher) to prove the nonexistence of a false negative. If this is the case then a full explanation must be noted in the case narrative of the final report. Refer to Section 13.8 for additional reporting requirements.

16.2 Method Blank

- If an analyte in the blank is found to be out of control and the analyte is also found in associated samples, those sample results shall be "flagged" in the report and the method blank results reported.
- If the analyte is found in the blank but not in the sample then the results for the sample may be reported without a qualifier.

16.3 Laboratory Control Sample

All results associated with an out of control laboratory control sample must be reported with the appropriate data qualifier. An indication of whether the LCS was out high or low should also be included.

16.4 Surrogate

Refer to Section 12.7.1 (Note 2) for specific information on the use of these compounds. Report surrogate recoveries only at the request of the client and report sample results with the appropriate data qualifier.

16.5 Laboratory Duplicate

All batch sample results associated with an out of control laboratory duplicate must be flagged with the appropriate data qualifier.

16.6 Internal Standard

All target analytes associated with an out of control internal standard must be flagged with the appropriate data qualifier.

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16.7 Estimated Sample Results

16.7.1 Sample Hold Time

All occurrences of missed holding times must be included on the final report including those samples received and/or analyzed outside of the specified hold times detailed in this standard operating procedure.

16.7.2 Matrix Interference

Sample data associated with matrix interference must be flagged with the appropriate data qualifier.

16.7.3 Results Outside Initial Calibration Range

All sample results not bracketed by initial calibration standards (within calibration range) must be reported has having less certainty by reporting with the appropriate data qualifier.

17.0 REFERENCES

17.1 EPA Method TO-14A, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA/625/R-96/010b, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1997.

17.2 EPA Method TO-15, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA/625/R-96/010b, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1997.

17.3 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, January 1999.

17.4 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Addendum, January 17, 2002.

17.5 National Environmental Laboratory Accreditation Conference, Chapter 5; *Quality Systems,* July 12, 2002.

17.6 *Preparation of Gas Phase Standards for Ambient Air Analysis,* Tekmar-DOHRMANN Application Note, Spring 96, Vol. 6.5.

18.0 TRAINING PLAN

All analysts must be trained in accordance with the guidelines detailed in the *SOP for Documentation of Training.* The training plan (Attachment A) shall be used to document the training certification of new analysts.

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19.0 ATTACHMENTS, FIGURES AND TABLES

19.1 Figures

Figure 1: Evaluation of Method Calibration
Figure 2: Evaluation of Continuing Calibration
Figure 3: Evaluation of Laboratory Control Sample (LCS) Results
Figure 4: Evaluation of Sample Results

19.2 Tables

Table 1: Instrument Tune Check Ion Abundance Criteria (TO-15)
Table 1A: Instrument Tune Check Ion Abundance Criteria (TO-14A)
Table 2: Volatile Organic Compounds, EPA Compendium Method TO-15 (SCAN)
- Target Analytes
- CAS Numbers
- Primary Ions
- Primary Ions
- Method Reporting Limits
- Associated Internal Standards

Table 2A: Volatile Organic Compounds, EPA Compendium Method TO-15 (SIM)
- Target Analytes
- Method Reporting Limits
- Primary Ions
- Secondary Ions
- Associated Internal Standards

Table 3: Standard Concentrations (SCAN) (Primary Sources)
Table 3A: Standard Concentrations (SIM) (Primary Sources)
Table 4: Standard Concentrations (SCAN) (Secondary Sources)
Table 4A: Standard Concentrations (SIM) (Secondary Sources)
Table 5: Purchased Stock Standard Concentrations (ug/m^3) Cylinder#1 (Primary and Secondary)
- Molecular Weights
- Densities
- Primary Source Concentrations
- Secondary Source Concentrations

Table 5A: Purchased Stock Standard Concentrations (ug/m^3) Cylinder#2 (Primary and Secondary)
- Molecular Weights
- Densities
- Primary Source Concentrations
- Secondary Source Concentrations

Table 6: Laboratory Control Limits (SCAN)
Table 6A: Laboratory Control Limits (SIM)

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19.3 Attachments

Attachment A: Training Plan for Analysis of TO-15 by GC/MS
Attachment B: TO-15 by GC/MS Initial Calibration Checklist
Attachment C: TO-15 by GC/MS Analyses Data Review Checklist
Attachment D: Control Limits (Laboratory Control Sample)

20.0 CHANGES FROM PREVIOUS REVISION

- Section 7.2 Revised
- Section 8.1 Revised
- Section 9.2.2 Revised and Renumbered
- Section 9.2.2.1 Revised, Added more detail
- Section 9.2.3 Revised
- Section 17.0 Revised
- Section 19.2 Renamed some tables
- Table 2A Added
- Table 3 Revised concentrations to three significant figures and added 0.1ng concentrations
- Table 3A Revised concentrations to three significant figures
- Table 4 Revised concentrations to three significant figures
- Table 4A Revised concentrations to three significant figures
- Attachment B Revised
- Attachment C Revised

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Figure 1
Evaluation of Initial Calibration

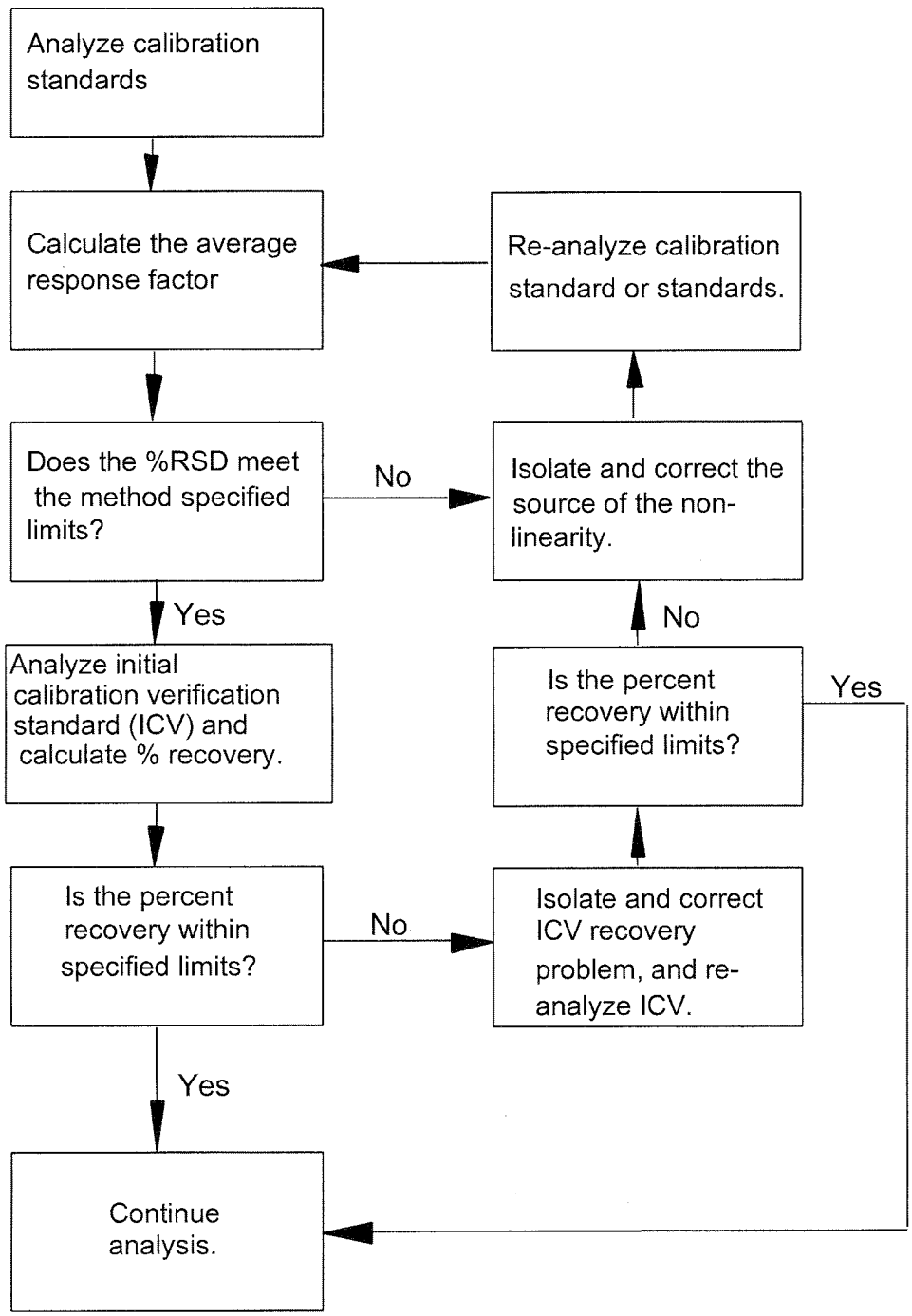

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Figure 2
Evaluation of Continuing Calibration

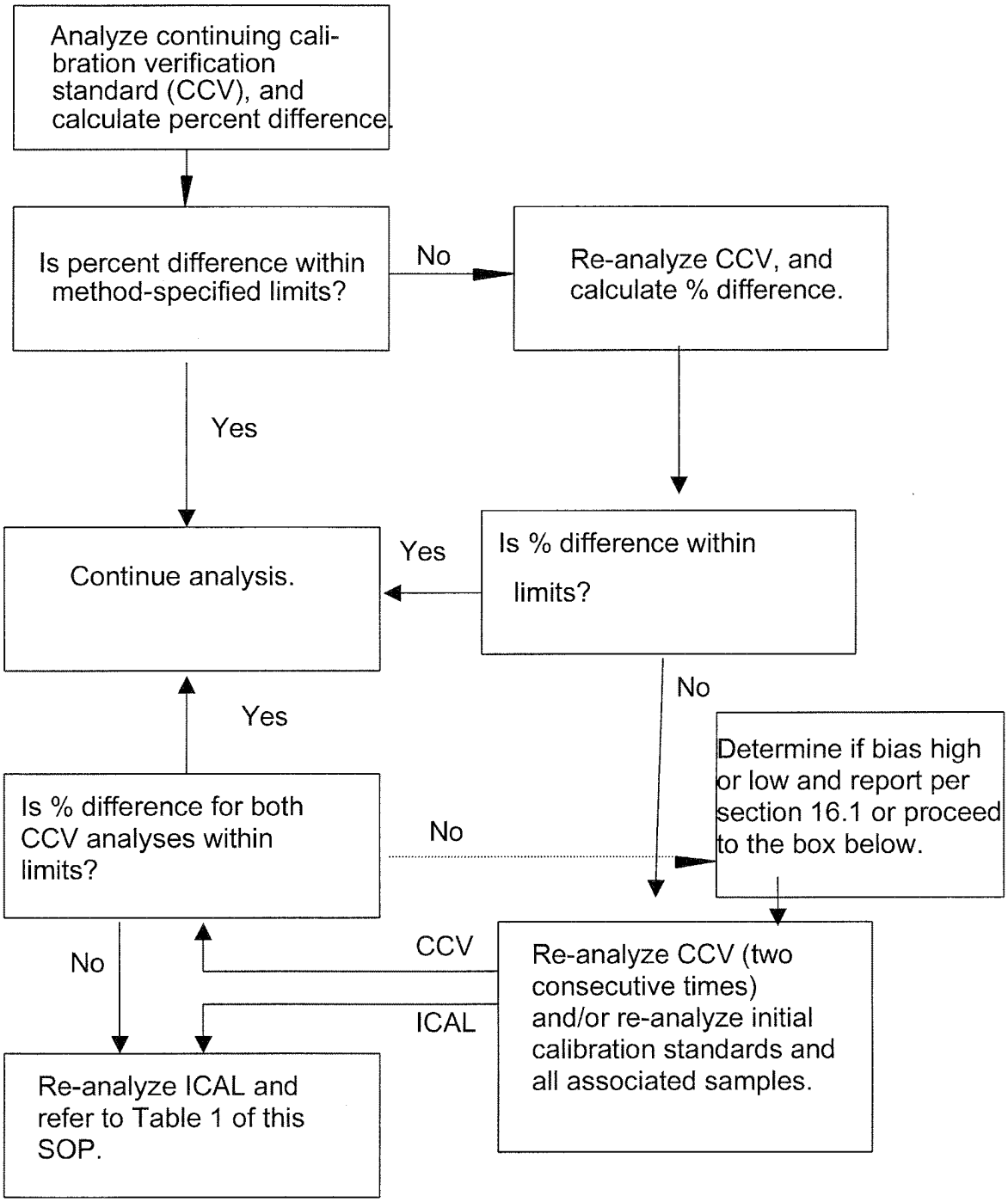

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Figure 3
Evaluation of Laboratory Control Sample (LCS) Results

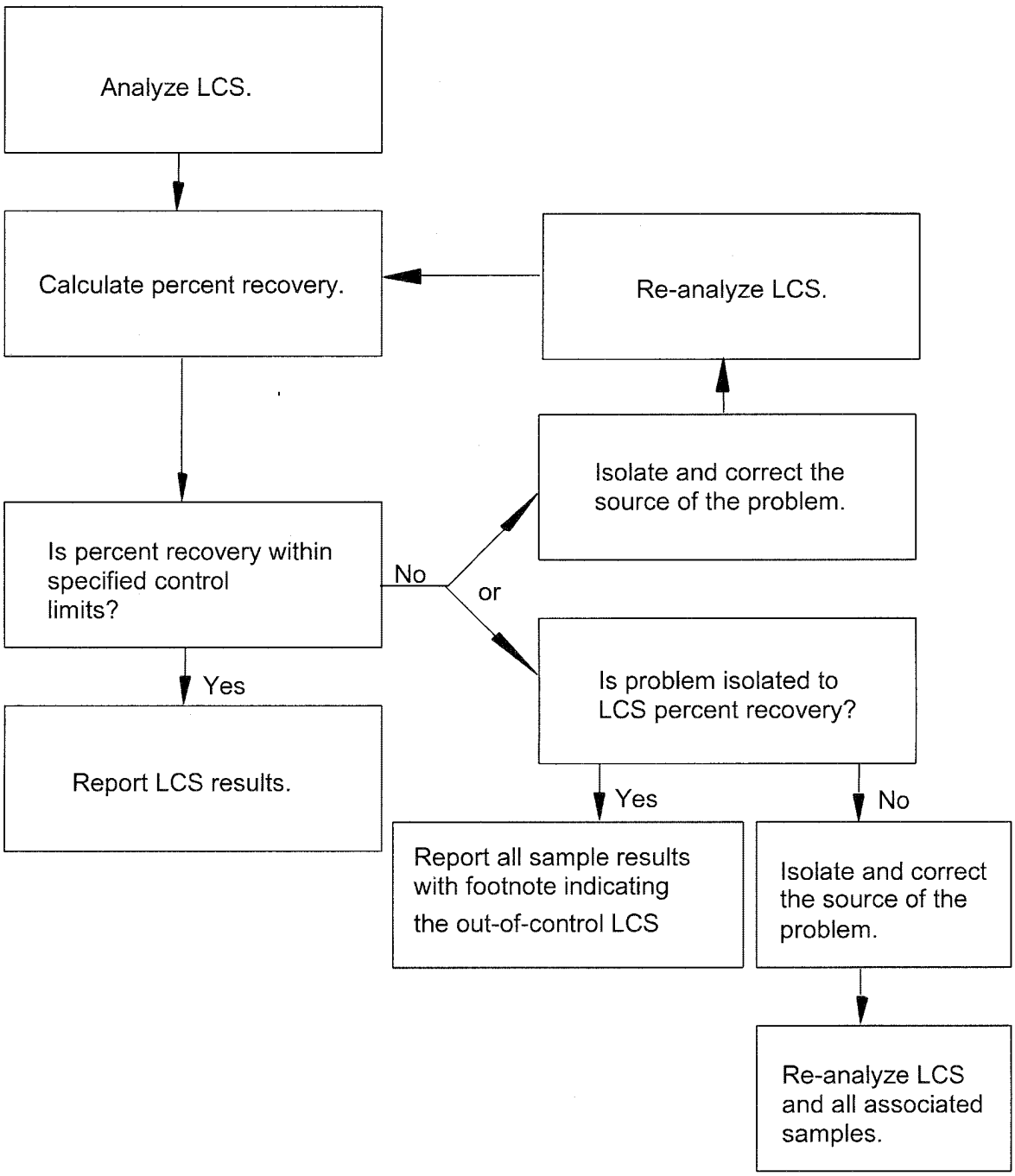

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Figure 4
Evaluation of Sample Results

