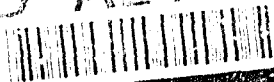
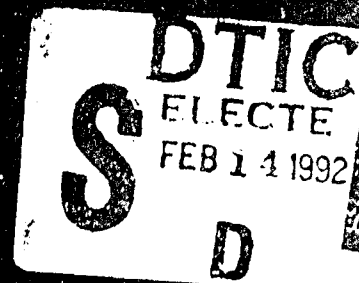


AD-A246 266



FINAL

***Data Summary Report
Area D Soil Gas
Sampling and Analysis***



McClellan Air Force Base

***Volume I
Data Summary***

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DEPARTMENT OF THE AIR FORCE

HEADQUARTERS SACRAMENTO AIR LOGISTICS CENTER (AFLC)
McCLELLAN AIR FORCE BASE, CALIFORNIA 95652



EMR

Data Summary Report, Operable Unit D Soil Gas Sampling and Analysis, Volumes I and II: Final Report

See Distribution

1. The above mentioned documents, along with formal response to Environmental Protection Agency (EPA) comments, are attached for your records.
2. This document is identified as a secondary document to the primary McClellan AFB Basewide Record of Decision (ROD) according to the guidelines promulgated in our Interagency Agreement (IAG). This document has been prepared for the United States Air Force for the purpose of aiding in the implementation of a final remedial action plan. The ongoing nature of the Remedial Investigation/Feasibility Study (RI/FS), along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this document since subsequent facts may become known which make this document premature or inaccurate. Acceptance of this document in performance of the contract under which it was prepared does not mean that the United States Air Force or the Department of Defense adopts the conclusions, recommendations, or other views expressed herein which are those of the contractor only and do not necessarily reflect the official position of either department. The attached CH2M Hill document has been reviewed as a matter involved in litigation and has been approved for release to the general public.
3. If you have any questions please contact me at (916) 643-0533.

FRANCIS E. SLAVICH
Project Officer

1 Atch
Final Report

92-03440



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COMBAT STRENGTH THROUGH LOGISTICS

RESPONSE TO COMMENTS

SUBJECT: Area D Soil Gas Data Summary Report
McClellan AFB
Delivery Order 5003

PROJECT: SAC28722.03

REVIEWER: Ramon Mendoza, U.S. EPA

DATE: January 14, 1992

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The Area D Soil Gas Data Summary Report is a document created with a very narrow focus: a collection and summary of data generated through sampling and analysis of subsurface gases from this capped hazardous waste site. The report provides resolution of the issues identified as study objectives. The report was not compiled to provide resolution of other questions involving use of the data beyond the scope of the immediate study. The study objectives were the following:

1. Provide recommended sampling (and analytical) protocols for future sampling anticipated for Area D subsurface gases
2. Provide results of analyses of the Area D subsurface gases for 17 target analytes which are a subset of the TO-14 list
3. Compare the effectiveness of three different sampling techniques (solid sorbents, Tedlar bags, and stainless steel canisters) for sampling the soil gas at Area D

The data presented in the two-volume summary were evaluated for usefulness in satisfying the project objectives. Data which did not satisfy standard quality control (QC) acceptance criteria were judged to be as useful for this study as data which met QC acceptance criteria in that both types of data can be used to provide a relative measure of the reliability of the methods evaluated. The data in this two-volume summary need no additional qualification for use for the specific study objectives. We recommend that more rigorous data qualification be pursued if more sensitive uses of these data (i.e., public health risk assessment) are contemplated.

Comment: The media/analysis study quality control (QC) results (for example Tables 6-1 to 6-12) and the field analysis QC results (Tables 6-13 and 6-14) need to be separated. We recommend that QC results for the well monitoring study should be moved into Section 7.

Labeling in the report is often not clear. The reader must differentiate when a "canister" is a "pressurized canister" and when is it an "ambient canister." At times the

report treats the two canister samples as the same. For example, in Section 5.6.2.2, Offsite Laboratory Field Duplicates, the "ambient pressure canister" duplicates consisted of one ambient and three pressure-filled canisters. The report also treats the results for the different types of sorbent cartridges as the same. For example, summary Tables 6-7 to 6-9 only list "sorbent tube" and do not specify how the data were combined or the rationale for combining data from different types of sorbents. At other times the discussion is kept separate. The samples done in the field lab versus those done in the offsite lab were also not always clearly differentiated. The report needs to be more clearly organized so that this source of confusion is minimized. The rationale for combining results should be clearly explained, since it seems to obscure the purpose of the original study.

Response: The results presented in Tables 6-1 through 6-14 are, by design, a condensed set of data produced by the completed soil gas study. Recoveries by media and representative concentrations for each site sampled constitute the summary of results. These results are presented in Section 6 (Results) of the report rather than in Section 7 (Comparison and Recommendations) where media comparisons and recommendations are presented.

The three general media types studied were solid sorbents, Tedlar bags, and stainless steel canisters. Variations on solid sorbents included carbon molecular sieve material and standard activated carbon (charcoal). Variations on stainless steel canisters included canisters filled to pressures above ambient (pressurized canister) and those filled using only the vacuum provided by the canister (ambient canister). Where the identity of the variation is considered important (Section 5.6.2.2, for example), it is noted in the report. Where the variation was not important in the context of the project objectives, the results are reported in terms of the general media type (i.e., "sorbent tube," or "canister"). Condensed data summaries in the report were prepared with the goal of reducing a large number of variables to a manageable number. When study objectives allowed, variations in media type or location of analyses were combined.

Comment: Section 5.3.2 discusses offsite lab QC samples, but often does not make it clear what media are relevant. For example, a "laboratory blank" or a "laboratory duplicate" is an appropriate analysis regardless of media. Either the report needs to label each type of QC sample clearly and specifically through all sections, or the different sections should be subdivided into more sections so that the subject of the discussion is clear.

Response: The offsite laboratory analyzed samples in all three general media types: solid sorbent, Tedlar bag, and stainless steel canisters (see Volume II, Section IV). Section 5 of Volume I is limited to a general overview of QC results. For example, where all QC samples generally met QC criteria, sample-by-sample specifics were not given. A laboratory duplicate is not possible for a solid sorbent sample which is to be thermally desorbed.

Comment: In general, the quality control program for the different media/analyses appeared to be inconsistent, making comparisons more difficult. The frequency with

which blanks, duplicates, and spikes were analyzed and reported appeared to vary from one set of media to the next and from one volume of the report to the other. For example, Volume I states that there were eight ambient pressure canister field blanks (Volume II says seven), one for pressurized canisters (Volume II says two), three for carbon molecular sieve (Volume II says one), six for charcoal sorbent traps, and nineteen for tedlar bags (Volume II says sixteen). This suggests that neither the comparison study nor the report was prepared in a uniform and consistent manner. Determining the relationships and relative strengths of the different approaches is thus made more difficult. We recommend that these inconsistencies be addressed.

Response: The inconsistencies have been addressed. Section I of Volume II has been removed, eliminating this source of inconsistency. QC sample frequency was based on a percentage of the total number of samples collected using a given technique. A varying number of soil gas samples per media, then, produces a varying number of QC samples.

Comment: The report suffered from general lack of quality control which made the results confusing. Aside from spelling and typographical errors, Tables 6-1 to 6-14 were inconsistently or incompletely labeled as to types of canisters, type of sorbent, location of analysis, etc. The same comment applies to Tables 7-6 through 7-18. Tables 6-2, 6-3, 6-5, 6-6, 6-8, 6-9, 6-11, and 6-12 should have presented mean values, mean percent recoveries, standard deviations, and relative standard deviations. For example, Tables 6-6 and 6-12 both labeled what should have been "mean percent recovery" as "% RSD." The units should be labeled, so values that are percent recoveries can be distinguished from those in ppbv. The quality control should be improved.

Response: The corrected Tables 6-1 through 6-14 and Tables 7-1, 7-2, and 7-5 through 7-18 are included in Volume I. We apologize for any confusion the incorrectly labeled tables produced. The content of the tables is presented in the context of a general comparison of sampling techniques. If other data manipulations are desired, the reader may prepare them from the data presented in these summaries, but this is beyond the scope of this study. Concentrations at each sampling location (Tables 6-13 and 6-14) were summarized from close support laboratory "ambient" canisters. Historical data was collected using activated carbon in sorbent tubes.

Comment: The report would have been easier to assess if Volume I had been organized along media lines so that the procedures, quality control, tables, discussion of results, and conclusions for each separate type of analysis were handled in its entirety in one section. This would also make it possible to reference the summary tables in the discussion so that the text could then be supported by the data in the tables. The lack of data qualifiers made it more difficult to determine which data were suspect and which were within acceptance limits. The laboratory should flag any data with data qualifiers.

Response: We agree that the Data Summary, Volume I could be rewritten (and might be easier to assess) with sections applicable to separate media types. However, this activity is beyond the scope of this study. Qualification of data, which would necessitate

a sample-by-sample, analyte-specific validation (Level IV data validation), was also beyond the scope of this effort. If a data use that requires such a validation (i.e., risk assessment or legal substantiation of reported concentrations) is contemplated, we recommend that it be pursued as a separate and additional project. The data generated during this study are all considered useful to satisfy the study objectives because data that does not meet data quality objectives can be used as a measure of the reliability of a sampling and analytical technique.