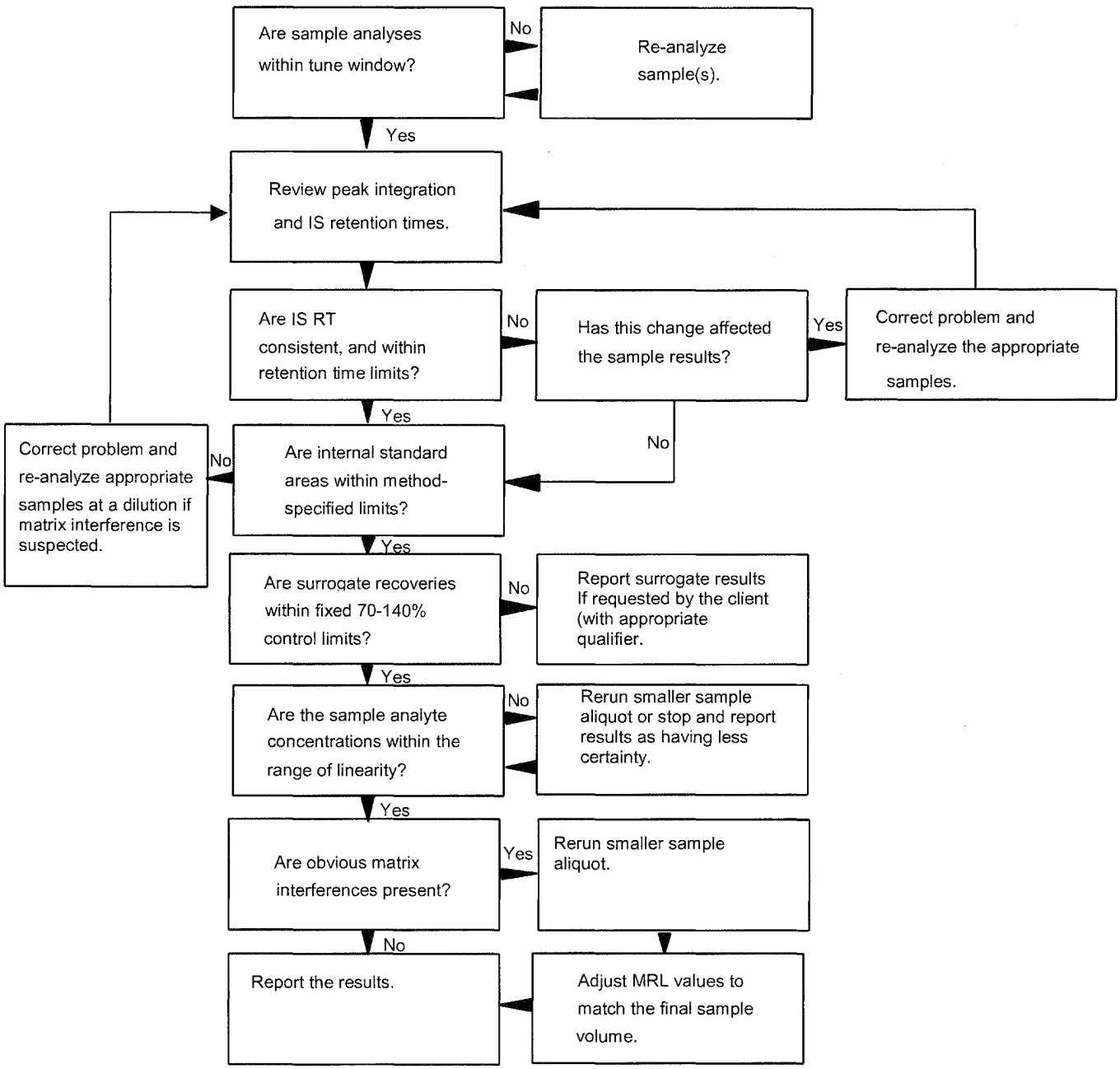

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TABLE 1

Required BFB Key Ions and Ion Abundance Criteria for Method TO-15

Mass	Ion Abundance Criteria[2]
50	8.0 to 40.0 percent of m/e 95
75	30.0 to 66.0 percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5.0 to 9.0 Percent of m/e 95
173	Less than 2.0 Percent of m/e 174
174	50.0 to 120.0 Percent of m/e 95
175	4.0 to 9.0 Percent of m/e 174
176	93.0 to 101.0 Percent of m/e 174
177	5.0 to 9.0 Percent of m/e 176

TABLE 1A

Required BFB Key Ions and Ion Abundance Criteria for Method TO-14A

Mass	Ion Abundance Criteria
50	15 to 40 percent of m/e 95
75	30 to 60 percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5 to 9 Percent of m/e 95
173	Less than 2 Percent of m/e 174
174	>50 Percent of m/e 95
175	5 to 9 Percent of m/e 174
176	>95 and <101 Percent of m/e 174
177	5 to 9 Percent of m/e 176

Note: The criteria listed in Tables 1 and 1A shall be met or exceeded in order for EPA Compendium Methods TO-15 or TO-14A to be referenced.

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TABLE 2

VOLATILE ORGANIC COMPOUNDS EPA COMPENDIUM METHOD TO-15 (SCAN)					
Compound[1]	**CAS Number**	**Primary Ion[2]**	**Secondary Ion(s)[2]**	**MRL ($\mu g/m^3$)[3]**	**Internal Standards[4]**
Bromochloromethane (IS1)	74-97-5	130	128, 132	1.0	Internal Standard 1
Propene	115-07-1	42	39,41	1.0	IS1
Dichlorodifluoromethane (CFC 12)[6]	75-71-8	85	87	1.0	IS1
Chloromethane[5]	74-87-3	50	52	1.0	IS1
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)[6]	76-14-2	135	137	1.0	IS1
Vinyl Chloride[5]	75-01-4	62	64	1.0	IS1
1,3-Butadiene[6]	106-99-0	54	39, 53	1.0	IS1
Bromomethane[5]	74-83-9	94	96	1.0	IS1
Chloroethane[5]	75-00-3	64	66	1.0	IS1
Ethanol[6]	64-17-5	45	46	5.0	IS1
Acetonitrile[6]	75-05-8	41	40	1.0	IS1
Acrolein[6]	107-02-8	56	55	1.0	IS1
Acetone[5]	67-64-1	58	43	5.0	IS1
Trichlorofluoromethane[5]	75-69-4	101	103	1.0	IS1
Isopropyl Alcohol[6]	67-63-0	45	43	1.0	IS1
Acrylonitrile[6]	107-13-1	53	52	1.0	IS1
1,1-Dichloroethene[5]	75-35-4	96	61	1.0	IS1
tert-Butanol	75-65-0	59	57,41,43	1.0[7]	IS1
Methylene Chloride[5]	75-09-2	84	49	1.0	IS1
Allyl Chloride[6]	107-05-1	41	76	1.0	IS1
Trichlorotrifluoroethane[5]	76-13-1	151	101	1.0	IS1
Carbon Disulfide[5]	75-15-0	76	78	1.0	IS1
trans-1,2-Dichloroethene[5]	156-60-5	61	96	1.0	IS1
1,1-Dichloroethane[5]	75-34-3	63	65	1.0	IS1
Methyl tert-Butyl Ether[5]	1634-04-4	73	57	1.0	IS1
Vinyl Acetate[5]	108-05-4	86	43	1.0[7]	IS1
2-Butanone (MEK)[5]	78-93-3	72	43	1.0	IS1
cis-1,2-Dichloroethene[5]	156-59-2	61	96	1.0	IS1
Diisopropyl Ether	108-20-3	87	45,59,43	1.0	IS1

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TABLE 2 (Continued)

VOLATILE ORGANIC COMPOUNDS EPA COMPENDIUM METHOD TO-15 (SCAN)					
Compound[1]	**CAS Number**	**Primary Ion[2]**	**Secondary Ion(s)[2]**	**MRL ($\mu g/m^3$)[3]**	**Internal Standards[4]**
Ethyl Acetate	141-78-6	61	70	1.0	IS1
n-Hexane[6]	110-54-3	57	86	1.0	IS1
Chloroform[5]	67-66-3	83	85	1.0	IS1
1,2-Dichloroethane-d4(S)	17060-07-0	65	67	1.0	IS1
Tetrahydrofuran	109-99-9	72	71,42	1.0	IS1
Ethyl tert-Butyl Ether	637-92-3	87	59,57,41	1.0	IS1
1,2-Dichloroethane[5]	107-06-2	62	64	1.0	IS1
1,4-Difluorobenzene(IS2)	540-36-3	114	88	1.0	Internal Standard 2
1,1,1-Trichloroethane[5]	71-55-6	97	99, 61	1.0	IS2
Isopropyl acetate	108-21-4	61	87,43	1.0	IS2
1-Butanol	71-36-3	56	41	1.0	IS2
Benzene[5]	71-43-2	78	77	1.0	IS2
Carbon Tetrachloride[5]	56-23-5	117	119	1.0	IS2
Cyclohexane	110-87-7	84	69,56	1.0	IS2
Tert-Amyl Methyl Ether	994-05-8	73	87,55,43	1.0	IS2
1,2-Dichloropropane[5]	78-87-5	63	62	1.0	IS2
Bromodichloromethane[5]	75-27-4	83	85	1.0	IS2
Trichloroethene[5]	79-01-6	130	132	1.0	IS2
1,4-Dioxane[6]	123-91-1	88	58	1.0	IS2
Isooctane	540-84-1	57	41	1.0	IS2
Methyl Methacrylate	80-62-6	100	69	1.0	IS2
n-Heptane	142-82-5	71	57,100	1.0	IS2
cis-1,3-Dichloropropene[5]	10061-01-5	75	77	1.0	IS2
4-Methyl-2-Pentanone[5]	108-10-1	58	85	1.0	IS2
trans-1,3-Dichloropropene[5]	10061-02-6	75	77	1.0	IS2
1,1,2-Trichloroethane[5]	79-00-5	97	83	1.0	IS2
Chlorobenzene-d5(IS3)	3114-55-4	82	117	1.0	Internal Standard 3
Toluene-d8(S)	2037-26-5	98	100	1.0	IS3
Toluene[5]	108-88-3	91	92	1.0	IS3

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STANDARD OPERATING PROCEDURE

for

Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS)

SOP Code: VOA-TO15

Revision: 11

December 13, 2005

Approved by: _____ 12/30/05
Chris Parnell – Team Leader (Volatile GC/MS) Date

_____ 12/30/05
Lynne Nelson – Quality Assurance Program Manager Date

_____ 1/3/06
John Yokoyama – Laboratory Operations Manager Date

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2665 Park Center Drive, Suite D
Simi Valley, CA 93065

Annual review of this SOP has been performed and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____
Initials: _____ Date: _____

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Standard Operating Procedure for Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS)

1.0 SCOPE AND APPLICATION

This procedure is based on and incorporates the requirements detailed in EPA Compendium Methods TO-15 and TO-14A and is used to quantify a wide range of volatile organic compounds (VOCs) in gaseous matrices collected in gas collection bags (method modification) and specially prepared stainless steel canisters. This method typically applies to ambient concentrations of VOCs above 0.5ppbv and above and typically requires VOC enrichment by concentrating up to one liter of a sample volume, with a virtually unlimited upper concentration range using dilutions from source level samples.

Table 2 lists compounds that can be determined by this procedure along with their method reporting limits (MRLs). The reported MRL may be adjusted higher; however, the capability of achieving lower MRLs for specific project requirements must be thoroughly demonstrated and documented. Additional compounds may be analyzed according to this procedure as described in the referenced methods as long as the requirements of this document are adhered to; however, if a compound is not listed in the TO-15 method, it should be reported as a modification. The number of samples that may be analyzed in a 24-hour period is about twenty. The number of sample results that may be reduced in an eight-hour day is approximately twenty.

This method has specific requirements including the use of canisters; any modification must be reported accordingly. All reports that fall under the laboratory's certificate of approval (in accordance with National Environmental Laboratory Accreditation Conference standards) must include a statement(s) clarifying any deviations from the scope of this certification. Refer to Section 13.9.2 for additional information and specific items, which require this clarification.

2.0 METHOD SUMMARY

The analytical method involves using a high-resolution gas chromatograph (GC) coupled to a mass spectrometer (MS). The GC/MS utilizes a linear quadrupole system, which allows for it to be operated by either continuously scanning a wide range of mass to charge ratios (SCAN mode) or by Select Ion Monitoring mode (SIM), which consists of monitoring a small number of ions from a specified compound list.

An aliquot of an air sample is concentrated on a solid adsorbent trap (either cryogenically cooled glass beads or stronger adsorbents at higher temperatures) to collect the analytes of interest. To remove co-collected water vapor, the concentrated sample then goes through a water removal (dry purge) step. After the sample is pre-concentrated on a trap, the trap is heated and the VOCs are thermally desorbed onto a refocusing cold trap. The VOCs are then thermally desorbed onto

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the head of a capillary column once the cold trap is heated. The oven temperature (programmed) increases and the VOCs elute and are detected by the mass spectrometer.

Mass spectra for individual peaks in the total ion chromatogram are examined with respect to the fragmentation pattern of ions corresponding to various VOCs including the intensity of primary and secondary ions. The fragmentation pattern is compared with stored spectra taken under similar conditions, in order to identify the compound. For any given compound, the intensity of the primary fragment is compared with the system response to the primary fragment for known amounts of the compound and this establishes the compound concentration that exists in the sample.

3.0 DEFINITIONS

3.1 Cryogen

A refrigerant used to obtain sub-ambient temperatures in the VOC concentrator and/or on front of the analytical column. Liquid nitrogen (cryogen) is used for this purpose and it has a boiling point of –195.8°C.

3.2 Gauge Pressure

Pressure measure with reference to the surrounding atmospheric pressure, usually expressed in units of psig. Zero gauge pressure is equal to atmospheric (barometric) pressure.

3.3 MS-SCAN

Mass spectrometric mode of operation in which the gas chromatograph (GC) is coupled to a mass spectrometer (MS) programmed to SCAN all ions repeatedly over a specified mass range.

3.4 MS-SIM

Mass spectrometric mode of operation in which the GC is coupled to a MS that is programmed to scan a selected number of ions repeatedly [i.e., selected ion monitoring (SIM) mode].

3.5 Analytical Sequence

The analytical sequence describes exactly how the field and QC samples in an analytical batch are to be analyzed.

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3.6 Neat Stock Standard

A purchased, single component assayed reference material having a stated purity used to prepare working calibration standards.

3.7 Stock Standards Solution

A concentrated solution of one or more target analytes at a known concentration purchased from a reputable commercial vendor. Stock standard solutions are used to prepare working calibration standards.

3.8 Intermediate Calibration Standard

A solution of one or more target analytes at a known concentration prepared either from one or more neat stock standards or from one or more stock standards solutions.

3.9 Working Calibration Standard

A solution of all the target analytes at a known concentration prepared either from one or more intermediate calibration standards and/or from one or more stock standard solutions.

3.10 Calibration or Standard Curve

A calibration or standard curve is a graph which plots the concentration of a compound (or an analyte) versus the instrument response to the compound.

3.11 Initial Calibration Verification (ICV) Standard

A solution prepared in the laboratory containing known concentration(s) of analytes of interest. The solution is prepared from neat stock standards and/or stock standards solutions which are from a different source then the standards used to prepare the working calibration standards.

3.12 Continuing Calibration Verification (CCV) Standard

A working calibration standard which is analyzed at specific intervals in order to verify that the instrument continues to meet the calibration criteria.

3.13 Field Sample

A sample collected and delivered to the laboratory for analysis.

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3.14 Manual Integration

This term applies to a data file in which setpoints have been changed and reintegration has occurred under the changed setpoints; baselines have been adjusted; peak integration start and stop "ticks" have been changed; peak area, or peak height, are changed after the time of data collection and data file generation.

3.15 Batch Quality Control (QC)

Batch QC refers to the QC samples that are analyzed in an analytical batch of field samples and includes the Method Blank (MB), Laboratory Control Sample (LCS) and Laboratory Duplicate (LD).

3.16 Internal Standard Calibration

Compares the instrument responses from the target compound in the sample to the responses of specific standards (called internal standards), which are added to the sample or sample preparation prior to analysis. The ratio of the peak area (or height) of the target compound in the sample or sample preparation is compared to a similar ratio derived for each calibration standard.

3.17 May

This action, activity, or procedural step is neither required nor prohibited.

3.18 Must

This action, activity, or procedural step is required.

3.19 Shall

This action, activity, or procedural step is required.

3.20 Should

This action, activity, or procedural step is suggested, but not required.

3.21 SOP

Standard Operating Procedure

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3.22 Service Request

A form generated, at the time of sample receipt, which details pertinent information such as client name, address, contact, client and laboratory sample identifications, sampling and receipt dates and times, requested analyses, sample type, canister pressures (initial and final), and the service request number (unique number for each submitted job) and serves as an inter-laboratory "custody" form which accompanies all samples throughout the laboratory.

4.0 INTERFERENCES

4.1 Summa Canisters

Canisters shall be stored in a contaminant free location and shall be capped tightly during shipment to prevent leakage and minimize any compromise of the sample. The pressure/vacuum is checked prior to shipment and upon receipt from the field. Any problems with the sample from the field are noted on the service request form and the Project Manager contacted.

Also, canisters must be cleaned and certified to be free from target analytes before being shipped to the field for sample collection. The procedure is described in detail in the *Standard Operating Procedure for Cleaning and Certification of Summa Canister and Other Specially Prepared Canisters* (refer to this procedure as well as Section 11.9.1 for the acceptance criteria.).

4.2 Analytical System

The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running humidified zero air blanks. The use of non-chromatographic grade stainless steel tubing, non-PTFE thread sealants, or flow controllers with buna-N rubber components must be avoided.

4.3 Carbon Dioxide

Excessive levels of carbon dioxide present in a sample may interfere with analysis by freezing up the cryogenic trap. A smaller aliquot must be analyzed to eliminate this problem, or the sample should be analyzed using the higher temperature multi-adsorbent trapping technique which allows carbon dioxide to pass.

4.4 Gas Collection Bags

This procedure covers the use of gas collection vessels such as Tedlar® or Mylar® bags. However, due to the nature of these types of bags it is not recommended that clients use

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this option for ambient air samples. Sample collection bags made out of ®Tedlar have contaminants that are inherent to the manufacturing process. The two main contaminants are phenol and N,N-Dimethylacetamide. However, this only becomes a problem when the concentration levels in the sample are low ppbv such as ambient air monitoring samples where more of the sample usually has to be concentrated and analyzed. To minimize the loss of sample integrity, a 72-hour hold time has been incorporated into the procedure.

4.5 Glassware

Interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware results in discrete artifacts and/or elevated baselines in the detector profiles should be minimized. All glassware associated with this method must be scrupulously cleaned to avoid possible contamination. The cleaning shall be performed in accordance with the procedure outlined in the *SOP for Glassware Cleaning*. The use of high purity water, reagents, and solvents helps to minimize these problems.

5.0 SAFETY

Each compound, mixture of compounds, standards, and surrogates, as well as samples, should be treated as a potential health hazard. Exposure to these chemicals should be reduced to the lowest level possible through the use of gloves (to minimize absorption through the skin) and hoods (to minimize inhalation). Refer to the laboratory's Environmental, Health and Safety Manual as it makes reference to the safe handling of chemicals, MSDS location, and the laboratory waste management plan for the safe disposal of chemicals and samples.

5.1 Material Safety Data Sheets (MSDS)

The analyst should consult MSDS for compounds being handled in the course of this procedure, and be familiar with proper safety precautions to be followed when handling hazardous chemicals. Care should be taken when handling standard material in a neat or highly concentrated form.

5.2 Liquid Nitrogen

Liquid nitrogen can cause serious tissue damage (frostbite) with only a few seconds of contact. The valves on the cryogen dewars should be opened slowly so leaky fittings can be identified. Neoprene or leather gloves should be worn when turning valves and handling tubing and fittings that have been in contact with the cryogen.

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5.3 Protective Clothing

Personal protective clothing (safety glasses, gloves and lab coat) are required when preparing standards and handling standard material in neat form.

5.4 Pressurized Gases

The use of pressurized gases is required for this procedure. Care should be taken when moving cylinders. All gas cylinders must be secured to a wall or an immovable counter with a chain or a cylinder clamp when not in use. The regulator should never remain on small "D" size cylinders following use. Sources of flammable gases (i.e. pressurized hydrogen) should be clearly labeled.

5.5 Syringes

The proper use of syringes should be part of employee training for this SOP. Care should be taken to avoid personal injury as a result or improper handling techniques.

6.0 SAMPLE COLLECTION, CONTAINERS, PRESERVATION, AND STORAGE

Air samples are collected in the field and delivered to the laboratory and shall be collected in either a specially prepared, leak-free, stainless steel pressure vessel (with valve) of desired volume (e.g., 6L) or a sample collection bag. Canister samples may either be grab or time integrated (using a variable flow controller, refer to the *Standard Operating Procedure for Flow Controllers and Critical Orifices)* utilizing the canister vacuum to draw the sample. Bags require the use of an upstream pump or a "lung machine."

There are no special preservation requirements for either canisters or bags. However, bags should be stored in boxes labeled with the specific service request number or by hanging them from clips to prevent puncture or other deterioration. Canisters should be stored on the appropriate shelves until they are to be analyzed.

Sample collection bags must be analyzed within 72 hours from confirmed time of sampling. Canisters do not have specific holding times; however, samples received by the laboratory shall be analyzed within 30 days of sampling or sooner if project specific requirements dictate.

7.0 APPARATUS AND EQUIPMENT

7.1 Gas Chromatograph (GC)

An instrument capable of temperature programming, with a column oven that may be cooled to sub-ambient temperature at the start of the gas chromatographic run to result in the resolution of the VOCs.

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- Hewlett Packard 5890 Series II Plus
- Hewlett Packard 6890 Series
- Hewlett Packard 6890A Series
- Agilent 6890N Series

7.2 Autosampler

Tekmar-Dohrmann AUTOCan Autosampler: 14-ACAN-074
Concentrating Trap (cryogenic trap, built-in): 14-6938-020
(Refer to Section 8.1 for information on the packing materials)
Cryofocusing Module w/split valve: 14-6520-A00
GAST Vacuum Pump: DOA-P104-AA

7.3 Mass Spectrometer (MS)

A MS capable of scanning from 34 to 350 amu every second or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for Bromofluorobenzene (BFB) which meets all of the criteria when 50ng or less of BFB is injected onto the GC/MS system.

- Hewlett Packard 5972 Series Mass Selective Detector
- Hewlett Packard 5973 Series Mass Selective Detector
- Agilent 5973N Mass Selective Detector
- Agilent 5973*inert* Mass Selective Detector

Note: Additional instruments may be added as long as they meet the minimum requirements of this document.

7.3.1 Ionization Gauge Controller

- Agilent: 59864B
- Granville-Phillips 330 Ionization Gauge Controller: 330001/2/3
- Hewlett Packard Ionization Gauge Controller: 59864B

7.4 Analytical Column

Any analytical column capable of separating the compounds of interest may be used. The capillary column should be directly coupled to the source of the mass spectrometer. The following are suggested columns; an alternative column may be used as long as sufficient peak resolution and separation is achieved.

Column: J& W DB-1 MS Fused Silica Capillary Column
60m x 0.32mm ID
1.0 micron film thickness

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OR

Restek RTX-1 Fused Silica Capillary Column
60m x 0.32mm ID
1.0 micron film thickness

7.5 Data Systems

IBM-compatible PC with Windows 95/98/NT and Hewlett Packard Chemstation software including EnviroQuant with Extracted Ion Current Profile (EICP), National Institute of Standards and Technology (NIST) library or equivalent.

7.6 Canister Pressurization Station

Vacuum/Pressure Gauge [0 to –30 inHg; 0-90 psig]

7.7 Canister Sampling Devices

Refer to the *Standard Operating Procedure for Flow Controllers and Critical Orifices* for specific calibration and other pertinent information.

- VICI Condyne Model 300 Flow Controller
- Critical Orifices (Laboratory manufactured)

7.8 Gas Collection Devices

- Lab Commerce, Aerosphere Model S6L, 6.0L Summa Passivated Canisters or equivalent
- Lab Commerce, Stabilizer Model 22.4L, 2.4L Canisters or equivalent
- Restek Corporation, #24203, 3.0L Silco Canisters or equivalent
- Tedlar bags – 0.5L, 1L, 3L, 5L, 10L, 25L, and 40L (other sizes are available; however, the volumes that are listed encompass the majority of the bags supplied and the samples submitted to the laboratory.

7.9 Dynamic Dilution System

- Entech Dynamic Diluter Model 4620A
- Toshiba laptop computer Model 2210CDT/6.0 and Software NT460

8.0 PREVENTIVE MAINTENANCE

A maintenance log will be kept documenting maintenance performed on each analytical system. The serial numbers of each instrument shall be recorded, and each log entry must include a description of the maintenance performed and be initialed by the analyst performing or observing/authorizing maintenance by an outside contractor.

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The instrument maintenance log must be kept current. An entry shall be made in the appropriate log every time maintenance is performed (no matter the extent). The entry in the log must include:

(a) the date of maintenance
(b) who did the maintenance
(c) description of the maintenance
(d) proof that the maintenance activity was successful.

A notation of a successful tune and continuing calibration or initial calibration and the file number that accompanies the data will serve as proof that the maintenance is complete and the instrument is in working order.

The extent of the maintenance is not important, however, it is important that a notation be included for each maintenance activity such as changing a column, tuning the instrument, changing the pump oil, cleaning the source, ordering a part. In addition, a notation should be made in the logbook stating that no samples were analyzed during the days that the instrument was down and no active maintenance was being conducted (i.e., where no other notation was made in the logbook for those days).

8.1 Concentrating Trap

Routine maintenance includes periodic solvent cleaning of the Silco steel lines in the valve oven if contamination is suspected. Also, periodic replacement of the multi-sorbent or partial replacement of the trap if analyte specific deterioration is detected is required.

Trap composition:

Bottom - Carbosieve SIII ~1.5cm
Middle – Carbopack B ~ 3.0cm
Top – Carbopack C ~ 2.5cm
Glass wool on top, bottom ~ 0.5cm and between layers ~ 0.1cm

After repacking, the trap should be baked at 290°C for a minimum of two hours (or until a clean blank is generated) and a partial repacking requires baking (@290°C) the trap for a minimum of 20 minutes (or until a clean blank is generated).

8.2 GC System

Column performance is monitored by observing both peak shapes and column bleed. Over time, the column will exhibit a poor overall performance, as contaminated sample matrices are analyzed. The length of time for this to occur will depend on the samples analyzed. When a noticeable decrease in column performance is evident and other maintenance options do not result in improvement, the column should be replaced (see

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Section 7.3). Whenever GC maintenance is performed, care should be taken to minimize the introduction of air or oxygen into the column.

Clipping off a small portion of the head of the column often improves chromatographic performance. When cutting off any portion of the column, make sure the cut is straight and "clean" (uniform, without fragmentation) by using the proper column-cutting tool. When removing any major portion of the column, which will affect the retention times and elution characteristics, a change in instrument conditions may be required to facilitate nominal analytical activity.

Performance can also be due to ineffective column ferrules, which should be replaced when a tight seal around the column is no longer possible. This can be detected with the use of a leak detector.

8.3 Mass Spectrometer

The Mass Selective Detector (MSD) ion source requires periodic cleaning to maintain proper performance. Symptoms of a dirty ion source include difficulty keeping the MSD in tune and fluctuating internal standard areas. The vacuum system should be serviced every six months, including changing the pump oil and checking the molecular sieve in the backstreaming trap.

8.4 Instrument Tuning

The instrument is tuned with guidance from the procedure described in the HP Operations Manual, when necessary. The tune shall meet the tune criteria described in this document.

9.0 STANDARDS, REAGENTS AND CONSUMABLE MATERIALS

9.1 Reagents and Equipment

9.1.1 UHP Grade Helium (99.999%)(GC carrier gas and preconcentrator purge/sweep gas)
9.1.2 Cryogen - Liquid nitrogen in 50 psig dewars (used to cool preconcentrator traps)
9.1.3 UHP/Zero Grade Air
9.1.4 ASTM Type II Water or equivalent

9.2 Standards

Standards are prepared for both SCAN and Selective Ion Monitoring (SIM) modes according to the procedures detailed in this section. The preparation of standards for the analysis of air samples is carried out by following the procedure, "Preparation of Gas

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Phase Standards for Ambient Air Analysis", Application Note, Spring 96, Vol. 6.5, *Tekmar*-DOHRMANN AutoCan Users Manual included in the TO-15 method manual. Neat standards that are used for making trace gas standards must be of high purity; generally a purity of 98 percent or better is commercially available.

9.2.1 Instrument Performance Check, Internal Standard and Surrogate Spiking Mixture
Prepare a standard solution of p-Bromofluorobenzene (BFB-used as both a tune check and surrogate compound), bromochloromethane, chlorobenzene-d5, and 1,4-difluorobenzene, 1,2-dichloroethane-d4(surrogate), and toluene-d8(surrogate) at 250μg/m^3 each in humidified zero air. Prepare this standard according to the procedure outlined in Volume 6.5 of the *Tekmar*-DOHRMANN Application Note.

9.2.1.1 An intermediate standard is prepared from neat compounds in a glass static dilution bottle (SDB). After the volume of the SDB is determined, calculate the mass of each compound to be spiked to achieve a final concentration of 5.0μg/mL. Then use the density of each neat compound to calculate the microliter amount to be spiked into the SDB. The SDB is then heated for a minimum of one hour at ~60°C to completely volatilize all components.

Concentration of the intermediate standard prepared in a SDB is 5.0µg/mL. The amount required to achieve this concentration is determined through the use of the following equation.

$$A = \frac{(C)(V)}{D} \qquad \textbf{(Equation 1)}$$

Where:

A Amount of each compound required to achieve the desired concentration of the standard in the SDB (µL)
C Desired concentration of SDB (µg/mL)
V Actual volume of the SDB (mL)
D Density of the compound in question (µg/µL)

Example:

Calculate the amount of neat bromochloromethane needed to achieve the final concentration of 5.0µg/mL of that compound in the SDB.

V = 2010mL
D = 1934.4µg/µL
C = 5.0µg/mL

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$$A = \frac{\left(5.0\frac{\mu g}{mL}\right)2010mL}{1934.4\frac{\mu g}{\mu L}} = 5.2\mu L$$

Density (µg/µL)	Compound
1934.4	Bromochloromethane
1170.1	1,4-Difluorobenzene
1157	Chlorobenzene-d5
1307	1,2-Dichloroethane-d4
943	Toluene-d8
1593	BFB

9.2.1.2 The Working standard is prepared in a Summa canister by spiking an aliquot of the stock SDB standard (9.2.1.1) using a heated gastight syringe. Connect a cleaned, evacuated Summa canister to a source of pure diluent gas (humidified zero air) using a teflon line with a stainless steel tee directly above the canister valve. One port of the tee is fitted with a septum. Spike the SDB stock and following removal of syringe a small flow of diluent gas to flush the spike into the can. Pressurize the can to positive 83.3 psig with humid zero air, and allow the contents to equilibrate for approximately 24 hours before using.

Concentration of the working standard prepared in a Summa canister is 250ng/L. The final pressure of the canister is 83.3psig; therefore, the pressurized volume is 40L, which is obtained through the use of the following equation.