Comment: (Section 5.2.1.3, Continuing Calibration) We are concerned that toluene exceeded QC acceptance criteria for a majority of days that samples were analyzed and that six of seventeen compounds failed to meet acceptance criteria for four different analysis days without indication that corrective action was taken. Normally this would invalidate the data for those compounds on the days which were outside limits. Corrective action, possibly including a new calibration curve, should have taken place. At a minimum, data affected should be flagged.

Response: The data that did not meet QC criteria are noted in the text of the Data Summary Report. In each case, the data were determined to be usable for the study given the project objectives. However, we agree that these data should be subjected to more rigorous validation if other, more sensitive use of these data is contemplated.

Comment: (Section 5.5.1, Field Blanks Analyzed by the CSL) The discussion in this section suggests that contamination was a minor problem in several situations, but does not suggest that any corrective action was taken to remedy it. Since twelve of eighteen samples contained blank contamination, it appeared that the problem may have been due to carryover. Flushing the system or collecting additional equipment blanks between samples would appear to have been advisable. Blanks are designed to demonstrate that the instrument is clean and is not contributing to sample "hits." We believe that corrective should have been taken to stop the carry-over of contaminants to subsequent samples. However, we agree that the limited carry-over did not preclude the use of the data for project specific uses.

Response: We agree that the carry-over that occurred during the study could require qualification of some of the study data if other, more sensitive use of these data is contemplated.

Comment: (Section 6.2, Method Detection Limits) The method detection limits estimated from the studies appear to be low given the variability of the results for samples spiked at higher levels. Summary tables should be provided in Volume II that give the results of the method detection limit studies.

Response: Method detection limit studies were not a specific requirement of this media comparison study. The limits reported are substantiated by low-level spikes and results of low-level audit samples. The analytical subcontractor (Environmental Analytical Services, Inc.) will provide documentation of these limits on request.

Comment: (Table 7-1, page 7-23, Sampling Precision-Field Duplicates) This summary table does not make sense. The compounds under the "Sample" column do not belong in the table and should be deleted.

Response: Table 7-1 has been corrected.

Comment: (Table 7-2, Qualitative Comparison of Media) This summary table contains several criteria which are not completely discussed in the text. For example, "ease of use" is not defined as to field procedures, laboratory procedures, media handling or preparation, and other areas. Holding times and cost are two factors significantly affecting the comparison of the sorbent traps versus the canisters. If the two traps were analyzed in tandem instead of separately, the cost factor would drop dramatically. In EPA Method 5040, (Volatile Organic Sampling Train), samples are analyzed in this manner. The table is admittedly subjective, and a number of the factors were known prior to the study taking place. If only quality factors were considered (i.e., ease of use and cost not factored in), and if compounds are considered by classes (i.e., volatile organic compounds) rather than on a compound by compound basis, the sorbent tubes and the canisters generate comparable data. Our point is that different analysis approaches support different conclusions. The term "ease of use" should be better defined.

Response: One of the surprising results of this study was that solid sorbents performed so well in comparison to canisters on the basis of laboratory analysis. These results suggest that solid sorbents may be as reliable as stainless steel canisters for TO-14 compounds in a gas matrix under certain circumstances. Analysis of two sorbent tubes in tandem negates the purpose of the tandem arrangement in this study (i.e., determination of the degree to which break-through occurs). We agree that analyzing a pair of tubes simultaneously will reduce costs compared to separate analyses, but break-through, which was a study concern, could not be evaluated if this procedure was adopted. "Ease of Use" was a subjective evaluation of the effort required to collect the sample and was thus a measure of field procedure reliability and effort. This is noted in the footnotes for Table 7-2. The field measurement of sample volume requires additional effort and introduces additional uncertainty for samples collected on solid sorbents.

**FINAL
SOIL VAPOR DATA SUMMARY REPORT
VOLUME I: DATA SUMMARY**

**LINE ITEM 0004 OF
DELIVERY ORDER 5003
UNDER CONTRACT/ORDER NO. F0469990D00355003**

**Prepared for
McClellan Air Force Base**

Prepared by

CHM HILL

3840 Rosin Court, Suite 110
Sacramento, California 95834

January 1992

NOTICE

This report has been prepared for the Air Force by CH2M HILL for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP). As the report relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report because subsequent facts may become known that may make this report premature or inaccurate. Acceptance of this report in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the Air Force.

This report is the result of sampling and analyses conducted in March and April at McClellan Air Force Base. The data on which this report are based were produced with a scientific study of sampling media as the major goal. The data presented in this report have been determined to be useful for project-specific objectives. Further data review and qualification should be performed prior to more sensitive use of these data.

EXECUTIVE SUMMARY

CH2M HILL has completed a soil gas sampling and analysis project for McClellan Air Force Base. During late March and early April, samples of soil gas were extracted from vent risers in the cap at Area D and from monitoring wells around the perimeter of the cap. Samples were analyzed at laboratories onsite and offsite using cryofocusing and GC/MS analytical techniques.

The purpose of the project was to generate data for use in a scientific study of the following:

- The effectiveness of three sampling media (solid sorbents, Tedlar bags, and stainless steel canisters) for sampling the soil gas matrix subsurface at Area D
- The concentrations of 17 target analytes in subsurface gases at Area D
- The effect of varying extraction rates and durations on target analyte concentrations in soil gas monitoring wells, and the length of time necessary for concentrations to recover once they are drawn down
- Recommended sampling and analytical procedures for future activities at Area D

The project objectives were accomplished through the following sequence of steps:

- Sampling and Analysis and Quality Assurance Project and Health and Safety Plans were prepared, reviewed, and revised.
- Laboratory services were subcontracted.
- Field equipment and laboratory space was established at the site.
- Samples were collected and analyzed.

The results of the analyses enabled CH2M HILL to conclude that, although there are specific situations where solid sorbents and Tedlar bags can be used successfully, evacuated stainless steel canisters are recommended for sampling gases of variable moisture content containing the levels and types of contaminants found in the subsurface matrix at Area D. Given the complex nature of the soil gas, these whole air sample canisters will need to be analyzed twice, cryofocusing separately on those compounds found at high- and low-level concentrations. An alternative and possibly superior approach would be to sample the soil gas using a 15-liter canister in the vacuum mode through a jumbo charcoal tube. This mixed-media sample-collection approach would allow for

superior collection efficiency for low-level organic compounds of interest (i.e., benzene, vinyl chloride) and offer an economical and efficient sample collection and analysis procedure. It would also provide a protocol capable of meeting all of the required sampling and analytical objectives including sensitive analyte detection and quantitation.

Project results also provided some insight into the effect of extracting gas on the concentrations in the monitoring wells and vent risers. It was determined that concentrations do not stabilize before a considerable volume (up to 40 well volumes) has been withdrawn from monitoring wells. It was also determined that well concentrations were not generally reduced during extraction of gas. Two extraction rates (10 standard cubic feet per hour [scfh] and about 40 scfh) were used to determine that concentrations stabilized at elevated levels.

The sampling experience and the results of the analyses were used to prepare recommended operating procedures for both laboratories and all types of sampling media evaluated. These are presented as standard operating procedures (SOPs) in Volume II of this report. Concentrations in the subsurface gases at Area D are summarized as the range of reported concentrations for monitoring wells and as the range of reported concentrations for the two types of media used at vent risers (Tedlar bags and stainless steel canisters).

Measures of precision and accuracy, costs of sampling and analysis, and field experience were used to compare media for their effectiveness for sampling the matrix of gases encountered in Area D. A recommended sample collection media is suggested.

This report is organized into two volumes, the first containing the data summary and interpretation, the second containing data as delivered from the lab and some of the more lengthy condensations of the data. Quality control reports for both laboratories used on this project and the SOPs for laboratories are also included in Volume II.

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VOLUME II: DATA

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- III CSL Data
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1.0 INTRODUCTION

CH2M HILL performed this work under a contract with McClellan Air Force Base for various environmental consulting services (contract number F04699-90-D-0035). The task order for which this report was prepared required sampling and analysis of soil gas extracted from vent risers through a low permeability cover over hazardous waste sites in Area D and from soil gas migration wells around the perimeter of the cover.

1.1 OBJECTIVES

The objectives of sampling and analyses were to (1) provide data for comparison of the various sampling media used, (2) determine the concentrations of target analytes in subsurface gases, (3) evaluate the change in subsurface gas concentrations over time during vapor extraction, (4) evaluate recovery of gas concentrations during non-extraction periods, (5) evaluate sampling and analytical methods for future use in determining the nature and extent of contamination at the site, and (6) recommend routine sampling and analytical protocols for soil gas monitoring at McClellan. This report is organized into a data interpretation volume (Volume I), and a second volume (Volume II) containing data both condensed and as received, and quality control reports.

To achieve the objectives, the project team performed the following tasks:

1. A sampling and analysis plan (SAP) and a quality assurance project plan (QAPP) were prepared and reviewed by the agencies involved and McClellan Air Force Base personnel.
2. An analytical subcontractor was selected to provide both onsite and offsite laboratory capability.
3. Samples were extracted from all 9 soil gas monitoring wells and from 10 of the 32 gas vent risers, using 5 different sampling media variations: Summa passivated canisters filled to atmospheric pressure, Summa passivated canisters filled to elevated pressures, Tedlar bags, and solid sorbent tubes including activated charcoal and carbon molecular sieve sorbents.
4. Samples were analyzed using gas chromatography and mass spectrometer detection (GC/MS) at both the onsite and the offsite laboratories.