PV = PDF(V) **(Equation 2)**

Where:

PV Pressurized canister volume (L)

PDF Pressure Dilution Factor, where PF = $\frac{P_{atm} + P_f}{P_{atm} + P_i}$

P_f Final Canister Pressure

P_i Initial Canister Pressure

V Volume of canister @ 1atm

P_{atm} Atmospheric Pressure = 14.7psig

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Example:

$$\frac{14.7+83.3}{14.7+0}(6L) = 40\text{L}$$

In order to prepare the canister with a concentration of 250ng/L, it must be determined how much of the intermediate standard is required. This is achieved through the use of the following equation.

$$A = \frac{(F)(V)}{(C)\left(1000\frac{ng}{\mu g}\right)} \qquad \textbf{(Equation 3)}$$

Where:

F	Desired concentration of working standard (ng/L)
V	Pressurized Volume of Canister (L)
C	Concentration of prepared SDB (µg/mL)
A	Amount of standard (mL) of the SDB required to obtain the desired working standard concentration

Example:

$$A = \frac{250\frac{ng}{L}(40L)}{\left(5.0\frac{\mu g}{mL}\right)\left(1000\frac{ng}{\mu g}\right)} = 2\text{mL}$$

9.2.2 Initial Calibration (ICAL) Standard Prepare the primary source calibration standards in Summa canisters with nominal concentrations of 20ng/L and 200ng/L for analyses in SCAN mode and 0.1ng/L and 5.0ng/L for analyses in Selective Ion Monitoring (SIM) mode for each of the target analytes. Differing injection volumes will create the standard concentrations listed in Tables 3 (SCAN) and 3A (SIM) of this document. The full list of analytes which are analyzed according to this method can also be found in Tables 2 (SCAN) and 2A (SIM).

Standards are prepared by diluting two stock standards together with humid zero air into a Summa canister. There are two stocks which are certified custom-blended cylinders (prepared by Spectra Gases Inc, Alpha, NJ). Refer to Table 5 for the list of analytes in the purchased cylinder#1 and Table 5A for the list of analytes in the purchased cylinder#2.

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9.2.2.1 Working standards are prepared into Summa canisters using the Entech Dynamic Diluter. Turn on the power to the diluter one hour prior to using to allow for the components to come to thermal equilibrium. Connect the computer and start the software. Connect a Zero Air source to the humidification chamber (flow controller #1). Connect stock standard cylinder#1 to flow controller #2 inlet. Connect stock standard cylinder#2 to flow controller #3 inlet. Open the cylinder valves. Adjust the inlet pressures to 50 to 60psig. The concentration of the two working standards prepared in Summa canisters should be 200ng/L and 20ng/L or 200ng/L and 4ng/L (depending on the dynamic range of the initial calibration-include 4ng/L if analyzing a 0.1ng standard on column) for SCAN and 0.1ng/L and 5.0ng/L for SIM.

Position 1 – Total Air Flow (Zero Air)
Position 2 – Standard Flow (Purchased Standard One)
Position 3 – Standard Flow (Purchased Standard Two)
Position 4 – Total Air Flow (Zero Air) (utilized if preparing a two dilution standard)
Position 5 – Diluted Standard Flow (utilized if preparing a two dilution standard)

Step1: Determine the required flow rate of the stock standards (positions #2 and #3). The range must be from 5 to 50sccm (standard cubic centimeters per minute, same as ml/min). The flows listed below are guidelines to be used for the default standard flow (based on the desired standard concentration) and were chosen based on the ultimate final dilution required and limitations of the Dynamic Diluter (flows must be from 150 to 2000ml/min.).

Desired Standard Conc.	Default Standard Flow
200ng/L	50ml/min
100ng/L	50ml/min
20ng/L	20ml/min
5.0ng/L	10ml/min
4.0ng/L	8ml/min
0.1ng/L	10ml/min (See Note 1 below)

Note 1: For the 0.1ng/L standard (or another two dilution standard), a slightly different procedure is performed. In order to prepare this standard, two dilutions must be performed. Unscrew the cover of the dilutor and connect the first mass flow controller as well as the tubing to re-reroute the first dilution output from the final standard Summa canister to the 2nd dilution chamber. Refer to example 2 for the calculation guidelines to prepare a two dilution standard.

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***Example 1*: Prepare a 200ng/L working standard. The concentration of each stock standard is 1000ng/L.**

Step 2: Determine the required dilution factor for each stock.

Dilution factor = Stock Conc. (ng/L) / Desired Standard Conc. (ng/L)

Dilution Factor = 1000ng/L / 200ng/L = 5

Step 3: Calculate Total Flow

Total Flow= (stock std. flow-see table above)*(Dilution Factor)

Total Flow=50ml/min*5 = 250ml/min

Step 4: Calculate Diluent Air Flow

Air Flow=Total Flow-(Sum of stock std. flows-purchased cylinders)

Air Flow=250ml/min-(50+50)ml/min = 150ml/min

***Example 2*: Prepare a 0.1ng/L working standard. The concentration of each stock standard is 1000ng/L.**

Step 2: Determine the required total dilution factor for the 0.1ng/L standard.

Dilution factor = Stock Conc. (ng/L) / Desired Standard Conc. (ng/L)

Dilution Factor = 1000ng/L / 0.1ng/L = 10,000

The two dilutions must be performed which total the dilution factor calculated above. Since the flow for the Diluter is restricted to a maximum of 2000ml/min, the total flow (as calculated in Step 3 below) cannot exceed 2000ml/min; therefore, the dilutions must be chosen accordingly.

Step 3: Calculate Total Flow

Total Flow = (stock std. flow-see table above)*(Dilution Factor)

Total Flow (Dilution 1)=10ml/min*200 = 2000ml/min

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For the 2nd dilution take the stock standard flow selected for dilution 1 for the two purchased cylinders (10ml/min each based on the desired final concentration) and add them together (10ml/min + 10ml/min for 20ml/min) to get the stock standard flow for the 2nd dilution.

2nd Dilution Factor Needed = Total Dilution/1st Dilution

2nd Dilution Factor = 10000/200(1st dilution) = 50

Total Flow (Dilution 2) = 20ml/min*50 = 1000ml/min

Step 4: Calculate Diluent Air Flow

Air Flow=Total Flow-(Sum of stock std. flows-purchased cylinders)

Air Flow=2000ml/min-(10+10)ml/min = 1980ml/min (Dilution 1)

Air Flow=1000ml/min-20ml/min = 980ml/min (Dilution 2)

Position 1 = 1980ml/min
Position 2 = 10ml/min
Position 3 = 10ml/min
Position 4 = 980ml/min
Position 5 = 20ml/min

Step 5: Enter flow rates in the appropriate fields in the Entech software. Start flows by clicking the "GO" button in the top right of the window. Allow flows to equilibrate for at least fifteen minutes, then attach an empty canister to the outlet port and open the valve. The outlet pressure will be displayed in the lower right of the window, in units of psia. Close the canister valve when the pressure reaches 30psia. There is a relief valve on the diluter that will open when the pressure reaches 35psia, so the canister will still be usable if the valve is not closed in time. Refer to Table 5 and 5A for the purchased stock concentrations to determine the final concentrations of the analytes in the standard

9.2.2.2 When analysis of additional (extra) compounds are requested which are not in the purchased stock cylinders, the following preparation instructions should be used.

9.2.2.2.1 *Equi-mass "soup"* (contains compounds in equal mass amounts) or *cocktail* prepared from the neat compounds for a large number

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of components. If additional SIM compounds are requested, the same cocktail may be used.

Cocktail Preparation:

Step 1: This cocktail is prepared by combining 25mg of each neat compound into a small glass vial. Use a microliter syringe to transfer each compound, cleaning with solvents in between. Put the vial in the freezer between aliquots to minimize volatilization. Take the density of each compound into account to determine the actual amount of each compound to spike into the cocktail by using the following equation.

$$S = \frac{A}{D} \qquad \textbf{(Equation 4)}$$

Where:

S Actual spike amount (μL)
A Desired amount for each compound (mg)
D Density (mg/μL); refer to Table 3 for the density

<u>*Example:*</u> The actual volume of acrolein to add to the cocktail is calculated by the following.

$$S(\text{Acrolein}) = \frac{25mg}{\left(0.840\frac{mg}{\mu l}\right)} = 29.8\mu L$$

Step 2: The concentration of each compound in the cocktail is determined by the following equation.

$$C = \frac{A}{V}\left(1000\frac{\mu g}{mg}\right) \qquad \textbf{(Equation 5)}$$

Where:

C Concentration of cocktail (μg/μL)
A Amount of each compound (mg)
V Final volume of cocktail (total spike volumes of each compound) (μL)

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Example:

$$C = \frac{25mg}{631.8\mu L}\left(1000\frac{\mu g}{mg}\right) = 39.569\mu g/\mu L$$

9.2.2.2.2 *An intermediate standard* is prepared from neat compounds by spiking individual compounds into a glass static dilution bottle (SDB) as described in 9.2.1.1 or spiking an aliquot of a cocktail into the SDB. The spike amount of a cocktail is determined by using the following equation.

$$S = \frac{C_1 V}{C_2} \qquad \textbf{(Equation 6)}$$

Where:

S Spike amount required in order to obtain the desired concentration (µL)
C_1 Desired concentration of SDB (µg/mL)
C_2 Concentration of cocktail (µg/µL)
V Volume of SDB (L)

Example: Determine the spike amount of the cocktail required to achieve the desired intermediate standard concentration.

$$S = \frac{\left(1\frac{\mu g}{ml}\right)(2010ml)}{27.81\frac{\mu g}{\mu L}} = 72.28\mu L$$

9.2.2.2.3 *Intermediate Standard Preparation (Gaseous Compounds)* As an alternative to the glass SDB method, if the extra compounds needed to be analyzed are gases at room temperature, use a gastight syringe to prepare an intermediate standard in a 1L Tedlar bag filled with humidified zero-grade air. Use the molecular weight of the compound to calculate the microliter amount to be spiked into the bag to achieve desired concentration.

The spike amount is determined by using the following equation.

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$$S = \frac{C * V * 24.46}{M * \left(1000 \frac{ng}{\mu l}\right)}$$

S Spike amount required in order to obtain the desired concentration (µl)
C Desired concentration (ng/L)
V Volume of the Tedlar Bag (1L)
M Molecular Weight of the compound
24.46 Molar Volume of gas at 25°C, 1atm

Example:

Make a 100,000ng/L intermediate standard of Chloro-difluoromethane (Freon22) in a Tedlar Bag, where M=86

$$S = \frac{100{,}000 \frac{ng}{L} * 1L * 24.46}{86 * \left(1000 \frac{ng}{\mu l}\right)} = 28.44\mu l$$

9.2.2.2.4 *The Working standard* for extra compounds is prepared in a Summa canister by spiking an aliquot of the intermediate standard (glass SDB or Tedlar bag) using a heated gastight syringe. The preparation of these standards shall follow the instructions detailed in Section 9.2.1.2. The concentrations for working standards are usually 20 and 200ng/L, however different concentrations can be chosen which work best for a particular project.

9.2.3 Initial Calibration Verification (ICV) - (Laboratory Control Sample - LCS) Prepare a secondary source standard (either a different manufacturer or different lot from the same manufacturer as the initial calibration standard) using the same procedures as the primary source. The ICV/LCS working standard should contain each target analyte present in the calibration working standard. Prepare the ICV/LCS working standard at a concentration of 100ng/L. Differing injection volumes account for the allowed concentrations listed in Table 4 for SCAN and 4A for SIM. The preparation of this standard shall follow the instructions detailed in Section 9.2.2, using the two certified second-source standard cylinders.

9.2.4 Continuing Calibration Verification (CCV) Standard The CCV is the same as the initial calibration working standards detailed in Section 9.2.2.

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Note 1: *The actual concentrations (analytes purchased in stock standard cylinders) listed in Table 3 and Table 4 of this document may change with recertification, new vendors or new purchased standards. If this is the case, the amount used for intermediate and working standards must be adjusted accordingly.*

Note 2: *Any of the desired standard concentrations may change as long as the equations and the appropriate densities remain the same.*

9.3 Storage and Expiration Dates

- Neat Stock Liquids – are stored @ -10°C to -20°C for a period of five years or as specified by the manufacturer.
- Equi-Mass Primary Stock Standard – is a cocktail or soup of neat compounds (containing compounds in equal mass amounts) used to in preparing intermediate gas phase standards and shall be stored in the freezer at -10°C to -20°C for up to six months. This is assuming that the soup is sealed with a septum-containing screw cap or Mininert™ valve. The selection of the compounds for the soup should be performed in accordance with the guidelines in Volume 6.5 of the *Tekmar*-DOHRMANN Application Note.
- Purchased Stock Standards Cylinders must be stored at laboratory temperature for a period of 2 years or as specified by the manufacturer.
- Intermediate Calibration Standards prepared by static dilution must be stored in an oven at a temperature of 60°C to ensure analyte vaporization. Every time a standard is prepared from the static dilution bottle (SDB), the concentration changes. To increase the useful lifetime of an SDB standard, remove volumes of 25mL or less. The volume removed can be manipulated by increasing the SDB concentration or by adjusting the canister final volume/pressure. Depending upon the volume removed, an SDB intermediate standard is stable for approximately two months as long as new working standards made from this standard continue to meet acceptance criteria. These bottles must be in the oven at 60°C for a minimum of one hour prior to use in preparing working standards. The guidelines for the storage and expiration date for the intermediate calibration standards are stated in Volume 6.5 of the *Tekmar*-DOHRMANN Application Note.
- Prepared Stock / Intermediate Calibration Standards prepared in Summa canisters (1000ng/L) may be stored at laboratory conditions for up to three months in an atmosphere free of potential contaminants. Upon preparation, canister standards should be allowed to sit for approximately 24 hours prior to use in order for equilibration to take place. Shorter equilibration periods may be necessary and acceptable as long as performance criteria are met.
- Calibration or Working Calibration Standards prepared in canisters may be stored at laboratory conditions for one month in an atmosphere free of potential contaminants. Upon preparation, canister standards should be allowed to sit for approximately 24

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hours prior to use in order for equilibration to take place. Shorter equilibration periods may be necessary and acceptable as long as performance criteria are met.

10.0 RESPONSIBILITIES

It is the responsibility of the analyst to perform the analysis according to this SOP and to complete all documentation required for data review. Personnel in the laboratory who have demonstrated the ability to generate acceptable results utilizing this SOP may perform analysis, interpretation and peer review of the results. The supervisor/manager must also ensure that method proficiency is documented initially and whenever significant changes in the instrument type, personnel, matrix or test method are made. The department supervisor/manager or designee shall perform final review and sign-off of the data.

11.0 PROCEDURE

Sufficient raw data records must be retained of the analysis, instrument calibrations and method detection limit studies including: analysis/calibration date and time, test method, instrument, sample identification, analyte identification, analyst's initials, concentrations and responses, as well as standards used for the analysis and calibrations, all manual calculations including sample dilutions and manual integrations to permit reconstruction of analyses. Make sure that all information entered and reported on the quantitation report and instrument run log is complete and accurate. Retain all daily QC per sequence on file for future reference including tune checks, opening standards, method blanks, laboratory control samples, laboratory duplicates, and initial calibrations and initial calibration verifications. Additionally, all passing QC Canister checks must also be retained on file.

Note: *All data records must explicitly connect data to the initial instrument calibration. This includes all samples, continuing calibrations and QC samples.*

11.1 Sample Preparation

The pressure/vacuum is checked and the canister pressurized as needed upon receipt by the laboratory. Samples collected in canisters shall be pressurized with humidified zero grade air. However, if the samples are to be analyzed in accordance with EPA Method 3C then the samples must be pressurized with UHP Helium. The client must be made aware of this in advance and given the option of either submitting two canisters for analysis or receiving a report with qualified results.

Canister Pressurization Samples may be pressurized to approximately 1.0psig up to approximately 3.5psig. If pressurization occurs, humidified zero air must be utilized (refer to exception stated above). This may be accomplished by connecting the sample canister to a source of pure diluent gas (zero air) using a teflon line with a stainless steel tee directly above the canister valve. One port of the tee is fitted with a septum and

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injecting 100μL of water into the can through the septum and allowed to vaporize for approximately 10 minutes. Alternatively, pressurize at a fill station by bubbling the diluent gas through a zero air bubbler. Both of these procedures shall utilize ASTM Type II water or equivalent. Additional information may be found in the *Standard Operating Procedure for Evaluation and Pressurization of Specially Prepared Stainless Steel Canisters*.

Initial and final pressures are recorded on the back of the sample identification tag and on the Service Request form. The dilution factor created by filling the sample canister is calculated using equation number 6 in Section 13.7.6.

11.2 Screening

The analyst must screen a sample or subset of samples if the source is of unknown origin. Typically, if the source is known to be indoor or ambient outdoor air, no screening is necessary.

However, if screening is required, inject a 1mL or smaller aliquot of each sample into a GC/flame ionization detector (FID) system that has been calibrated with a standard containing a subset of the target analytes. This subset represents the most commonly found compounds in air samples, such as acetone, trichloroethylene, and toluene. A single point calibration is sufficient.
Use the results to determine the maximum volume of sample to be analyzed by TO-15 by utilizing the following equation. Dilutions may be prepared as necessary according to Section 11.11.2.

$$I = \frac{C}{H}$$

Where:

I Injection volume (mL)
C Maximum calibration level (ng on column)
H Compound screening concentration (ng/mL)

<u>*Example:*</u> Select the compound with the highest concentration (toluene = 1.0ng/mL). If the upper calibration level is 100ng on column, then the following calculation determines the maximum injection volume to analyze.

$$\frac{100ng}{1.0ng/mL} = 100\text{mL maximum injection volume}$$

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11.3 Analytical Sequence and Data System Setup

11.3.1 Data System For the Tekmar AUTOCan, fill in the sequence log of the Teklink program with the appropriate information. Refer to the Section 11.4.1 for the operating parameters.

For the HP Chemstation, load the appropriate acquisition method for the GC/MS in the top window of the Chemstation program. Suggested GC/MS operating parameters are given in Section 11.4.2.

11.3.2 Analytical Sequence For this internal standard calibration method analysis, a CCV standard is to be analyzed every 24 hours. That is, the last analysis in the sequence must be started within 24 hours from the time of the initiation of the sequence. The initiation is considered to be the injection of the BFB tune standard.

The analytical sequence must be completed for the analysis of ≤20 (19 samples including dilutions with one laboratory duplicate) field samples. A method blank (MB) shall be run to monitor for laboratory introduced contamination. There must be at a minimum a laboratory duplicate (LD) analyzed in each batch to access batch precision. A laboratory control sample (LCS) shall be analyzed at a rate of at least one per batch of twenty or fewer samples. The concentration of the LCS (ICV standard) should be at the lower end of the calibration curve as an indication that the system allows for good recovery at those concentrations. The following generalized analytical sequence is to be followed:

Analytical Sequence Guideline

With Calibration	Tune Check[1]
	Calibration Standards (5 Standards Minimum)
	ICV Standard[2] (Acts as the ICV and LCS)
	QC Canister Checks[6]
	MB[7]
	Sample(s) – 1-19
	Laboratory Duplicate[4]
With Continuing	Tune Check[1]
	Calibration
	CCV Standard[5]
	QC Canister Checks[6]
	MB[7]
	LCS[3]
	Sample(s) – 1-19
	Laboratory Duplicate[4]

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[1] The introduction of the tune check standard is the start of the 24 hour analysis window. The instrument performance check solution must be analyzed initially and once per 24 hour time period of operation.
[2] In this scenario, the ICV may also be evaluated as the LCS.
[3] An LCS shall be analyzed at a rate of 1 in 20 or fewer samples. The LCS is the second source calibration check standard analyzed at the lower end of the calibration curve.
[4] A laboratory duplicate must be analyzed at a rate of 1 per 20 or fewer samples. The duplicate must be rotated among clients, whenever possible.
[5] A CCV must be analyzed at the beginning of every analytical sequence.
[6] Any number of QC check canisters may be analyzed in the sequence to determine a canister cleaning batch or batches acceptability.
[7] Any of the QC Check Canisters may serve as the method blank as long as the minimum requirements detailed in this document are met. A method blank shall be analyzed at a rate of 1 in 20 or fewer samples.

Note: Client project batch specifications may require certain modifications to the analytical sequence; however, a batch may not be more lenient than that which is specified in this document.

11.4 Conditions

11.4.1 Sample Collection Conditions The suggested settings and system parameters are as follows:

Adsorbent Trap

Set Point:	35°
Sample Volume:	up to 1,000mL
Dry Purge:	400mL
Sampling Rate:	100mL/min
Desorb Temp.:	260°C to 280°C
Desorb Flow Rate:	8-10mL/min He
Desorb Time:	3.0 minutes

Refocusing Trap

Temperature:	-180°C
Injection Temp.:	120°C
Injection Time:	1.0 min

Adsorbent Trap Reconditioning Conditions

Temperature:	10°C above desorb temperature
Initial Bakeout:	2 hours or until clean blank is obtained
After each run:	15 minutes

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11.4.2 GC/MS System

Optimize GC conditions for compound separation and sensitivity.

Item	Condition
Carrier Gas	Helium
Flow Rate	1.0-1.5mL/minute
Temperature Program	Initial Temperature: 35°C Initial Hold Temperature: 3 minutes Ramp Rate: 5°C/min to 125°C 2nd Ramp: 20°C/min to 240°C for 6 min hold
Detector B (MSD *Interface)*:	280°C
Electron Energy	70 Volts (nominal)
Mass Range	34 to 280 amu (SCAN mode)
Mass Range	Scan masses corresponding to the target analytes (SIM mode)
Scan Time	To give at least 10 scans per peak, not to exceed 1 second per scan.

Note: *The instrument may be operated in Selective Ion Monitoring (SIM) mode if requested by the client.*

11.5 Instrument Performance Check

Since the BFB tuning compound is included in the internal standard and surrogate standard canister and a autosampler is used, it is necessary to establish that a given GC/MS meets tuning and standard mass spectral abundance criteria prior to the reduction and approval of any data collection. The 24-hour time period for GC/MS instrument performance check and standards calibration (initial calibration or continuing calibration verification criteria) begins at the injection of the BFB, which shall be documented in laboratory records. Upon completion of the successful BFB tune, the tune report must be printed and retained on file for future reference.

The following is the procedure to follow when performing the instrument performance check.

- Inject 50ng or less (on column)
- Three scans (peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged.
- Background subtraction is conducted using a single scan prior to the elution of BFB.

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All subsequent standards, samples and QC samples associated with a BFB analysis must use identical instrument conditions. Refer to Section 12.1 for the acceptance criteria and Section 15.1 for the required corrective action.

11.6 Initial Calibration

Refer to Section 12.2 for the technical requirements for performing an initial calibration.

11.6.1 Calibration Points Analyze a minimum of five levels of the calibration standard (analyze low to high) that span the monitoring range of interest of the samples. The range is typically 0.5ng-100ng on column. The dynamic range is dependent on the sensitivity of a particular instrument as well as the required reporting limit for a given project and may be adjusted accordingly. Refer to Table 3 for the concentrations of the compounds of interest in the initial calibration.

The initial calibration is performed to determine instrument sensitivity and the linearity of the GC/MS response for the target compounds. One of the calibration points from the initial calibration curve must be at the same concentration as the continuing calibration verification standard. Also, one of the standards must be at or below the method reporting limit for the compounds of interest or the MRL must be adjusted accordingly.

11.6.2 Recalibration Each GC/MS system must be recalibrated following any instrument maintenance which may change or effect the sensitivity or linearity of the instrument or if the continuing calibration verification acceptance criteria have not been met as specified in Section 12.4.

11.6.3 Analytical Window If time remains in the 24-hour tune window after meeting the acceptance criteria for the initial calibration, samples may be analyzed according to the procedure described in this document (see Section 11.3.2). If time does not remain in the analytical window, a new sequence shall commence with the analysis of the instrument performance check compound (BFB) and the continuing calibration verification standard.

11.6.4 Procedure The system should be operated using temperature and flow rate parameters equivalent to those in Section 11.4. Use the standard prepared in accordance with Section 9.2.2 of this SOP. Attach the calibration standard and internal standard/surrogate canisters to the designated inlets on the preconcentrator and open the canister valves. Analyzing different volume aliquots of the calibration standards produces differing concentrations. Internal standards/surrogates must be added at the same volume for every standard, sample and QC sample.

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Analyte responses (target ion areas) are tabulated and recorded using the Enviroquant program. Quantitation ions for the target compounds are shown in Table 2 and the primary ion should be used unless interferences are present, in which case the secondary ion may be used. Refer to Section 13.1 for the required calculations and Section 12.2.1 for the acceptance criteria.

11.6.5 Initial Calibration Review Analyst's calculation and assessment along with a peer review of all ICAL data and documentation as stated in Attachment B is required before the ICAL may be used to analyze samples. In the case where samples are placed on the autosampler and allowed to run overnight, the sample results may only be reported if the ICAL is reviewed and found to be acceptable. The ICAL checklist in Attachment B must be used to document the review and approval process.

Analyte concentrations, which are not "real", not to be reported, or otherwise marked off the initial calibration, should be followed by a short explanation regarding the reason for the omission.

11.6.6 Initial Calibration File An ICAL file is to be created for each initial calibration performed per instrument into which is placed the following ICAL documents. The file shall remain in the laboratory and be filed by instrument and date.

- ICAL Checklist filled out, reviewed and approved
- BFB tune analysis report
- Blank analysis quantitation report
- Calibration status report (aka Calibration History)
- Relative Response Factor Report / Percent Relative Standard Deviation
- Quantitation report for each calibration standard (including manual integration documentation – before and after manual integration)
- ICV quantitation report and %recovery report.

11.7 Initial Calibration Verification Standard

Verify the initial calibration by analyzing an initial calibration verification standard (ICV). This standard shall be obtained or prepared from materials acquired from a different manufacturer or lot from that of the initial calibration and prepared according to Section 9.2.3.

Inject 25ng or less (refer to Table 4 for the secondary source standard concentrations) of the ICV standard depending on the dynamic range of a given instrument and refer to Section 13.3 for the required calculations and Section 12.3 for the acceptance criteria.

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11.8 Continuing Calibration Verification Standard

Verify the calibration each working day, where necessary (e.g., an ICAL was not analyzed or the 24-hour tune window has closed) by analyzing a continuing calibration verification (CCV) standard from the initial calibration standard canister. The concentration of the calibration verification should be varied within the established calibration range. Refer to Table 3 for the standard concentrations, the same concentrations as that of the initial calibration must be utilized.

Refer to Section 13.2 for the required calculations and Section 12.4 for the acceptance criteria.

11.9 Canister Quality Control Check and Method Blank

A Quality Control (QC) check canister may also serve as a method blank (see Note 1 below) as long as the analyte concentration requirements stated in the canister quality control check section (Section 11.9.1) and the other requirements (refer to Section 12.5 for internal standard requirements) are met. If a QC canister fails with respect to the analyte concentration criterion, it may still be used as a method blank as long as the method blank criteria stated in 11.9.2 are met. If a QC canister still fails, another QC canister or a new canister must be prepared and analyzed (per Section 11.9.2) in order to verify that no system contamination exists.

Note 1: The use of a QC canister as a method blank is considered acceptable since a canister that has been sent into the field, returned and cleaned more closely resembles the manner in which client samples are handled.

11.9.1 Canister Quality Control Check The actual cleaning procedure, number of cans to select for analysis (to release a cleaning batch) and corrective actions are covered in the *Standard Operating Procedure for Cleaning and Certification of Summa Canister and Other Specially Prepared Canisters* and are not covered in this section. However, the procedure for analyzing and certifying a cleaning batch is included.

The canister to be checked, shall be pressurized with humidified zero grade air prior to analysis. Analyze an aliquot of one liter along with the same volume of internal standard and surrogate as standards and samples. The unique laboratory barcode given to a canister shall be the information included in the sample analysis identification, which is for tracking purposes. A canister is considered "clean" if the analysis shows <0.2ppbv of any target analyte (refer to Note 1), except acetone and ethanol. These compounds are considered exceptions; the concentration requirement for these analytes is <3.0ng/L ($\mu g/m^3$) or <1.26ppbv for acetone and <1.59ppbv for ethanol (refer to Note 2).

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If the batch of canisters are to be used for tentatively identified compounds (TIC) analysis, any non-target peaks present in the QC check canister analysis must be evaluated and determined to be less than the TIC reporting limit (<10% of the peak height of Internal Standard 2, as referenced in Table 2).

Note 1: The requirement of <0.50μg/m^3 (assuming a one liter injection, 0.50ng/L as is specified on the quantitation reports) satisfies this requirement for all target analytes except Chloromethane (0.41μg/m^3), 1,3-Butadiene (0.44μg/m^3), Acetonitrile (0.33μg/m^3), Acrolein (0.45μg/m^3), Acrylonitrile (0.43μg/m^3), and Isopropanol (0.49μg/m^3) each of which has a molecular weight of less than 62. The values in parentheses are the maximum concentrations that may be found on the quantitation reports (by mass, ng) for a QC Check canister in order for the acceptance criterion of <0.2ppbv to be met.

Additionally, a custom report for automatically calculating the ppbv levels found in QC canisters and method blanks must be performed and maintained (if found acceptable).

Note 2: The acetone and ethanol concentrations found in any QC canister must be <3.0μg/m^3 (<1.26 ppbv for acetone and 1.59ppbv for ethanol). These analytes are included in the target analyte list only at the request of clients. The method reporting limit has been raised to 5.0μg/m^3 for each.

$$ppbv = \frac{\mu g / m^3}{MW} x24.46 \qquad \mu g / m^3 = \frac{ppbv}{24.46} xMW$$

Make a notation on the sample identification tag as to the status of the check and return the canister to the canister conditioning room. Additionally, if the check was found to be acceptable, the quantitation report must be kept on file for future reference.

11.9.2 Method Blank In order for a method blank to be considered acceptable all target analytes must be less than the method reporting limit and fulfill each of the additional requirements in Section 12.5. If the QC canister(s) fail the corresponding criteria then the following must be performed.

- Prepare a canister that has not left the building by pressurizing with humidified zero air.
- Analyze an aliquot of the blank (1 liter) with internal standard and surrogate
- Be consistent with the volume of internal standards introduced for each analysis.

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Additionally, analyze a method blank whenever a high concentration sample is encountered and carryover is suspected.

The analyst should cross out those concentrations that are not real and initial and date the quantitation report for those QC Check canisters and method blanks that meet the acceptance criteria included in this section.

11.10 Laboratory Control Sample

The laboratory control sample is an injection of the initial calibration verification standard. Inject the LCS (ICV) at concentrations below the midpoint of the calibration curve. Make sure that all of the pertinent information is included on the quantitation report including the sample identification (LCS), concentration, standard used, and analyst.

11.11 Sample Analysis

11.11.1 Procedure Prior to analysis, all sample containers (canisters and bags) should be at temperature equilibrium with the laboratory.

- Attach sample canisters Tekmar AUTOCan using a 9/16" wrench.
- Before opening the valve, check for leaking fittings by running the leak check program in the Teklink software.
- If system is leak tight, open the canister valves and start the automated preconcentration procedure. Make sure the Chemstation data acquisition software has been readied.
- Maintain the trap at an elevated temperature until the beginning of the next analysis.
- Introduce the same volume of internal standards (surrogates included) as used for the standards and QC samples.

Check all target compounds using the QEdit routine in Enviroquant, making sure all extracted ion chromatogram peaks are integrated properly (see Section 11.12).

Note: *The secondary ion quantitation is only allowed if there is sample matrix interference with the primary ion. If the secondary ion quantitation is performed, document the reasons in the instrument run logbook and/or on the quantitation report (initial and date any notation).*

Refer to Section 13.5 for the required calculations and check the internal standard peak areas and retention times as well as applicable surrogate recoveries to see if they meet acceptance criteria (see Section 12.7).

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SCAN Mode

The instrument is normally operated in the SCAN mode, where the following procedure may be followed.

- Upon sample injection onto the column, the GC/MS system is operated so that the MS scans the atomic range from 34 to 270 amu. At least ten scans per eluting chromatographic peak should be acquired. Scanning allows identification of unknown compounds in the sample through searching of library spectra. See operating conditions in Section 11.4.
- Each run is approximately 45 minutes long. Generate a quantitation report for each run.
- If reporting Tentatively Identified Compounds (TICs), refer to Section 11.11.3 for identification criteria.

SIM Mode

When the client requests SIM mode, select SIM instead of SCAN mode and identify a minimum of two ions per analyte of interest. Also, a minimum of two ions for each internal standard and surrogate compound should be selected.

11.11.2 Sample Dilution If any target analyte results are above the highest level of the initial calibration, a smaller sample aliquot should be analyzed. The dynamic range of volume aliquots for the automatic cryogenic concentrator is 50cc to 1L. If a volume smaller than 50cc is to be analyzed, a dilution should be made in a Tedlar bag, or the sample directly injected using a gastight syringe. Guidance in performing dilutions and exceptions to this requirement are given below.