Data collected during project execution were used to compare the different media, to establish the concentrations of the target soil gas constituents at the various sampling locations, and to generate sampling and analytical protocols recommended for future nature and extent studies at Area D. These data were also used to determine if soil

gas concentrations were declining during sampling (draw down) and, if so, if the concentrations would increase during periods when no extraction was occurring (recovery).

1.2 CHRONOLOGY

This project was initiated with preparation of SAPs and QAPPs. Toward the end of November 1990, these plans were essentially complete with the chosen sampling and analytical approaches described. Minor adjustments continued up to the time field work started in March (including addition of carbon molecular sieve as one of the solid sorbents and incorporation of thermally desorbable sorbent tubes). In December and January, selection of the analytical subcontractor was accomplished. A preliminary survey of laboratory costs and capabilities was followed by competitive bidding and final selection of the qualified laboratory. The laboratory selected was responsible for establishing cryofocusing GC/MS capabilities onsite and for the varied media techniques (Tedlar bags, thermally desorbed solid sorbents, and canisters), in addition to cryofocusing GC/MS capabilities offsite.

Sampling was conducted first at the soil gas monitoring wells on the perimeter of the site. The multi-media sampling manifold was set up on monitoring well 1, with a sampling pump that extracted approximately 10 standard cubic feet per hour (scfh) and a continuous hydrocarbon analyzer to evaluate total hydrocarbon concentrations over the period(s) of sampling. Three sets of the multi-media samples were collected, providing replicates for statistical confidence. On monitoring well 1, the multi-media sampling and low-flow draw-down and recovery evaluation were conducted simultaneously. It was determined that concentrations in this well were not significantly reduced during sampling and that a higher sampling flow rate would be necessary to draw the well concentrations down. Sampling of the remaining monitoring wells proceeded with low flow draw-down sampling separated from the multimedia sampling; the 10-scfh pump and hydrocarbon analyzer were used for a period of time, with a limited number of canister samples taken. Then the multi-media train was set up and the media comparison samples taken. Finally, a high flow pump (approximately 40 scfh) was used for monitoring wells 1, 7, and 9, and an additional set of canister samples taken to determine if the concentrations could be drawn down. Draw down of well concentrations of total hydrocarbons measured by the FID was not observed at any well at either flow rate.

Once sampling was completed at the monitoring wells, vent risers were sampled with a simplified multi-media sampling train. Solid sorbent samples were not collected from vent risers due to the high moisture content expected in the vent riser gases. The sampling manifold consisted of tubing and tees for Tedlar bags and canister samples. One additional tee or port was included for duplicates of either the Tedlar bags or the canisters. Initially, each sample line included a condensate knock-out to collect liquids for analysis. It quickly became apparent that quantities of condensate collected were not sufficient to analyze, so water traps in each line were replaced with one for the

entire train. Sampling continued with this arrangement. The train included a continuous hydrocarbon analyzer to evaluate concentration changes during vent riser sampling.

Sampling was initiated on March 20, 1991, on monitoring well 1. The last vent riser was sampled on April 12, 1991. Sample analysis proceeded concurrently with sampling and was completed approximately 1 week after the last sample was taken. The sequence of samples collected at all the sampling locations is presented in Volume II, Section V, Sample Tracking Spreadsheet.

2.0 SITE DESCRIPTION

Area D consists of approximately 140 acres located in the northwest portion of McClellan Air Force Base (Figure 2-1). The area was first used for waste disposal in the 1940s and was most recently used in 1981. Several activities conducted in Area D led to its current contamination. Discrete sites within Area D were evaluated as part of the ongoing effort to clean up the entire facility. These included the following:

- A refuse/solid waste burn and burial pit
- Underwatered industrial wastewater sludge disposal and burn pits
- A skimmed oil burn area
- A sodium valve disposal pit
- An industrial wastewater sludge landfarm
- Fuel, solvent, and sludge disposal pits

Materials disposed of within Area D include industrial sludge, waste solvents, fuel, and oil. Approximately 38,000 cubic yards of waste sludge are known to be present in Area D. Varying levels of volatile organics, organic acids, base/neutral compounds, trace metals, and cyanides are present both in the sludge and in the surrounding soil. Some of these contaminants have also been detected in the groundwater beneath Area D.

2.1 SITE HISTORY

In 1985, as part of the McClellan Air Force Base Installation Restoration Program, a multi-layer cap with low permeability was installed over the surface of Area D. Its purpose was to prevent rainwater infiltration and soil gas migration. A typical cap cross section is shown in Figure 2-2. Thirty-two vent risers were installed in the cap to allow for venting or collection and disposal of soil gas that might accumulate under the cap. Figure 2-3 shows the general location of the cap with respect to one of the buildings on the base, and the locations of the vent gas risers in the cap. Between October 6 and October 16, 1986, three clusters of three soil gas wells were installed around the perimeter of the cap to detect lateral vapor migration from the site. Figure 2-4 shows the general monitoring well and cap orientation. The nine soil gas wells were installed at the request of the California Department of Health Services (DHS) to allow monitoring and speciation at multiple depths in the vadose zone. Each of the clusters of wells consists of three individual wells with a 3-foot interval of well screen. Each cluster includes a shallow well (10 to 20 feet), a medium well (35 to 50 feet) and a deep well (65 to 80 feet). The actual location of the screened section in these ranges of depths was selected to be in a zone of permeable sand. Figure 2-5 is a schematic of the well design.