- Use results of the original analysis to determine the approximate dilution factor required and get the largest analyte peak within the initial calibration range.
- The dilution factor chosen should keep the response of the analyte peak for a reported target compound in the upper half of the initial calibration range of the instrument.
- All dilution factors must be documented and included in the final report.

Note: *Refer to Section 16.7.3 for requirements on reporting results outside of the initial calibration range.*

Tedlar bag dilution:

- Make a dilution by filling a Tedlar bag with 1.0 liter of humidified zero air using a one-liter gas syringe.

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- Calculate the volume of balance gas needed to obtain the required dilution.
- Remove the difference in the balance gas using a syringe.
- Add the calculated sample amount using a gastight syringe.

Direct injection:

- Make a direct injection by attaching a clean, humidified zero air filled Summa canister to the preconcentrator autosampler using 1/4" stainless steel or teflon tubing with a "tee" septum port. This canister should be the same canister that may be used as the method blank.
- Inject the sample through the septum while the preconcentrator withdraws a 200cc aliquot from the canister.

11.11.3 Tentatively Identified Compounds When requested, a mass spectral library search may be made for the purpose of tentatively identifying sample components not associated with the calibration standards. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system mass spectral library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Certain programs may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. The following guidelines are used for making tentative identifications.

- Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.
- The relative intensities of the major ions should agree within ±20%. For example, for an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance should be between 30 and 70%.
- Molecular ions present in the reference spectrum should be present in the sample spectrum.
- Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.
- Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.
- The concentration of the tentatively identified compound is estimated by assuming a response factor of 1.0 and comparing the response of the tentatively identified compound to the response of the 2nd internal standard.

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TABLE 2 (Continued)

VOLATILE ORGANIC COMPOUNDS EPA COMPENDIUM METHOD TO-15 (SCAN)					
Compound[1]	**CAS Number**	**Primary Ion[2]**	**Secondary Ion(s)[2]**	**MRL ($\mu g/m^3$)[3]**	**Internal Standards[4]**
2-Hexanone[5]	591-78-6	43	58	1.0	IS3
Dibromochloromethane[5]	124-48-1	129	127	1.0	IS3
1,2-Dibromoethane[5]	106-93-4	107	109	1.0	IS3
n-Butyl Acetate[6]	123-86-4	43	56, 73	1.0	IS3
n-Octane	111-65-9	57	114	1.0	IS3
Tetrachloroethene[5]	127-18-4	166	164	1.0	IS3
Chlorobenzene[5]	108-90-7	112	114	1.0	IS3
Ethylbenzene[5]	100-41-4	91	106	1.0	IS3
m-, p-Xylenes[5]	1330-20-7	91	106	1.0	IS3
Bromoform[5]	75-25-2	173	175	1.0	IS3
Styrene[5]	100-42-5	104	78, 103	1.0	IS3
o-Xylene[5]	95-47-6	91	106	1.0	IS3
n-Nonane[6]	111-84-2	43	57, 85	1.0	IS3
1,1,2,2-Tetrachloroethane[5]	79-34-5	83	85	1.0	IS3
4-Bromofluorobenzene(S)	460-00-4	174	176	1.0	IS3
Cumene[6]	98-82-8	105	120	1.0	IS3
alpha-Pinene[6]	80-56-8	93	77	1.0	IS3
n-Propylbenzene	103-65-1	91	120,65	1.0	IS3
3-Ethyltoluene	620-14-4	105	120	1.0	IS3
4-Ethyltoluene[6]	622-96-8	105	120	1.0	IS3
1,3,5-Trimethylbenzene[6]	108-67-8	105	120	1.0	IS3
alpha-Methylstyrene	98-83-9	118	103,117	1.0	IS3
2-Ethyltoluene	611-14-3	105	120	1.0	IS3
1,2,4-Trimethylbenzene[6]	95-63-6	105	120	1.0	IS3
n-Decane	124-18-5	57	71,85	1.0	IS3
Benzyl Chloride[6]	100-44-7	91	126	1.0	IS3
1,3-Dichlorobenzene[5]	541-73-1	146	148	1.0	IS3
1,4-Dichlorobenzene[5]	106-46-7	146	148	1.0	IS3
sec-Butylbenzene	135-98-8	105	134,91	1.0	IS3

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TABLE 2 (Continued)

VOLATILE ORGANIC COMPOUNDS EPA COMPENDIUM METHOD TO-15 (SCAN)					
Compound[1]	**CAS Number**	**Primary Ion[2]**	**Secondary Ion(s)[2]**	**MRL ($\mu g/m^3$)[3]**	**Internal Standards[4]**
p-Isopropyltoluene	99-87-6	119	134,91	1.0	IS3
1,2,3-Trimethylbenzene	526-73-8	105	120	1.0	IS3
1,2-Dichlorobenzene[5]	95-50-1	146	148	1.0	IS3
d-Limonene[6]	5989-27-5	68	93	1.0	IS3
1,2,Dibromo-3-Chloropropane[6]	96-12-8	157	75, 39	1.0	IS3
n-Undecane	1120-21-4	57	71	1.0	IS3
1,2,4-Trichlorobenzene[6]	120-82-1	184	145, 182	1.0	IS3
Naphthalene[6]	91-20-3	128	129	1.0	IS3
n-Dodecane	112-40-3	57	71,85	1.0	IS3
Hexachlorobutadiene[6]	87-68-3	225	227	1.0	IS3

(S) = Surrogate (IS1) = Internal Standard 1 (IS2) = Internal Standard 2 (IS3) = Internal Standard 3

Note 1: Additional compounds may be reported as long as the minimum requirements of this document are met. The compounds listed in this table are reported using TO-15 SCAN. The Selected Ion Monitoring (SIM) compounds are a subset of this list and are included in Table 2A.

Note 2: These are suggested primary and secondary ions. However, any ions in the analyte spectra that are sufficient enough in response to reach the desired reporting limit and having a limited amount of interference, is acceptable for both the primary and secondary ion selection. Analyst experience should be utilized in determining appropriate ions.

Note 3: The method reporting limit listed is the standard SCAN limit (lowest concentration in the initial calibration curve), but may change with each new initial calibration performed. Therefore, current reporting limits should be reviewed.

Note 4: The listing of the internal standard by which the compounds are quantitated is for TO-15 SCAN only. SIM compounds (SCAN subset) and their corresponding ions and internal standards are listed in Table 2A.

Note 5: These compounds are included in the laboratories' standard 43 compound reporting list.

Note 6: These compounds are included in the laboratories' standard 67 compound reporting list (includes standard 43 compound reporting list).

Note7: Regardless of the low standard ICAL concentration, these compounds may not be reported below $1.0 \mu g/m^3$.

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TABLE 2A

VOLATILE ORGANIC COMPOUNDS, EPA Compendium Method TO-15 (SIM)				
Compound	**MRL (ug/m3)[1]**	**Primary Ion[2]**	**Secondary Ion[2]**	**Internal Standard**
Dichlorodifluoromethane	0.025	85	87	IS1
Chloromethane	0.025	52	50	IS1
Vinyl Chloride	0.025	62	64	IS1
Chloroethane	0.025	64	66	IS1
Acetone	0.50	58	43	IS1
1,1-Dichloroethene	0.025	96	98,61	IS1
Methylene Chloride	0.10	84	49	IS1
Trichlorotrifluoroethane	0.025	151	153	IS1
trans-1,2-Dichloroethene	0.025	96	98,61	IS1
1,1-Dichloroethane	0.025	63	65	IS1
Methyl tert-Butyl Ether	0.025	73	57	IS1
cis-1,2-Dichloroethene	0.025	96	98,61	IS1
Chloroform	0.10	83	85	IS1
1,2-Dichloroethane	0.025	62	64	IS1
1,1,1-Trichloroethane	0.025	97	99	IS1
Benzene	0.10	78	77	IS1
Carbon Tetrachloride	0.025	117	119	IS1
1,2-Dichloropropane	0.025	63	62,76	IS2
Trichloroethene	0.025	130	132	IS2
cis-1,3-Dichloropropene	0.025	75	77,39	IS2
1,1,2-Trichloroethane	0.025	83	97,61	IS2
Toluene	0.10	91	92	IS2
1,2-Dibromoethane	0.025	107	109	IS2
Tetrachloroethene	0.025	166	164	IS2
Chlorobenzene	0.025	112	114	IS3
Ethylbenzene	0.10	91	106	IS3
m-&-p-Xylene	0.200	91	106	IS3
o-Xylene	0.100	91	106	IS3
1,1,2,2-Tetrachloroethane	0.025	83	85	IS3
1,4-Dichlorobenzene	0.025	146	148	IS3
Naphthalene	0.10	128	129	IS3
Hexachlorobutadiene	0.025	225	227	IS3

(IS1) = Internal Standard 1 (IS2) = Internal Standard 2 (IS3) = Internal Standard 3

Note 1: The method reporting limit listed is the standard SIM limit (lowest concentration in the initial calibration curve), but may change with each new initial calibration performed. Therefore, current reporting limits should be reviewed.
Note 2: These are suggested primary and secondary ions. However, any ions in the analyte spectra that is sufficient enough in response to reach the desired reporting limit and having a limited amount of interference, is acceptable for both the primary and secondary ion selection. Analyst experience should be utilized in determining appropriate ions.

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Table 3
Standard Concentrations (SCAN) (Primary Sources)[1]

Compound Name	0.1ng	0.5ng	1.0ng	5.0ng	10ng	25ng	50ng	100ng
Bromochloromethane (IS1)	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
Propene	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Dichlorodifluoromethane (CFC 12)	0.099	0.495	0.990	4.95	9.90	24.8	49.5	99.0
Chloromethane	0.098	0.490	0.980	4.90	9.80	24.5	49.0	98.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	0.098	0.490	0.980	4.90	9.80	24.5	49.0	98.0
Vinyl Chloride	0.099	0.495	0.990	4.95	9.90	24.8	49.5	99.0
1,3-Butadiene	0.110	0.550	1.10	5.50	11.0	27.5	55.0	110
Bromomethane	0.098	0.490	0.980	4.90	9.80	24.5	49.0	98.0
Chloroethane	0.099	0.495	0.990	4.95	9.90	24.8	49.5	99.0
Ethanol	0.101	0.505	1.01	5.05	10.1	25.3	50.5	101
Acetonitrile	0.097	0.485	0.970	4.85	9.70	24.3	48.5	97.0
Acrolein	0.094	0.470	0.940	4.70	9.40	23.5	47.0	94.0
Acetone	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Trichlorofluoromethane	0.097	0.485	0.970	4.85	9.70	24.3	48.5	97.0
Isopropyl Alcohol	0.100	0.500	1.00	5.00	10.0	25.0	50.0	100
Acrylonitrile	0.099	0.495	0.990	4.95	9.90	24.8	49.5	99.0
1,1-Dichloroethene	0.109	0.545	1.09	5.45	10.9	27.3	54.5	109
tert-Butanol	0.099	0.495	0.990	4.95	9.90	24.8	49.5	99.0
Methylene Chloride	0.107	0.535	1.07	5.35	10.7	26.8	53.5	107
Allyl Chloride	0.102	0.510	1.02	5.10	10.2	25.5	51.0	102
Trichlorotrifluoroethane	0.107	0.535	1.07	5.35	10.7	26.8	53.5	107
Carbon Disulfide	0.100	0.500	1.00	5.00	10.0	25.0	50.0	100
trans-1,2-Dichloroethene	0.104	0.520	1.04	5.20	10.4	26.0	52.0	104
1,1-Dichloroethane	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
Methyl tert-Butyl Ether	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
Vinyl Acetate	0.102	0.510	1.02	5.10	10.2	25.5	51.0	102
2-Butanone (MEK)	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
cis-1,2-Dichloroethene	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Diisopropyl Ether	0.101	0.505	1.01	5.05	10.1	25.3	50.5	101
Ethyl Acetate	0.110	0.550	1.10	5.50	11.0	27.5	55.0	110
n-Hexane	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Chloroform	0.109	0.545	1.09	5.45	10.9	27.3	54.5	109
1,2-Dichloroethane-d4 (S)	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
Tetrahydrofuran	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Ethyl tert-Butyl Ether	0.102	0.510	1.02	5.10	10.2	25.5	51.0	102
1,2-Dichloroethane	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
1,4-Difluorobenzene(IS2)	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
1,1,1-Trichloroethane	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106

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Table 3 - Continued
Standard Concentrations (SCAN) (Primary Sources)[1]

Compound Name	0.1ng	0.5ng	1.0ng	5.0ng	10ng	25ng	50ng	100ng
Isopropyl acetate	0.098	0.490	0.980	4.90	9.80	24.5	49.0	98.0
1-Butanol	0.097	0.485	0.970	4.85	9.70	24.3	48.5	97.0
Benzene	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Carbon Tetrachloride	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
Cyclohexane	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
tert-Amyl Methyl Ether	0.102	0.510	1.02	5.10	10.2	25.5	51.0	102
1,2-Dichloropropane	0.104	0.520	1.04	5.20	10.4	26.0	52.0	104
Bromodichloromethane	0.110	0.550	1.10	5.50	11.0	27.5	55.0	110
Trichloroethene	0.108	0.540	1.08	5.40	10.8	27.0	54.0	108
1,4-Dioxane	0.110	0.550	1.10	5.50	11.0	27.5	55.0	110
Isooctane	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
Methyl Methacrylate	0.101	0.505	1.01	5.05	10.1	25.3	50.5	101
n-Heptane	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
cis-1,3-Dichloropropene[2]	0.100	0.500	1.00	5.00	10.0	25.0	50.0	100
4-Methyl-2-Pentanone	0.107	0.535	1.07	5.35	10.7	26.8	53.5	107
trans-1,3-Dichloropropene[2]	0.110	0.550	1.10	5.50	11.0	27.5	55.0	110
1,1,2-Trichloroethane	0.102	0.510	1.02	5.10	10.2	25.50	51.0	102
Chlorobenzene-d5 (IS3)	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
Toluene-d8 (S)	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
Toluene	0.104	0.520	1.04	5.20	10.4	26.0	52.0	104
2-Hexanone	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
Dibromochloromethane	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
1,2-Dibromoethane	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
n-Butyl Acetate	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
n-Octane	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
Tetrachloroethene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
Chlorobenzene	0.104	0.520	1.04	5.20	10.4	26.0	52.0	104
Ethylbenzene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
m- & p-Xylene	0.226	1.130	2.26	11.3	22.6	56.5	113	226
Bromoform	0.114	0.570	1.14	5.70	11.4	28.5	57.0	114
Styrene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
o-Xylene	0.111	0.555	1.11	5.55	11.1	27.8	55.5	111
n-Nonane	0.104	0.520	1.04	5.20	10.4	26.0	52.0	104
1,1,2,2-Tetrachloroethane	0.111	0.555	1.11	5.55	11.1	27.8	55.5	111
4-Bromofluorobenzene (S)	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
Cumene	0.108	0.540	1.08	5.40	10.8	27.0	54.0	108
alpha-Pinene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
n-Propylbenzene	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
3-Ethyltoluene	0.101	0.505	1.01	5.05	10.1	25.3	50.5	101

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Table 3 - Continued
Standard Concentrations (SCAN) (Primary Sources)[1]

Compound Name	0.1ng	0.5ng	1.0ng	5.0ng	10ng	25ng	50ng	100ng
4-Ethyltoluene	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
1,3,5-Trimethylbenzene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
alpha-Methylstyrene	0.101	0.505	1.01	5.05	10.1	25.3	50.5	101
2-Ethyltoluene	0.100	0.500	1.00	5.00	10.0	25.0	50.0	100
1,2,4-Trimethylbenzene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
n-Decane	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
Benzyl Chloride	0.104	0.520	1.04	5.20	10.4	26.0	52.0	104
1,3-Dichlorobenzene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
1,4-Dichlorobenzene*	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
sec-Butylbenzene	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105
p-Isopropyltoluene	0.110	0.550	1.10	5.50	11.0	27.5	55.0	110
1,2,3-Trimethylbenzene	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
1,2-Dichlorobenzene	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
d-Limonene	0.102	0.510	1.02	5.10	10.2	25.5	51.0	102
1,2-Dibromo-3-Chloropropane	0.102	0.510	1.02	5.10	10.2	25.5	51.0	102
n-Undecane	1.106	0.530	1.06	5.30	10.6	26.5	53.0	106
1,2,4-Trichlorobenzene	0.108	0.540	1.08	5.40	10.8	27.0	54.0	108
Naphthalene*	0.103	0.515	1.03	5.15	10.3	25.8	51.5	103
n-Dodecane	0.106	0.530	1.06	5.30	10.6	26.5	53.0	106
Hexachlorobutadiene	0.105	0.525	1.05	5.25	10.5	26.3	52.5	105

* - Indicates a solid @ room temperature.