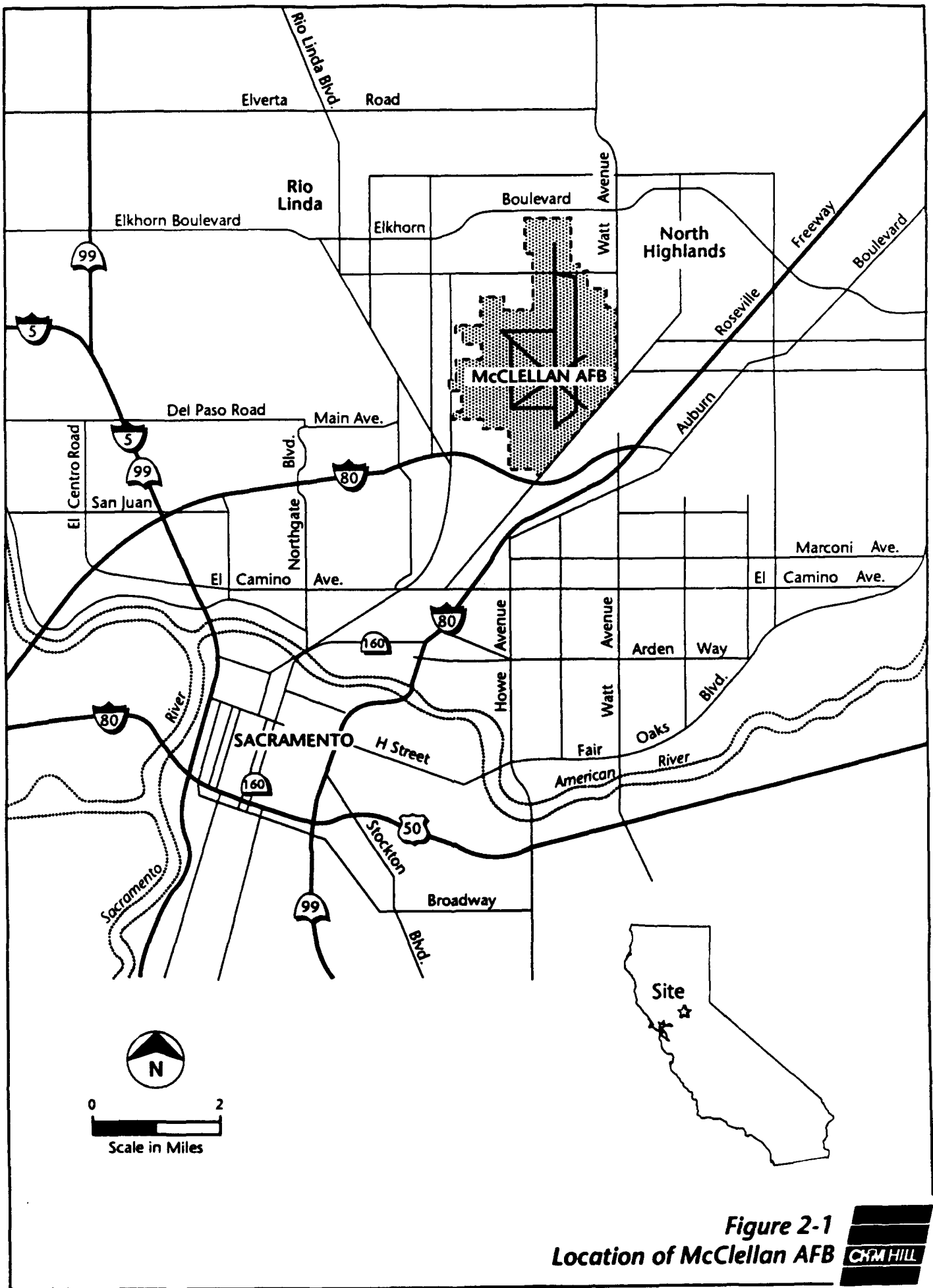


Figure 2-1
Location of McClellan AFB



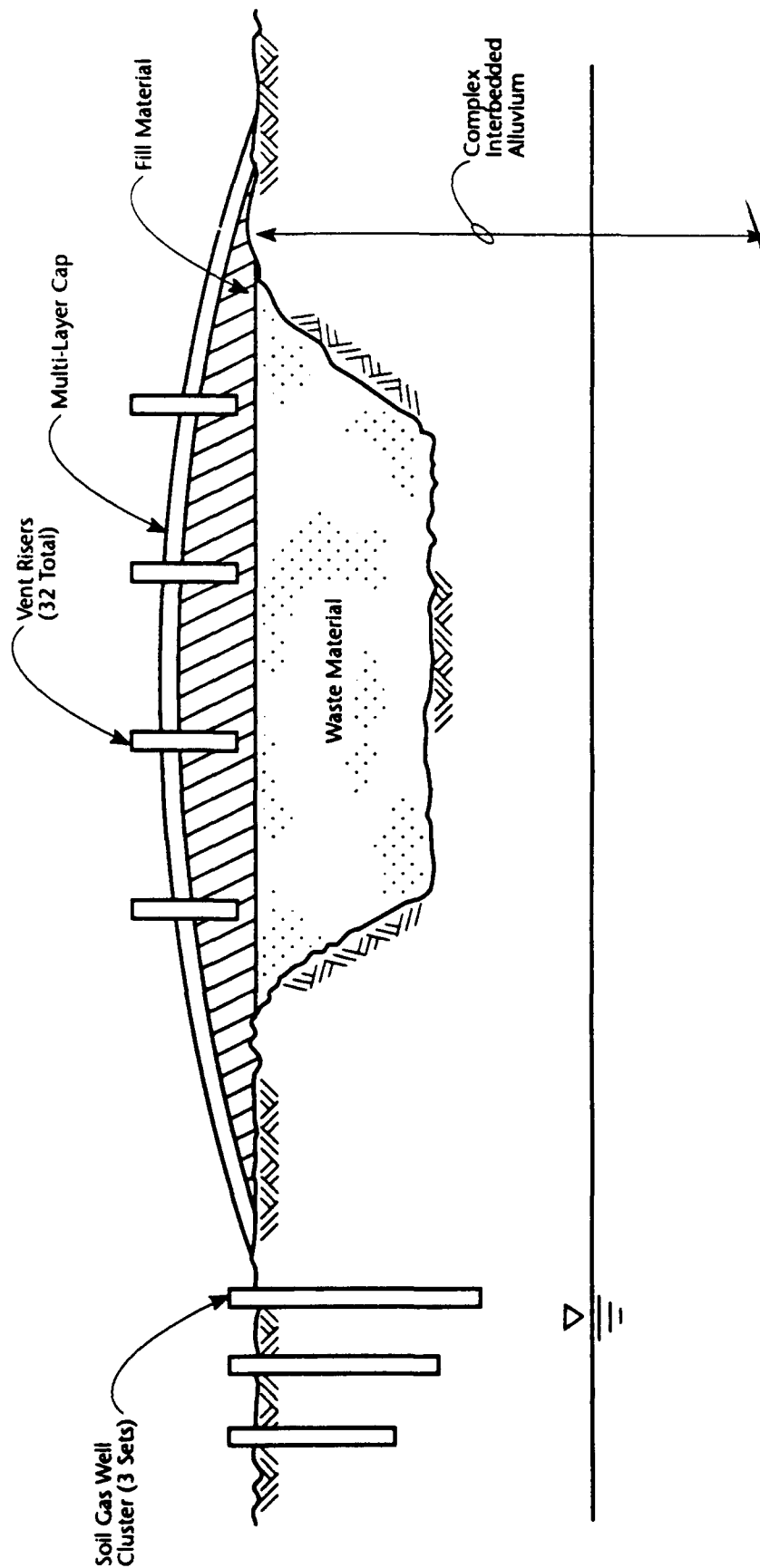


Figure 2-2
Simplified Cross-Section
of Area D Cap



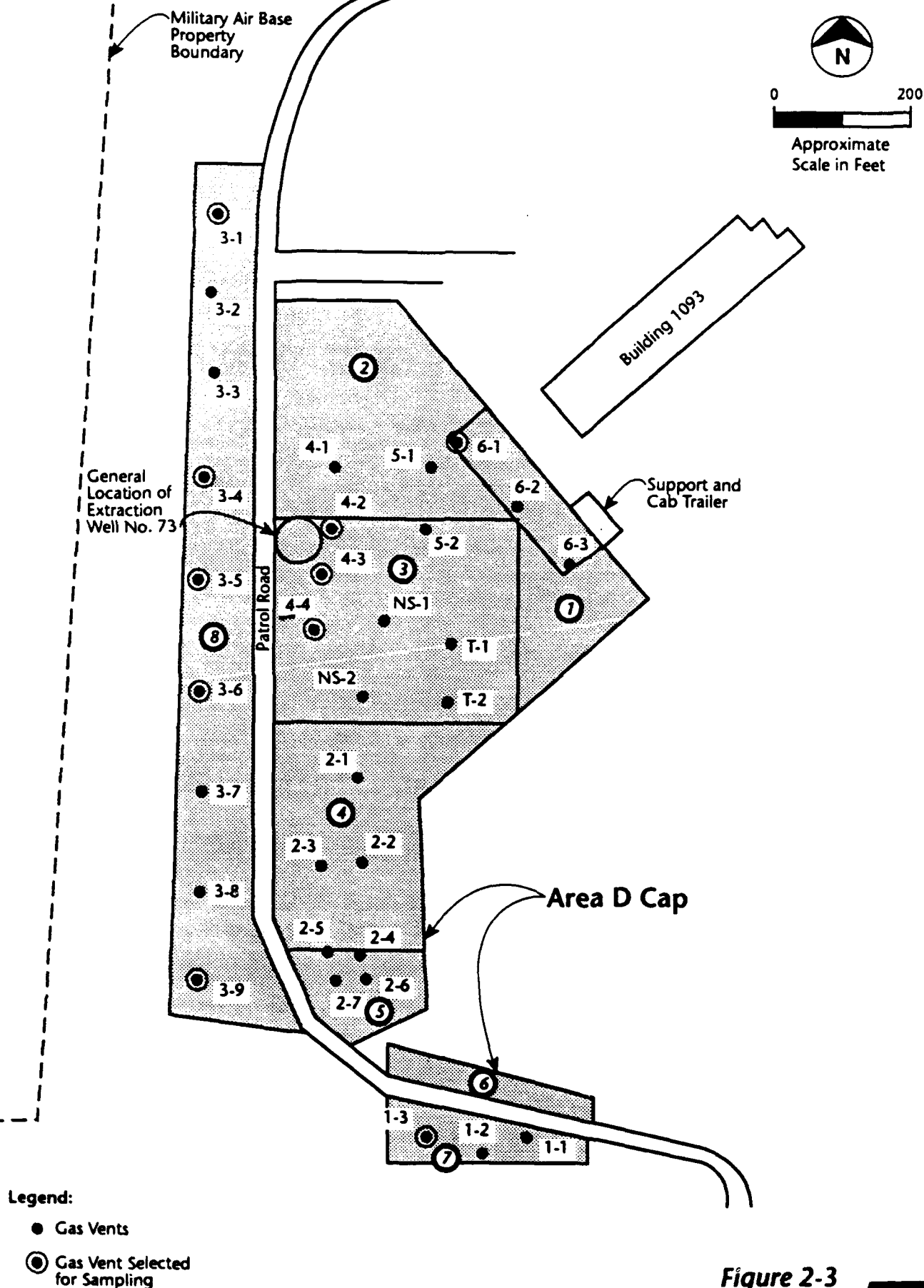


Figure 2-3
General Location of Vent Risers
Showing Risers Selected for Sampling





0 200

Approximate
Scale in Feet

Military Air Base
Property
Boundary

- MW-3
- MW-2
- MW-1

Building 1093

Support and
Cab Trailer

Patrol Road

- MW-9
- MW-8
- MW-7

Area D Cap

Legend:

- Monitoring Well

- MW-6 ○
- MW-5 ○
- MW-4 ○

Figure 2-4
Locations of Soil Gas Wells, McClellan AFB Area D

CHM FILE

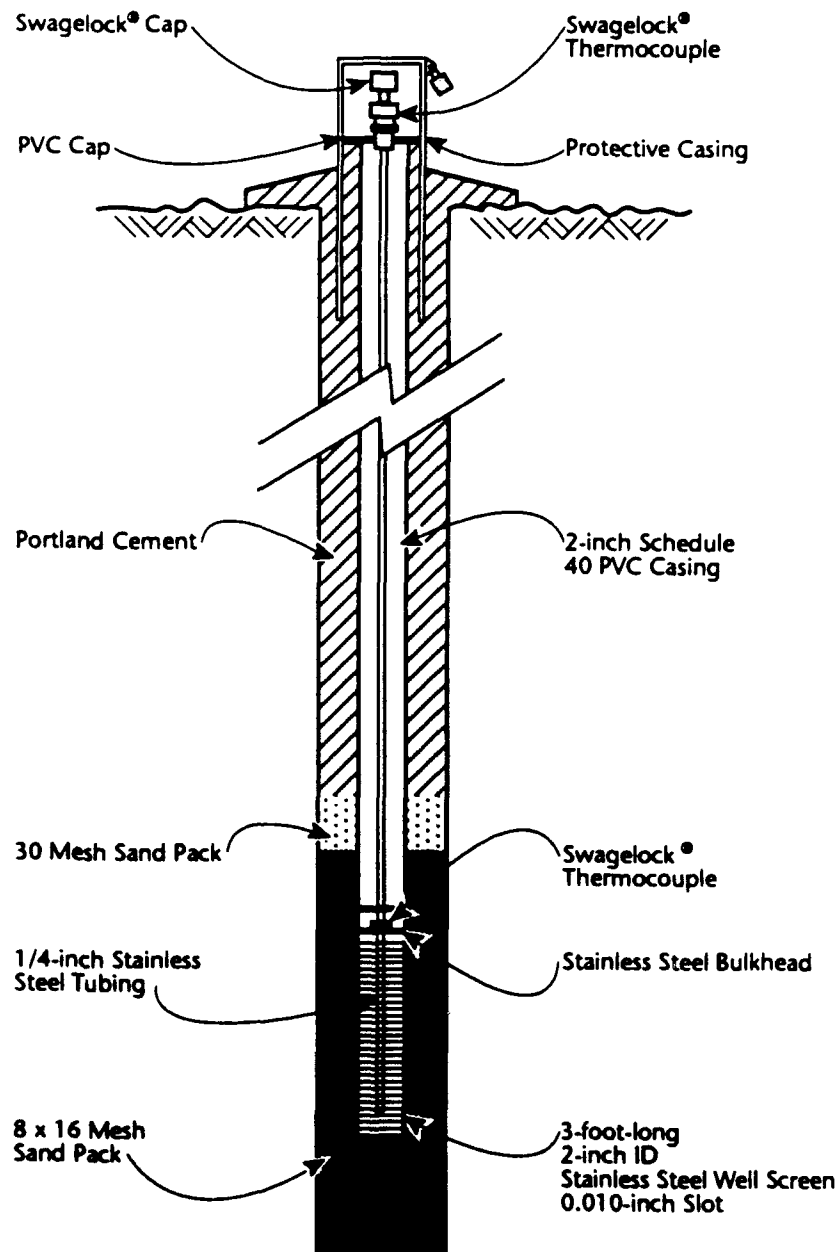


Figure 2-5
Schematic Diagram of
Soil-Vapor Gas Completion,
McClellan AFB



2.2 PROJECT SAMPLING

Project objectives for monitoring wells were satisfied using an elaborate sampling train. Samples were collected simultaneously in Tedlar bags, solid sorbent tubes, and Summa-passivated canisters. Monitoring well 1 was the first sampled on this project. Initially, low-flow draw-down and recovery sampling were expected to overlap with the multimedia sampling. McClellan project officers requested that these be separated, so after monitoring well 1, sampling was conducted in the following sequence:

1. Low-flow drawdown and recovery sampling
2. Multimedia sampling
3. High-flow drawdown and recovery sampling

Once this sampling sequence was complete, a limited number of samples were collected to respond to additional questions developed by McClellan project officers during the sampling effort. This select sampling led to a few breakthrough solid sorbent samples (tubes in series to evaluate breakthrough) and a few additional solid sorbent and canister samples at requested flow rates. Tubes in series were used at monitoring wells 2, 6, 7, and 9. Low flow rates were evaluated at monitoring wells 2 and 7.

Sampling at vent risers was conducted with a simplified version of the multimedia sampling manifold. Samples were collected in Tedlar bags and Summa-passivated canisters only. Some samples of condensate removed from vent riser gases were collected. Solid sorbent samples were not collected from vent risers because of concern for the high moisture content anticipated in vent riser gases. Because of this concern, a condensate trap was installed for each line off the main manifold. The limited quantities of condensate collected led to replacing the traps off the main manifold with one central trap in the main manifold. The single trap still did not collect enough condensate to be analyzed effectively.

At each location (vent risers and monitoring wells), three replicates of multimedia samples were collected. Blanks of each media type were performed, and duplicates were collected periodically. The procedures produced approximately 400 samples from the 19 locations.

2.3 PROJECT ANALYSIS

Project analytical objectives were satisfied using a close support laboratory established onsite and at an offsite laboratory. The onsite laboratory analyzed only samples collected in Summa-passivated canisters. The offsite laboratory analyzed all types of samples including the canisters, Tedlar bags, and both types of solid sorbents (charcoal and carbon molecular sieve). Analytical equipment at both labs was equivalent and consisted of gas chromatographs and mass spectrometers. The close support laboratory

was established to verify that the onsite capability could be provided and to determine whether high quality data (low detection limits) could be generated from such a facility.

The project specifications included a list of 17 target analytes and required that concentrations be determined to 1 part per billion or lower. The onsite analyzer was a Hewlett-Packard mass spectrometer capable of the specified sensitivity. Concentrations of a select group of the target analytes found in monitoring well samples, including Freon 113, were consistently high enough to overpressure the detector and cause automatic shut-down of the integrator. To achieve the analysis with the specified sensitivity, these samples were run by turning off the detector and integrator while high concentration materials were eluting. Selected samples were then re-run with a lower volume injection, increasing the method detection limit but quantifying the compounds that had been passed over in the first analysis. The offsite analyzer was not as sensitive to overpressuring and did not require multiple analyzer runs for a given sample.

The analyses used cryofocusing and full-scan GC/MS. Samples collected in Tedlar bags were analyzed according to CARB method 422 using cryotrapping. The GC/MS was operated in full-scan mode. Samples collected on solid sorbents were analyzed in accordance with EPA Method TO-02 with cryotrapping/GC-MS also operated in the full-scan mode. The Summa-passivated canisters were analyzed in accordance with EPA Method TO-14 with cryotrapping and full-scan GC/MS.

3.0 FIELD PROCEDURES

3.1 SAMPLING TECHNIQUES AND EQUIPMENT

3.1.1 WELL DEPLETION AND RECHARGE

Monitoring wells were sampled to determine, in part, if concentrations of target analytes would be reduced during periods of vapor extraction and, if so, to determine the length of time necessary for the concentrations to recover.

The first sampling accomplished at each monitoring well was a low flow depletion and recharge analysis. The equipment used for this type of sampling is shown in Figures 3-1 and 3-2. The extraction pump used was an oil-lubricated design capable of delivering 10 scfh while pumping against the slight vacuum that developed in the sampling manifold (≤ 1 -inch mercury vacuum). The oil-lubricated pump contaminated the system on its outlet side. This required installation of the pump in the system downstream of all sampling and analytical equipment.

Sample lines and fittings to be used between the wellhead and the sample containers had to be ultra clean to avoid contaminating samples. The ultra clean portion of the sampling train was limited because the price of components is high. Components in the manifold between the well head and containers were as follows:

Well Head Connection:	316 stainless steel (SS), 1/4-inch tubing compression connection
Glasswool Filter Holder:	Teflon
Sample Tee:	316 SS, 1/4-inch tubing compression connection
Sample Line Valve:	316 SS needle valve with 1/4-inch tubing compression connection
Canister connection:	316 SS, 1/4-inch tubing compression connector
Sample Manifold Lines:	Teflon tubing, 1/4-inch outside diameter, new

Components from the sample tee throughout the remainder of the system were specified to be clean but not necessarily ultra clean. Those components were as follows:

Sample Line:	1/4-inch-outside-diameter tubing, polyethylene or equivalent
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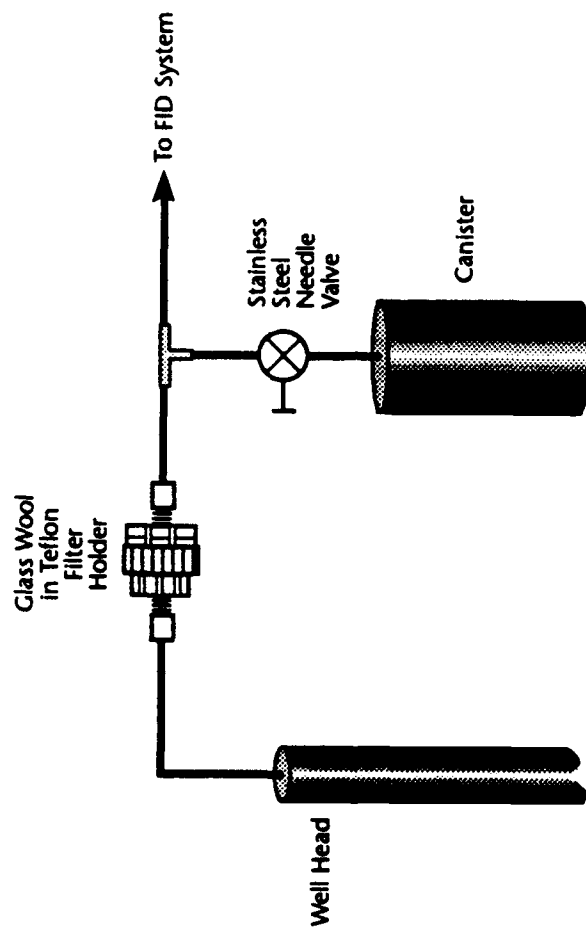


Figure 3-1
Low Flow
Sample Manifold



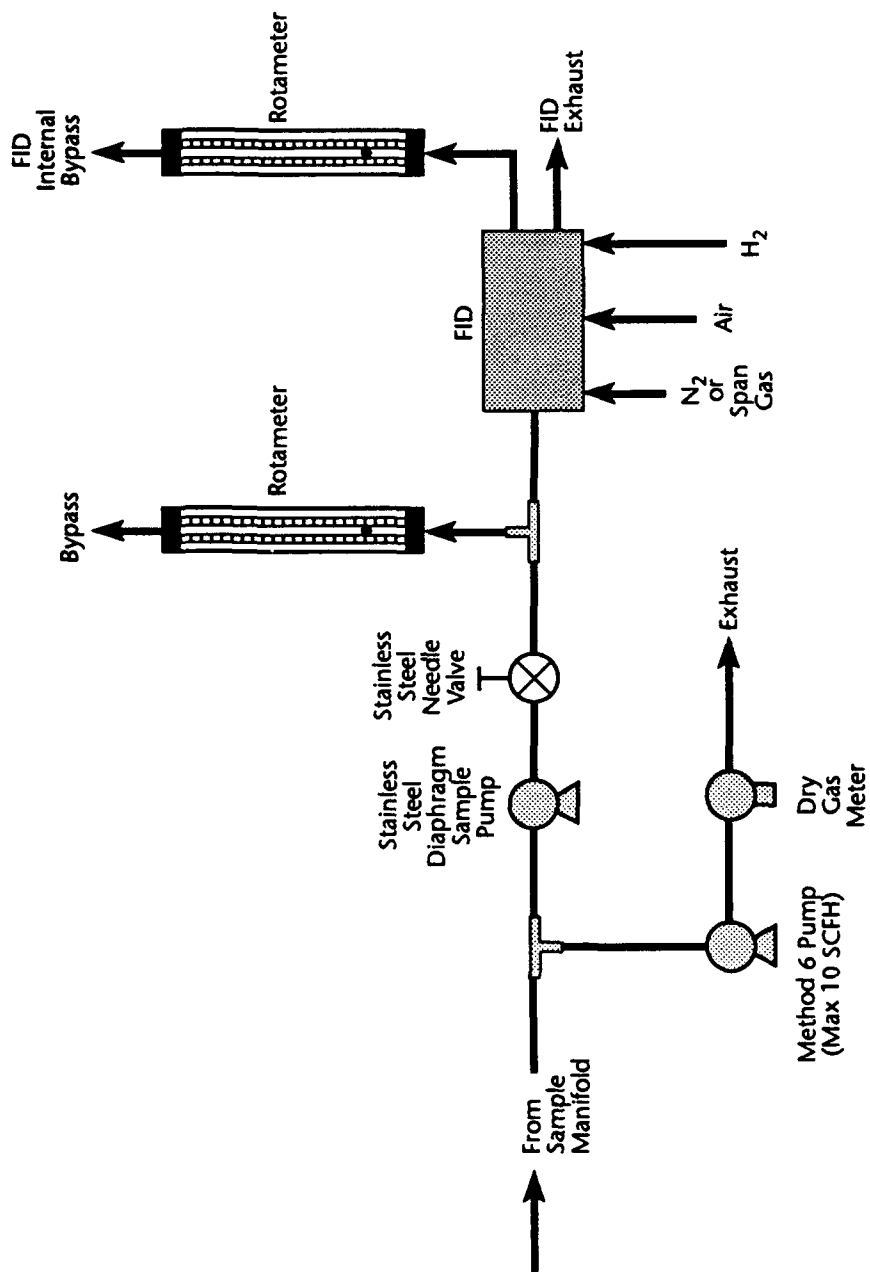


Figure 3-2
FID System Low Flow
Drawdown/Recovery



FID Inlet Pump: Stainless diaphragm, 4 liters/minute (l/m) free air

Connectors, Tees: 316 SS, clean

Flow measurement was conducted to determine gross volume extracted. The use of this information (for evaluating approximate volumes withdrawn prior to well concentration stabilization) did not require great accuracy. Rotameters were installed in the exhaust lines on either side of the hydrocarbon analyzer and the oil-lubricated pump exhaust was measured with an integral dry gas meter.

Sampling for low-flow depletion and recharge was conducted in the following sequence of steps:

1. Initiate analyzer and allow to warm up. Open the tee leading to the sample manifold and leave open to ambient air.
2. Connect and tighten sample manifold and then connect to the well head.
3. Span and zero the analyzer.
4. Connect the sample manifold to the FID pump tee.
5. Start pumps and record initial flow rates using rotameters and dry gas meters.
6. Collect first canister sample (grab).
7. Periodically check and record flow rates for rotameters and total flow through oil-lubricated pump from the dry gas meter.
8. Purge the sample line and collect the intermediate sample.
9. Purge the sample line and collect the final canister sample.
10. Turn off sample pumps and record the period of low-flow extraction from the monitoring wells.

The initial sampling period of approximately 8 hours was reduced to around 2 hours at wells sampled later in the project when it became apparent that low flow rates would not draw the well concentrations down.

The samples collected were grab samples drawn into evacuated Summa canisters by the pressure difference between the canister and the gases in the manifold. All of the low-flow samples were analyzed by the close support laboratory.

One problem was encountered with this equipment arrangement. The FID internal pump, which required 3 l/m, did not have sufficient suction to draw against even the slight vacuum created in the sample line. We solved the problem by inserting a small stainless diaphragm pump ahead of the analyzer to withdraw samples between the well and the main gas extraction pump. A tee or port was installed between the diaphragm pump and the FID and the excess flow not required by the FID was vented. Total flows out of a monitoring well then were the sum of the flows out of the various exhaust points.

Additional depletion and recharge sampling was conducted using higher extraction rates at monitoring wells 1, 7, and 9. A pressure/vacuum pump constructed with stainless heads and Teflon valves was used to achieve up to 40-cubic-feet-per-hour (cfh) withdrawal rates. Figures 3-3 and 3-4 are schematics of the high flow system. The components of this system were as follows:

Well Head Connection:	316 SS, 1/4-inch tubing compression connector
Vacuum Gauge Tee:	316 SS, 1/4-inch tubing compression fittings
Vacuum Gauge:	2-inch face, 30-inch mercury vacuum to zero (Hg-0) scale
Extraction Pump:	Pressure/vacuum, oil-free, stainless heads, Teflon valves, capacity $\approx$ 2 cubic feet per minute (cfm) at 15-inch mercury vacuum
Condensate Trap:	Ehrlenmeyer flask, Teflon Two-hole stopper, silicone
Sample Tee:	316 SS, 1/4-inch tubing compression fittings
Sample Valves:	316 SS, 1/4-inch tubing compression connections
Sample Manifold:	1/4-inch outside diameter Teflon tubing, new

Components from the outlet side of the sample tee through the rest of the system were not required to be ultra clean. The components were as follows:

Sample Line:	1/4-inch-outside-diameter tubing, polyethylene or equivalent
Connectors, Tees, Valves:	Clean, suitable (316 SS or Teflon)

Differences in the location of the main extraction pump and increased condensation in sampling lines required that the high-flow flow measurement be conducted slightly differently than the low flow. Total flow was measured periodically with a rotameter

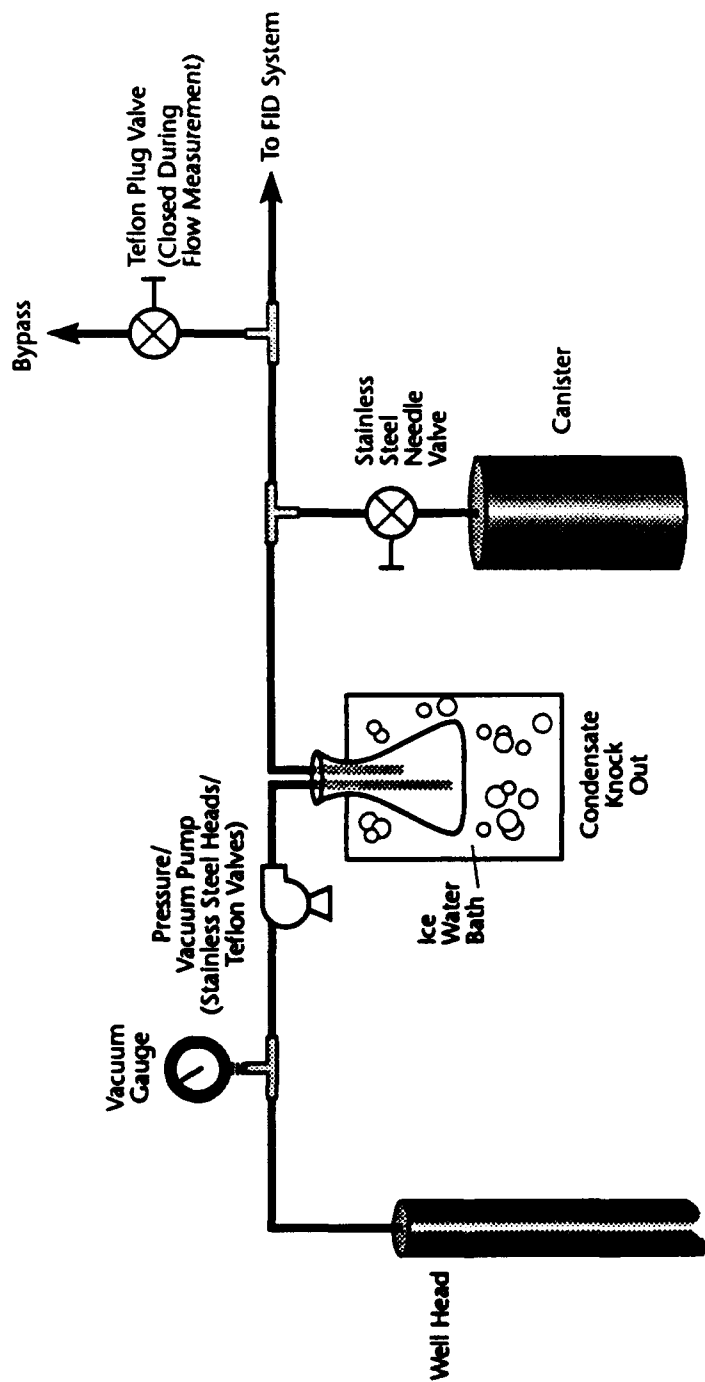
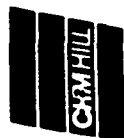