Note 1: The concentrations detailed in this table may change with each standard purchased or internally prepared. Refer to the appropriate initial calibration file, where necessary for the corresponding concentrations.

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Table 3A
Standard Concentrations (SIM) (Primary Sources)[1]

Compound	10pg	25pg	100pg	250pg	500pg	1,000pg	2,500pg	10,000pg
Dichlorodifluoromethane	9.90	24.8	99.0	248	495	990	2480	9900
Chloromethane	9.80	24.6	98.0	245	490	980	2450	9800
Vinyl Chloride	9.90	24.8	99.0	248	495	990	2480	9900
Chloroethane	9.90	24.8	99.0	248	495	990	2480	9900
Acetone	10.6	26.5	106	265	530	1060	2650	10600
1,1-Dichloroethene	10.9	27.3	109	273	545	1090	2730	10900
Methylene Chloride	10.7	26.8	107	268	535	1070	2680	10700
Trichlorotrifluoroethane	10.7	26.8	107	268	535	1070	2680	10700
trans-1,2-Dichloroethene	10.4	26.0	104	260	520	1040	2600	10400
1,1-Dichloroethane	10.5	26.3	105	263	525	1050	2630	10500
Methyl tert-Butyl Ether	10.5	26.3	105	263	525	1050	2630	10500
cis-1,2-Dichloroethene	10.6	26.5	106	265	530	1060	2650	10600
Chloroform	10.9	27.3	109	273	545	1090	2730	10900
1,2-Dichloroethane	10.3	25.8	103	258	515	1030	2580	10300
1,1,1-Trichloroethane	10.6	26.5	106	265	530	1060	2650	10600
Benzene	10.6	26.5	106	265	530	1060	2650	10600
Carbon Tetrachloride	10.3	25.8	103	258	515	1030	2580	10300
1,2-Dichloropropane	10.4	26.0	104	260	520	1040	2600	10400
Trichloroethene	10.8	27.0	108	270	540	1080	2700	10800
cis-1,3-Dichloropropene	10.0	25.0	100	250	500	1000	2500	10000
1,1,2-Trichloroethane	10.2	25.5	102	255	510	1020	2550	10200
Toluene	10.4	26.0	104	260	520	1040	2600	10400
1,2-Dibromoethane	10.3	25.8	103	258	515	1030	2580	10300
Tetrachloroethene	10.3	25.75	103	258	515	1030	2580	10300
Chlorobenzene	10.4	26.0	104	260	520	1040	2600	10400
Ethylbenzene	10.3	25.75	103	258	515	1030	2580	10300
m-&-p-Xylene	22.6	56.5	226	565	1130	2260	5650	22600
o-Xylene	11.1	27.75	111	278	555	1110	2780	11100
1,1,2,2-Tetrachloroethane	11.1	27.75	111	278	555	1110	2780	11100
1,4-Dichlorobenzene	10.5	26.25	105	263	525	1050	2630	10500
Naphthalene	10.3	25.75	103	258	515	1030	2580	10300
Hexachlorobutadiene	10.5	26.25	105	263	525	1050	2630	10500

Note 1: The concentrations detailed in this table may change with each standard purchased or internally prepared. Refer to the appropriate initial calibration file, where necessary for the corresponding concentrations.

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Table 4
Standard Concentrations (SCAN) (Secondary Sources)[1]

Compound Name	25ng
Bromochloromethane (IS1)	25.0
Propene	26.8
Dichlorodifluoromethane (CFC 12)	25.8
Chloromethane	25.8
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	26.8
Vinyl Chloride	25.8
1,3-Butadiene	27.0
Bromomethane	25.8
Chloroethane	26.0
Ethanol	24.0
Acetonitrile	23.8
Acrolein	23.5
Acetone	27.3
Trichlorofluoromethane	24.3
Isopropyl Alcohol	24.8
Acrylonitrile	24.5
1,1-Dichloroethene	27.5
tert-Butanol	24.5
Methylene Chloride	27.3
Allyl Chloride	25.5
Trichlorotrifluoroethane	27.5
Carbon Disulfide	25.0
trans-1,2-Dichloroethene	26.8
1,1-Dichloroethane	27.3
Methyl tert-Butyl Ether	27.0
Vinyl Acetate	25.8
2-Butanone (MEK)	27.3
cis-1,2-Dichloroethene	27.3
Diisopropyl Ether	25.0
Ethyl Acetate	28.8
n-Hexane	27.3
Chloroform	28.5
1,2-Dichloroethane-d4 (S)	25.0
Tetrahydrofuran	27.0
Ethyl tert-Butyl Ether	25.8
1,2-Dichloroethane	26.8
1,4-Difluorobenzene(IS2)	25.0
1,1,1-Trichloroethane	27.0

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Table 4 - Continued
Standard Concentrations (SCAN) (Secondary Sources)[1]

Compound Name	25ng
Isopropyl acetate	23.8
1-Butanol	23.8
Benzene	27.0
Carbon Tetrachloride	26.5
Cyclohexane	27.0
tert-Amyl Methyl Ether	25.8
1,2-Dichloropropane	26.8
Bromodichloromethane	28.3
Trichloroethene	28.3
1,4-Dioxane	28.3
Isooctane	26.3
Methyl Methacrylate	26.3
n-Heptane	27.3
cis-1,3-Dichloropropene[2]	25.8
4-Methyl-2-Pentanone	27.3
trans-1,3-Dichloropropene[2]	28.8
1,1,2-Trichloroethane	26.5
Chlorobenzene-d5 (IS3)	25.0
Toluene-d8 (S)	25.0
Toluene	26.8
2-Hexanone	27.0
Dibromochloromethane	27.0
1,2-Dibromoethane	26.5
Butyl Acetate	25.8
n-Octane	26.5
Tetrachloroethene	26.5
Chlorobenzene	26.8
Ethylbenzene	26.5
m- & p-Xylene	58.0
Bromoform	29.5
Styrene	26.5
o-Xylene	28.3
n-Nonane	26.3
1,1,2,2-Tetrachloroethane	28.3
4-Bromofluorobenzene (S)	25.0
Cumene	27.3

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Table 4 - Continued
Standard Concentrations (SCAN) (Secondary Sources)[1]

Compound Name	25ng
alpha-Pinene	26.3
n-Propylbenzene	26.5
3-Ethyltoluene	25.5
4-Ethyltoluene	27.3
1,3,5-Trimethylbenzene	26.5
alpha-Methylstyrene	25.5
2-Ethyltoluene	25.0
1,2,4-Trimethylbenzene	26.8
n-Decane	26.3
Benzyl Chloride	26.5
1,3-Dichlorobenzene	26.3
1,4-Dichlorobenzene*	27.0
sec-Butylbenzene	26.5
p-Isopropyltoluene	27.5
1,2,3-Trimethylbenzene	26.3
1,2-Dichlorobenzene	26.8
d-Limonene	26.0
1,2-Dibromo-3-Chloropropane	25.8
n-Undecane	26.5
1,2,4-Trichlorobenzene	28.3
Naphthalene*	25.8
n-Dodecane	26.8
Hexachlorobutadiene	27.5

* - Indicates a solid @ room temperature.

Note 1: The concentrations detailed in this table may change with each standard purchased or internally prepared. Refer to the appropriate initial calibration file, where necessary for the corresponding concentrations.

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Table 4A
Standard Concentrations (SIM) (Secondary Sources)[1]

Compound	500pg
Dichlorodifluoromethane	515
Chloromethane	505
Vinyl Chloride	515
Chloroethane	520
Acetone	545
1,1-Dichloroethene	550
Methylene Chloride	545
Trichlorotrifluoroethane	550
trans-1,2-Dichloroethene	535
1,1-Dichloroethane	545
Methyl tert-Butyl Ether	540
cis-1,2-Dichloroethene	545
Chloroform	570
1,2-Dichloroethane	535
1,1,1-Trichloroethane	540
Benzene	540
Carbon Tetrachloride	530
1,2-Dichloropropane	535
Trichloroethene	565
cis-1,3-Dichloropropene	515
1,1,2-Trichloroethane	530
Toluene	535
1,2-Dibromoethane	530
Tetrachloroethene	530
Chlorobenzene	535
Ethylbenzene	530
m-&-p-Xylene	1160
o-Xylene	565
1,1,2,2-Tetrachloroethane	565
1,4-Dichlorobenzene	540
Naphthalene	515
Hexachloro-1,3-butadiene	550

Note 1: The concentrations detailed in this table may change with each standard purchased or internally prepared. Refer to the appropriate initial calibration file, where necessary for the corresponding concentrations.

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Table 5
Purchased Stock Standard Concentrations ($\mu g/m^3$)[1] Cylinder#1
(Primary and Secondary)

Compound Name	Molecular Weight	Density (g/mL)	Primary Source (S15-07180501)	Secondary Source (S15-07180502)
Propene	42.08	N/A	1060	1070
Dichlorodifluoromethane	120.9	1.329	990	1030
Chloromethane	50.49	0.911	980	1010
Freon 114	170.9	1.455	980	1050
Vinyl Chloride	62.50	0.9106	990	1030
1,3-Butadiene	54.09	0.6149	1100	1080
Bromomethane	94.94	1.6755	980	1030
Chloroethane	64.52	0.8902	990	1040
Ethanol	46.07	0.7893	1010	960
Acetone	58.08	0.7845	1060	1090
Trichlorofluoromethane	137.4	N/A	970	970
Isopropyl Alcohol	60.10	0.7809	1000	990
1,1-Dichloroethene	96.94	1.213	1090	1100
Methylene Chloride	84.94	1.3266	1070	1090
Trichlorotrifluoroethane	187.38	1.5635	1070	1100
Carbon Disulfide	76.14	1.2632	1000	1000
trans-1,2-Dichloroethene	96.94	1.2565	1040	1070
1,1-Dichloroethane	98.96	1.1757	1050	1090
Methyl tert-Butyl Ether	88.15	0.7402	1050	1080
Vinyl Acetate	86.09	0.9317	1020	1030
2-Butanone	72.11	0.7999	1060	1090
cis-1,2-Dichloroethene	96.94	1.2837	1060	1090
Ethyl Acetate	88.106	0.9003	1100	1150
n-Hexane	86.17	0.6548	1060	1090
Chloroform	119.4	1.4832	1090	1140
Tetrahydrofuran	72.11	0.8892	1060	1080
1,2-Dichloroethane	98.96	1.2351	1030	1070
1,1,1-Trichloroethane	133.4	1.3390	1060	1080
Benzene	78.11	0.8765	1060	1080
Carbon Tetrachloride	153.8	1.5940	1030	1060
Cyclohexane	84.16	0.7739	1050	1080
1,2-Dichloropropane	113	1.1560	1040	1070
Bromodichloromethane	163.8	1.980	1100	1130
Trichloroethene	131.4	1.4642	1080	1130
1,4-Dioxane	88.11	1.0337	1100	1130
n-Heptane	100.2	0.6837	1050	1090
cis-1,3-Dichloropropene[2]	111	1.224	1000	1030

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Table 5
Purchased Stock Standard Concentrations ($\mu g/m^3$)[1] Cylinder#1 (Primary and Secondary)

Compound Name	Molecular Weight	Density (g/mL)	Primary Source (S15-07180501)	Secondary Source (S15-07180502)
4-Methyl-2-Pentanone	100.2	0.7965	1070	1090
trans-1,3-Dichloropropene[2]	111	1.217	1100	1150
1,1,2-Trichloroethane	133.4	1.4397	1020	1060
Toluene	92.14	0.8669	1040	1070
2-Hexanone	100.16	0.8113	1050	1080
Dibromochloromethane	208.3	2.451	1060	1080
1,2-Dibromoethane	187.9	2.1791	1030	1060
Tetrachloroethene	165.8	1.6227	1030	1060
Chlorobenzene	112.6	1.1058	1040	1070
Ethylbenzene	106.2	0.8670	1030	1060
m- & p-Xylene	106.2	0.8642,0.8611	2260	2320
Bromoform	252.8	2.899	1140	1180
Styrene	104.1	0.9060	1030	1060
o-Xylene	106.1	0.8802	1110	1130
1,1,2,2-Tetrachloroethane	167.9	1.5953	1110	1130
4-Ethyltoluene	120.2	0.8614	1050	1090
1,3,5-Trimethylbenzene	120.2	0.8652	1030	1060
1,2,4-Trimethylbenzene	120.2	0.8758	1030	1070
Benzyl Chloride	126.59	1.1004	1040	1060
1,3-Dichlorobenzene	147	1.2884	1030	1050
1,4-Dichlorobenzene*	147	1.2475	1050	1080
1,2-Dichlorobenzene	147	1.3059	1030	1070
1,2,4-Trichlorobenzene	181.5	1.459	1080	1130
Hexachlorobutadiene	260.8	1.556	1050	1100

* Indicates a solid at room temperature.

Note 1: The concentrations detailed in this table may change with each standard purchased. Refer to the appropriate cylinder certificate, where necessary for the corresponding concentrations.

Note 2: The density for a mixture of cis- & trans-1,3-Dichloropropene is 1.2205g/mL.

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Table 5A
Purchased Stock Standard Concentrations ($\mu g/m^3$)[1] Cylinder#2 (Primary and Secondary)

Compound Name	Molecular Weight	Density (g/mL)	Primary Source (S15-07060501)	Secondary Source (S15-07060502)
Acetonitrile	41.02	0.7857	970	950
Acrolein	56.06	0.840	940	940
Acrylonitrile	53.06	0.8060	990	980
tert-Butanol	74.12	0.7887	990	980
Allyl Chloride	76.53	0.9376	1020	1020
Diisopropyl Ether	102.18	0.7241	1010	1000
Ethyl tert-Butyl Ether	102.176	0.7519	1020	1030
Isopropyl Acetate	102.13	0.8718	980	950
1-Butanol	74.1224	0.8098	970	950
tert-Amyl Methyl Ether	102.176	0.7703	1020	1030
Isooctane	114.23	0.6877	1050	1050
Methyl Methacrylate	100.12	0.944	1010	1050
n-Butyl Acetate	116.16	0.8825	1030	1030
n-Octane	114.23	0.6986	1050	1060
n-Nonane	128.26	0.7176	1040	1050
Cumene	120.2	0.8618	1080	1090
alpha-Pinene	136.24	0.8582	1030	1050
n-Propylbenzene	120.1938	0.8670	1050	1060
3-Ethyltoluene	120.2	0.8645	1010	1020
alpha-Methylstyrene	118.19	0.9106	1010	1020
2-Ethyltoluene	120.2	0.8807	1000	1000
n-Decane	142.28	0.7300	1050	1050
sec-Butylbenzene	134.2206	0.8601	1050	1060
p-Isopropyltoluene	134.2206	0.8573	1100	1100
1,2,3-Trimethylbenzene	120.1938	0.8944	1060	1050
d-Limonene	136.24	0.8402	1020	1040
1,2-Dibromo-3-Chloropropane	236.33	2.093	1020	1030
n-Undecane	156.31	0.7402	1060	1060
Naphthalene*	128.17	1.0253	1030	1030
n-Dodecane	170.34	0.7487	1060	1070
Tert Butyl Benzene	134.2206	0.867	1040	1030
n-Butyl Benzene	134.2206	0.860	1040	1060

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ATTACHMENT A

Training Plan for Analysis of VOCs by GC/MS

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Training Plan for Analysis of VOCs by GC/MS