Figure 3-3
High Flow
Sample Manifold



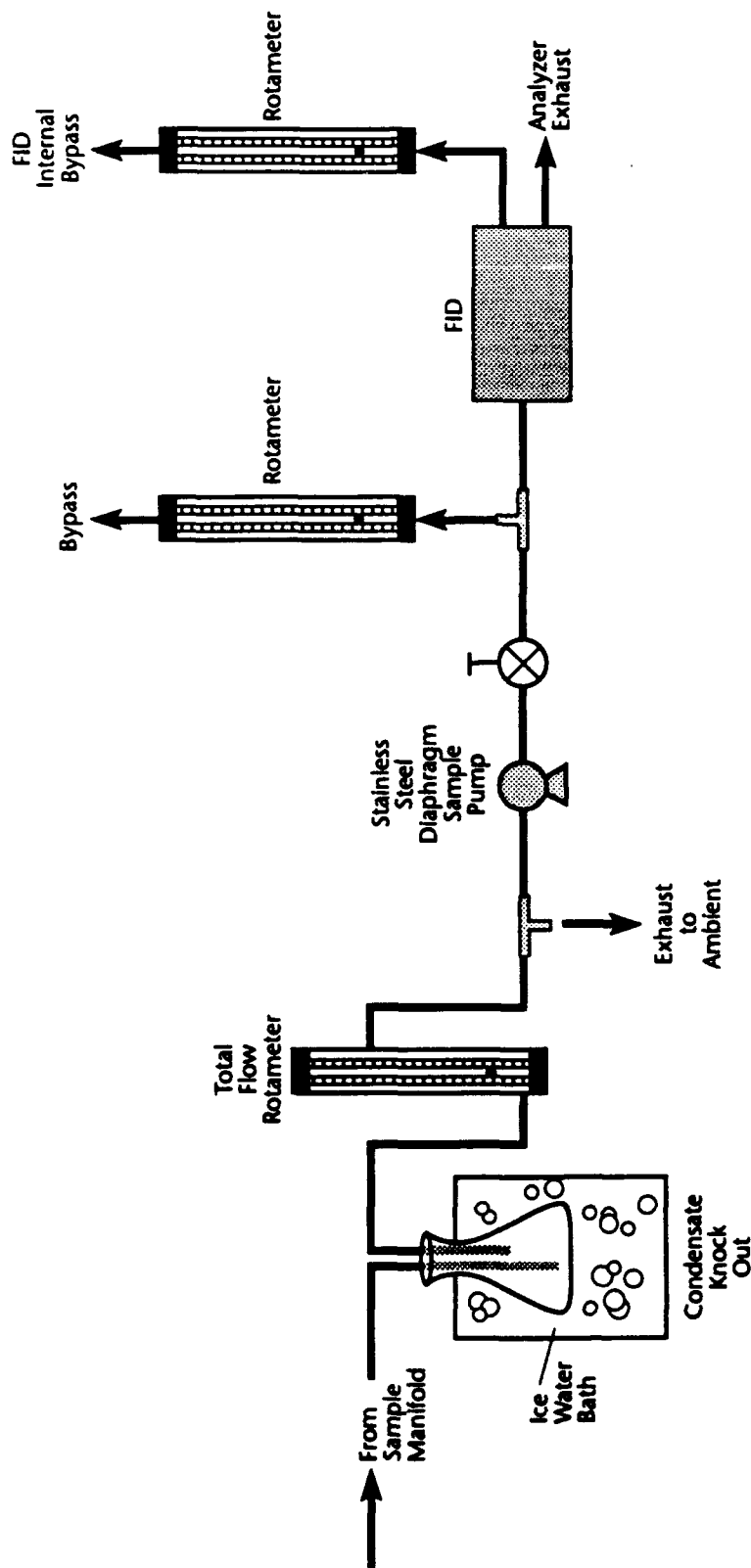


Figure 3-4
FID System
High Flow



in the sample line near the inlet to the auxiliary pump supplying the FID. Most of the flow was bypassed (vented to ambient) except during flow measurement. The increased flows generated larger quantities of condensate in the sample line, requiring that a water trap be installed in-line ahead of the rotameter. The bypass line was considerably shorter than the sample line leading to the rotameter and FID, so the flow rates measured with the bypass closed are somewhat lower than average flow rates out of the well.

High-flow sampling was conducted at the selected wells for varying lengths of time: 12 hours at well 1, 4 hours at monitoring wells 7 and 9. Canister samples were collected at the beginning and end of the extraction period. The sampling system and extraction pump were shut down and restarted 12 to 16 hours later. This was done to determine if well concentrations had returned to initial values during the idle period (recharge). After restarting, a canister sample was taken at beginning and end of a much shorter period (1 to 2 hours).

Vacuum Gauge:	2-inch face, 30-inch mercury vacuum to zero scale
Extraction Pump:	Pressure/vacuum, oil-free, stainless heads, Teflon valves, capacity $\approx$ 2 cfm at 15-inch mercury vacuum
Condensate Trap:	Ehrlenmeyer flask, Teflon Two-hole stopper, silicone
Sample Tee:	316 SS, 1/4-inch tubing compression fittings
Sample Valve:	316 SS, needle valve, 1/4-inch tubing compression connections
Canister Connector:	316 SS, 1/4-inch tubing compression connections
Sample Manifold:	1/4-inch-outside-diameter Teflon tubing, new

Components from the outlet side of the sample tee through the rest of the system were not required to be ultra clean. The components were as follows:

Sample Line:	1/4-inch-outside-diameter tubing, polyethylene or equivalent
Connectors, Tees, Valves:	Clean, suitable (316 SS or Teflon)

3.1.2 SOIL GAS WELL MULTI-MEDIA

Project objectives included comparison of three different sample collection media: canisters, Tedlar bags, and solid sorbents. Canister sampling involved variations in sample collection including grab and integrated sample collections and subatmospheric and

pressure filling techniques. Solid sorbents used were activated carbon and carbon molecular sieve. To accomplish the media comparison, a sampling train was devised to collect up to six samples simultaneously. A schematic of the train is shown in Figures 3-5 and 3-6.

The ultra clean portion of the sampling train extended from the well head connection to the outlet side (FID side) of the last sampling tee in the series. The specifications for the clean components are as follows:

Well Head Connection:	316 SS, 1/4-inch tubing compression connection
Glass Wool Filter Holder:	Teflon
Sample Tees:	316 SS, 1/4-inch tubing compression connection
Tedlar Bag Container Connections:	316 SS, quick connect with ball check on inset
Solid Sorbent Line Valve:	316 SS, 1/4-inch tubing compression connections
Duplicate Lines:	Teflon
Sample Container Connection:	1/4-inch tubing compression connector
Canister Line Valve:	316 SS, 1/4-inch tubing compression connections
Vacuum Gauge:	30-inch Hg-0 range, 2-inch face, 1/4-inch tubing connectors
Sample Container Connection:	1/4-inch tubing compression connection
Sample Line:	1/4-inch-outside-diameter Teflon tubing, new

Train components that did not contact sampled gas were not required to be ultra clean. These components included the following:

Tedlar Bag Container:	5-gallon plastic bucket with gas-tight seal, 316 SS quick connect fittings, ball check on inset
Tedlar Bag Container Evacuation Pump & Solid Sorbent Pump:	Personal sampling pump