SOP Title:_____ Revision:_____ Date:_____

Trainee: _____ Trainer: _____ Instrument: _____

1. Read SOP *Training Duration:* _____ Trainer: ____ Trainee: ____ Date: _____
2. Read Methods TO-14A and TO-15 *Training Duration:* _____ Trainer: ____ Trainee: ____ Date: _____
3. Demonstrated understanding of the scientific basis of the analysis Trainer: ____ Trainee: ____ Date: _____
   - Whole air sample preconcentration techniques *Training Duration:* _____
   - Gas chromatography *Training Duration:* _____
   - Mass spectrometry *Training Duration:* _____
4. Demonstrated familiarity with related SOPs *Training Duration:* _____ Trainer: ____ Trainee: ____ Date: _____
   - SOP for Analytical Batches and Analytical Sequences; Rev. ____
   - SOP for Making Entries into Logbooks and onto Benchsheets; Rev. ____
   - SOP for Manual Integration of Chromatographic Peaks; Rev. ____
   - SOP for Significant Figures; Rev. ____
   - SOP for Nonconformity and Corrective Action Documentation; Rev. ____
   - SOP for Determination of Method Detection Limits; Rev. ____
   - SOP for Cleaning and Certification of Summa Canisters; Rev. ____
5. Observe performance of SOP *Training Duration:* _____ Trainer: ____ Trainee: ____ Date: _____
   - ___sample preparation/dilution and sample loading and analysis
   - ___analytical sequence setup
   - ___standard preparation
   - ___BFB tuning evaluation/initial calibration/initial calibration verification
   - ___continuing calibration verification
   - ___EnviroQuant introduction
   - ___data reduction and reporting
   - ___canister and bag handling
6. Perform SOP with supervision *Training Duration:* _____ Trainer: ____ Trainee: ____ Date: _____
   - ___sample preparation/dilution and sample loading
   - ___analytical sequence setup
   - ___standard preparation
   - ___BFB tuning evaluation/initial calibration/initial calibration verification
   - ___continuing calibration verification
   - ___sample analysis
   - ___EnviroQuant use
   - ___data reduction and reporting
   - ___canister and bag handling
7. Independent performance of the SOP *Training Duration:* _____ Trainer: ____ Trainee: ____ Date: _____
   - ___sample loading and sample dilutions
   - ___analytical sequence setup
   - ___standard preparation
   - ___BFB tuning evaluation/initial calibration/initial calibration verification
   - ___continuing calibration verification
   - ___sample analysis
   - ___EnviroQuant proficiency
   - ___data reduction and reporting
   - ___canister and bag handling
   - ___initial demonstration of competency (-4 Laboratory Control Samples)
8. Instrument operation and maintenance Trainer: ____ Trainee: ____ Date: _____
   - ___autosampler *Training Duration:* _____
   - ___gas chromatograph and capillary column installation *Training Duration:* _____
   - ___mass spectrometer *Training Duration:* _____
   - ___data system *Training Duration:* _____

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ATTACHMENT B

Initial Calibration Review Checklist

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EPA Compendium Method TO-15
ICAL Date: _____
Instrument: MS2 MS3 MS7 MS8 MS9
Mode: SIM SCAN

Initial Calibration Review Checklist

Analyst **Reviewer**

☐ 1. Is the required documentation in the ICAL file? ..... ☐
- ☐ BFB Tune analysis Report ..... ☐
- ☐ Calibration Status Report (aka Calibration History) ..... ☐
- ☐ Response Factor Report/Percent RSD ..... ☐
- ☐ Quantitation Report for each calibration standard (including manual integration documentation) ..... ☐
- ☐ ICV Quantitation Report ..... ☐

☐ 2. Was the ICAL performed continuously (i.e., not interrupted for maintenance or for sample analysis)? ... ☐

☐ 3. Have all the calibration standards been analyzed within 24 hours of each other? ..... ☐

☐ 4. Does the BFB tune check standard analysis at the start meet the tune criteria? ..... ☐

☐ 5. Are all the analytes in the blank analysis <MRL? ..... ☐

☐ 6. Does each analyte's ICAL include a minimum of 5 concentrations at 5 consecutive levels? ..... ☐

☐ 7. Were the standards analyzed from low concentration to high concentration? ..... ☐

☐ 8. For each analyte, are there no levels skipped? ..... ☐

☐ 9. For each analyte, is there only one value used for each calibration level? ..... ☐

☐ 10. For each analyte, is the lowest standard's concentration at or below the analyte's MRL? ..... ☐

☐ 11. If a point is dropped, are all the responses for each target analyte dropped and is the information noted in the ICAL explaining the reason? ..... ☐

☐ 12. Is the average RSD <30% for all analytes, with no more than two exceptions <40%? ..... ☐

☐ 13. Is the response Y at each calibration level within 40% of the mean area response over the initial calibration range for each internal standard? ..... ☐

☐ 14. For the ICV analysis, is the percent recovery for each analyte 70-130%? ..... ☐

☐ 15. Was the RRT for each target compound at each calibration level within 0.06RRT units of the mean RRT for the compound? ..... ☐

☐ 16. Is the retention time shift for each of the internal standards at each calibration level within 20s of the mean retention time over the initial calibration range for each standard? ..... ☐

☐ 17. If there are any manual integrations, are they performed correctly according to the corresponding SOP. ☐

☐ 18. Is the ICAL range good from 0.5ng (or 0.1ng) to 100ng for all compounds? ..... ☐YES ☐NO
If not, note exceptions and the corresponding MRLs below-*specify applicable range*:

COMMENTS:

Initial Reviewer: _____ Secondary Reviewer: _____
Date: _____ Date: _____

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ATTACHMENT C

Data Review Checklist

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EPA Compendium Method TO-15 Data Review Checklist

(Note exceptions in Comments Section and attach Nonconformity and Corrective Action Reports as appropriate)

Analysis Date: _____ Analyst: _____ CAS Project #: _____

Instrument: MS2 MS3 MS7 MS8 MS9 Analysis Mode: SIM SCAN

☐ 1. Is the required documentation present? ..... ☐
- ☐ BFB Tune analysis Report
- ☐ CCV analysis Quantitation Report & %D report
- ☐ Duplicate analysis Quantitation Report
- ☐ Quantitation Report for each sample including
- ☐ manual integration documentation
- ☐ LCS analysis Quantitation Report
- ☐ MB analysis Quantitation Report
- ☐ spectral match details for each hit, where necessary

☐ 2. Does the BFB **tune** check standard analysis meet the tune criteria? ..... ☐

☐ 3. Are all analyses within the tune's **24-hr. window**? ..... ☐

☐ 4. Does the **CCV** have a difference ≤30% for all analytes? ..... ☐
[Note <u>all</u> outliers biased high and/or low]

☐ 5. Are all the **IS** retention times within 20 seconds of the CCV RT or the RT from the midpoint (ICAL)? ... ☐

☐ 6. Are all the **IS** responses within ±40% of CCV or the midpoint in the ICAL? ..... ☐

☐ 7. Are all the **surrogate** recoveries (in CCVs, MBs, LCSs, etc.) within acceptance limits (70%-140%)? ..... ☐

☐ 8. Are all the analytes in the **MB** <MRL? ..... ☐

☐ 9. Are all the analytes in the **LCS** within the percent recovery acceptance limits? ..... ☐

☐ 10. Are all the analytes in the **Lab Duplicate** within ±25% or the client specified limits? ..... ☐

☐ 11. Are all the analyte hits in the samples within the **calibration range** and/or noted? ..... ☐

☐ 12. Are all peak **integrations** acceptable? ..... ☐

☐ 13. Are all manual **integrations** flagged and documented? ..... ☐

☐ 14. Are all **calculations** correct? ..... ☐

☐ 15. Has the analyst initialed and dated each **quantitation report**? ..... ☐

☐ 16. For **TICs** are the relative intensity and other requirements met? ..... ☐

☐ 17. **Auto report**? ..... ☐

☐ 18. **MRL = _____ug/m3 or pg (Circle one) (ethanol and acetone = 5.0ug/m3).**

☐ 19. **Adjusted MRL = _____ug/m3 or pg (Circle one) for the following compounds.**

☐ 20. **Default Volume (MS9) Analyzed = _____.**

<u>COMMENTS:</u>

Initial Reviewer: _____ Secondary Reviewer: _____
Date: _____ Date: _____

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ATTACHMENT D

Laboratory Generated Control Limits
Percent Recovery (Laboratory Control Sample)

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Table 6

Laboratory Control Limits - Percent Recovery (SCAN)

Compound Name	LCL %Recovery	UCL % Recovery
Propene	66	134
Dichlorodifluoromethane	**70**	**127**
Chloromethane	**70**	**127**
Freon 114	**18**	**165**
Vinyl Chloride	**71**	**131**
1,3-Butadiene	**60**	**125**
Bromomethane	**73**	**128**
Chloroethane	**72**	**128**
Ethanol	**34**	**134**
Acetonitrile	**62**	**125**
Acrolein	**69**	**120**
Acetone	**65**	**115**
Trichlorofluoromethane	**70**	**143**
Isopropyl Alcohol	**60**	**124**
Acrylonitrile	**73**	**129**
1,1-Dichloroethene	**73**	**131**
tert-Butanol	52	154
Methylene Chloride	**67**	**123**
Allyl Chloride	**63**	**137**
Trichlorotrifluoroethane	**72**	**133**
Carbon Disulfide	**69**	**127**
trans-1,2-Dichloroethene	**73**	**131**
1,1-Dichloroethane	**69**	**134**
Methyl tert-Butyl Ether	**55**	**142**
Vinyl Acetate	**58**	**165**
2-Butanone	**69**	**137**
cis-1,2-Dichloroethene	**74**	**130**
Diisopropyl Ether	74	126
Ethyl Acetate	69	144
n-Hexane	**74**	**129**
Chloroform	**71**	**133**
Tetrahydrofuran	72	130
Ethyl tert-Butyl Ether	68	127
1,2-Dichloroethane	**71**	**132**
1,1,1-Trichloroethane	**74**	**133**
Isopropyl Acetate	77	132
1-Butanol	47	118

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Table 6

Laboratory Control Limits (Continued) - Percent Recovery (SCAN)

Compound Name	LCL-%Recovery	UCL-% Recovery
Benzene	**68**	**126**
Carbon Tetrachloride	**73**	**136**
Cyclohexane	75	128
tert-Amyl Methyl Ether	72	125
1,2-Dichloropropane	**74**	**128**
Bromodichloromethane	**73**	**136**
Trichloroethene	**73**	**132**
1,4-Dioxane	**67**	**143**
Isooctane	77	125
Methyl Methacrylate	74	139
n-Heptane	74	133
cis-1,3-Dichloropropene	**76**	**132**
4-Methyl-2-Pentanone	**75**	**137**
trans-1,3-Dichloropropene	**76**	**134**
1,1,2-Trichloroethane	**74**	**129**
Toluene	**79**	**128**
2-Hexanone	**69**	**143**
Dibromochloromethane	**80**	**134**
1,2-Dibromoethane	**80**	**130**
Butyl Acetate	**67**	**150**
n-Octane	81	125
Tetrachloroethene	**78**	**130**
Chlorobenzene	**78**	**131**
Ethylbenzene	**79**	**130**
m- & p-Xylene	**80**	**131**
Bromoform	**76**	**136**
Styrene	**73**	**135**
o-Xylene	**80**	**131**
n-Nonane	**83**	**122**
1,1,2,2-Tetrachloroethane	**81**	**131**
Cumene	**80**	**126**

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Table 6

Laboratory Control Limits (Continued) -Percent Recovery (SCAN)

Compound Name	LCL-%Recovery	UCL-% Recovery
alpha-Pinene	**67**	**132**
n-Propylbenzene	**81**	**125**
3-Ethyltoluene	**80**	**130**
4-Ethyltoluene	**77**	**128**
1,3,5-Trimethylbenzene	78	130
alpha-Methylstyrene	31	166
2-Ethyltoluene	**79**	**128**
1,2,4-Trimethylbenzene	**79**	**131**
n-Decane	83	125
Benzyl Chloride	77	148
1,3-Dichlorobenzene	**79**	**136**
1,4-Dichlorobenzene	78	133
sec-Butylbenzene	**80**	**128**
p-Isopropyltoluene	**80**	**133**
1,2,3-Trimethylbenzene	**75**	**133**
1,2-Dichlorobenzene	78	135
d-Limonene	41	146
1,3-Dibromo-3-Chloropropane	61	155
n-Undecane	**71**	**141**
1,2,4-Trichlorobenzene	**76**	**125**
Naphthalene	**41**	**162**
n-Dodecane	**31**	**188**
Hexachlorobutadiene	**68**	**136**

Note: The standard 67 compound list consists of those compounds listed in bold typeface. The limits may change without a revision of this document; refer to the method manual for verification.

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Table 6A

Laboratory Control Limits -Percent Recovery (SIM)

Compound Name	LCL %Recovery	UCL % Recovery
Dichlorodifluoromethane	76	117
Chloromethane	64	110
Vinyl Chloride	67	127
Chloroethane	67	119
Acetone	36	209
1,1-Dichloroethene	75	119
Methylene Chloride	70	130
Trichlorotrifluoroethane	70	112
trans-1,2-Dichloroethene	74	120
1,1-Dichloroethane	72	122
Methyl tert-Butyl Ether	80	110
cis-1,2-Dichloroethene	74	121
Chloroform	71	129
1,2-Dichloroethane	73	121
1,1,1-Trichloroethane	76	119
Benzene	59	120
Carbon Tetrachloride	73	123
1,2-Dichloropropane	74	119
Trichloroethene	72	122
cis-1,3-Dichloropropene	75	127
1,1,2-Trichloroethane	71	122
Toluene	71	132
1,2-Dibromoethane	71	129
Tetrachloroethene	72	130
Chlorobenzene	67	129
Ethylbenzene	68	125
m-&-p-Xylene	59	123
o-Xylene	60	124
1,1,2,2-Tetrachloroethane	57	134
1,4-Dichlorobenzene	48	139
Naphthalene	8	133
Hexachloro-1,3-butadiene	38	155

APPENDIX J

Example of Data Management Spreadsheet

Appendix J
Example of Data Management Table
Delphi VOC Plume Site
Phase I Indoor Air Sampling and Mitigation

EPA ID	Property Address	Property Owner	Comments	Owner's Phone Number	Rental	Tenant Contact	Tenant Phone Number	Baseline Acess Agreement Signed (date)	Baseline Sub-Slab Sample Result (ppbV)					Baseline Indoor Air Sample Result (ppbV)					Recommended Course of Action	Phase I Access Agreement Signed	SSD Evaluation Conducted
									Sample Date	Sample ID	CHLOROFORM	TCE	PCE	Sample Date	Sample ID	CHLOROFORM	TCE	PCE			
EPA-01									5/3/2007	EPA-01-SS	ND (1.6)	ND (1.6)	2.1	NA	NA	NA	NA	NA	NFA	NA	NA
EPA-02									5/5/2007	EPA-02-SS	NA	NA	NA	6/6/2007	EPA-02-IA	ND (0.20)	0.75	2.7	Mitigation	Pending	
EPA_03									6/19/2007	EPA-03-SS	7.1	182	110	7/19/2007	EPA-03-IA	ND (0.20)	ND (0.20)	1.3	Quarterly Monitoring	10/3/2007	NA

KEY

NA	Not applicable
ND	Not detected
PCE	Tetrachloroethene
TCE	Trichloroethene
NFA	No Further Action
	Sample result is pending
182	Sample result exceeds ODH recommended health-based screening level[1]
	Sample collected by U.S. EPA
	Sample collected by Delphi
	Mitigation Monitoring
	Quarterly Sampling

All results and screening/action levels are displayed in parts per billion by volume (ppbv)

(0.23) Number in parenthesis indicates laboratory's analytical method reporting limit (MRL)

Indoor Air and Sub-slab Soil Vapor ODH-recommended Screening Levels for VOCs in Residential Structures[1] (parts per billion by volume)

Chemical Name	ATSDR[2] Indoor Air Short-Term Action Level	Indoor Air Long-Term Screening Level[3]	Sub-slab Soil Vapor Screening Level[3]
TCE	100	0.4	4
PCE	200	12	120
Chloroform	50	2.2	22

1. Established in correspondence from Ohio Department of Health (June 4, 2007)

2. ATSDR = Agency for Toxic Substances Disease Registry

3. From U.S. EPA Draft Vapor Intrusion Guidance (2002)