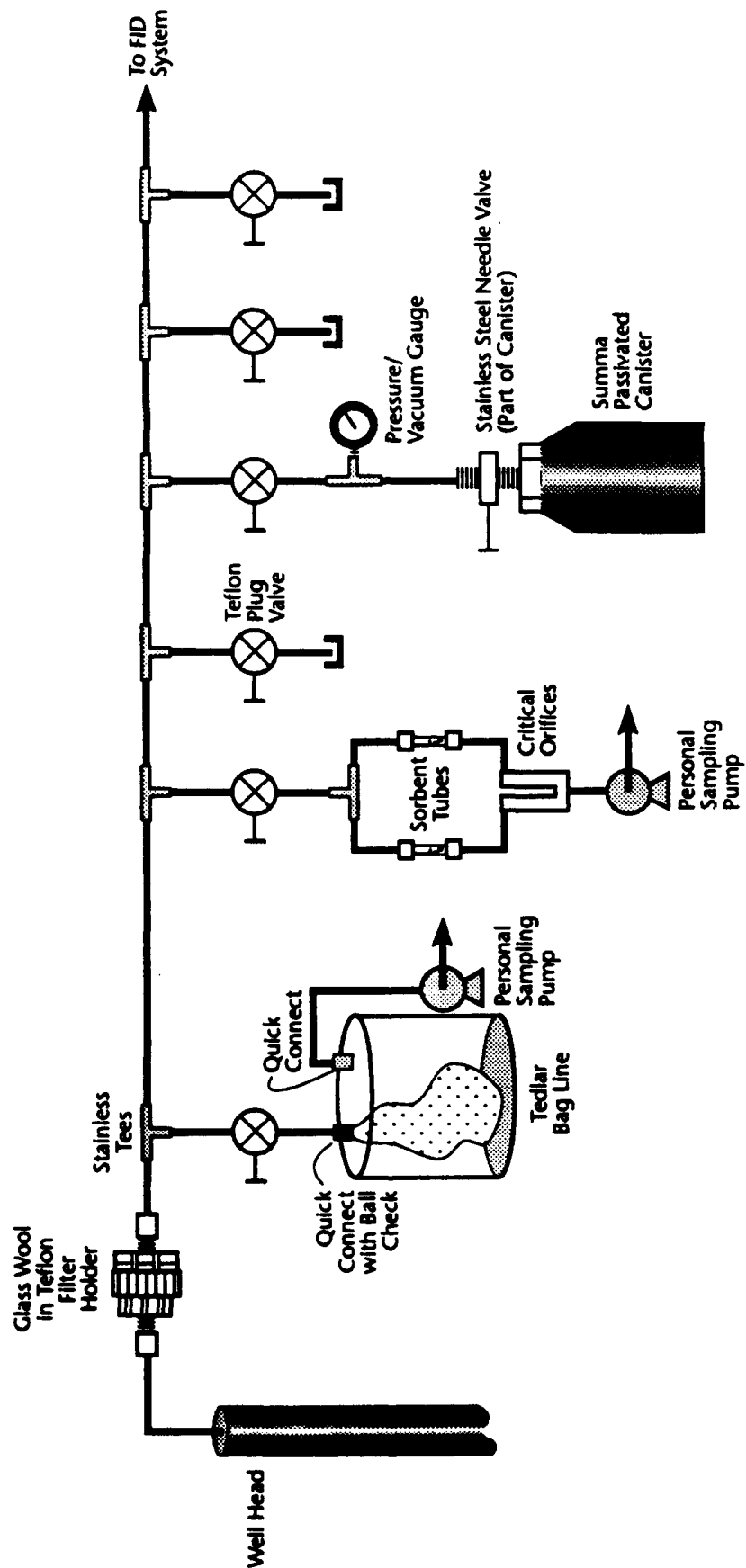


Figure 3-5
Multimedia

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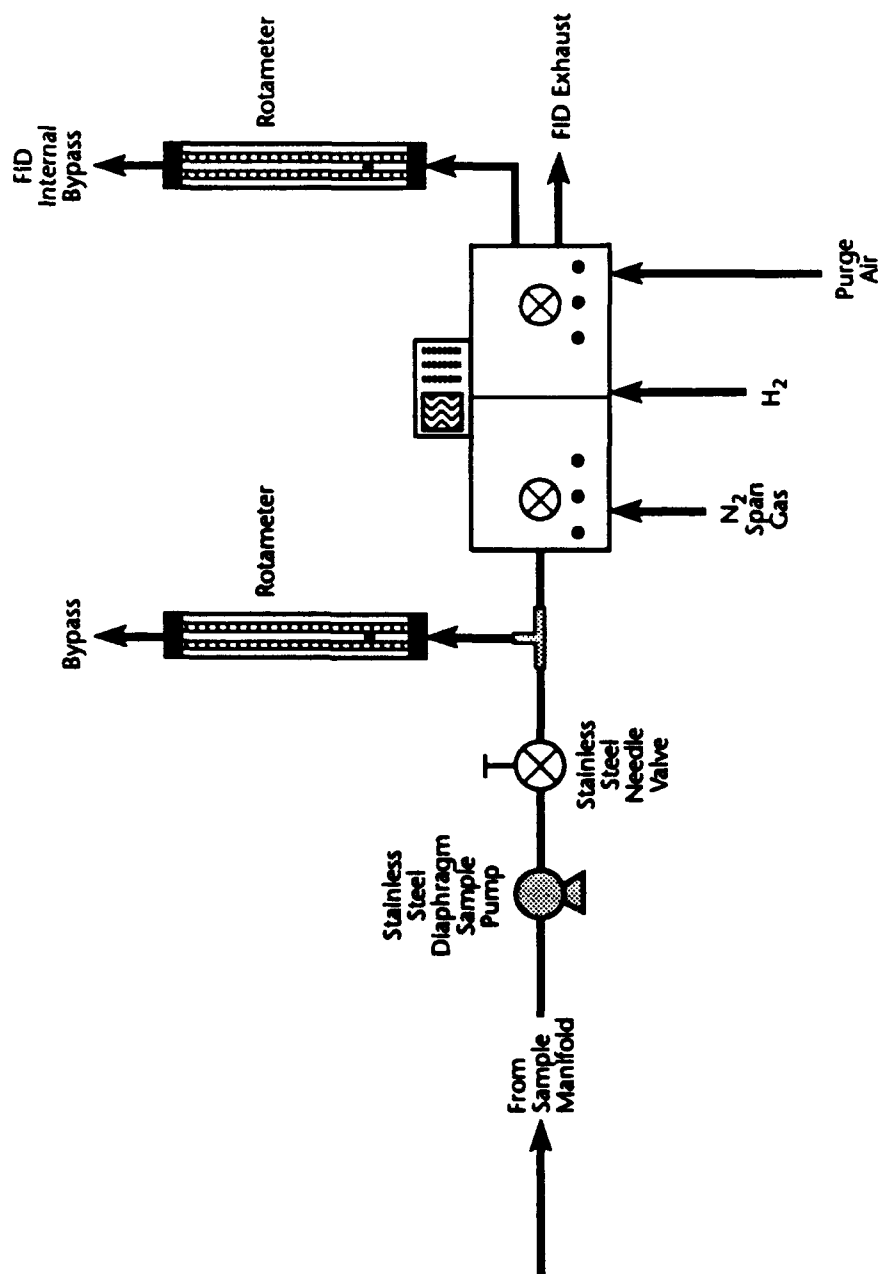


Figure 3-6
FID System
Multimedia

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Tedlar Bag Container Vacuum Line:	¼-inch-outside-diameter Teflon tubing, sleeve connected if necessary with tygon tubing
Solid Sorbent Line:	¼-inch-outside-diameter Teflon tubing, sleeve connected if necessary with tygon
Solid Sorbent Orifices:	Personal sampler low-flow orifices, calibrated to appropriate flow rate

Multi-media sampling used the following sequence of steps:

1. Assemble the ultra clean manifold with all valves open and sample container connections sealed.
2. Connect the ultra pure nitrogen supply to the sample line tee and set the N₂ supply pressure to 5 to 10 psi.
3. Apply leak detection fluid to all connections and fittings and tighten or replace leaking.
4. Once all leaks are eliminated, rinse off leak detection fluid with deionized water.
5. Close all sample line valves and attach one container of each media type.
6. Open valves and start pumps to collect N₂ blank samples.
7. Collect canister blanks as grab samples (one each for offsite and onsite laboratories).
8. Run pumps for selected sampling period (Tedlar and solid sorbents), then close valves and shut off pumps.
9. With valves closed and the well head connector unsealed, connect to selected monitoring well. Connect the sample line to the FID.
10. Span and zero the FID and record initial flow readings.
11. Attach an auxiliary pump in sequence to each sample container connection, open each valve, and draw sample gas through the line. Then close the valves and attach the containers.
12. Open the sample valves, start the pumps at preset flow rates (integrated), or open canister valves for grab samples.

13. After samples are collected, close all valves, seal samples, and prepare samples for shipment.
14. Repeat steps 11-14 for replicate samples.
15. Rezero and span the FID and shut system down.

Multimedia sampling incorporated a number of duplicate samples. These were collected side by side with the samples they were to be compared to: a twin system of the media type being duplicated was set up and samples collected simultaneously. Solid sorbent duplicates were collected from the common tee in the solid sorbent line. The gas was drawn through the sorbent tubes, passing through twin orifices and then connecting back together prior to the personal sampling pump.

The hydrocarbon analyzer was used to determine that well concentrations were reasonably stable prior to sampling and remained reasonably stable during sampling. Total hydrocarbon readings were added to sample container tags to alert analytical personnel to relative concentrations to be expected during analysis.

3.1.2.1 Pressure Canister Collection

One of the objectives of the multimedia sampling effort was to evaluate vacuum versus pressure-filled canister sampling. Pressure-filled canisters were collected from monitoring wells 2 and 8 and vent risers 3-5 and 3-6. The technique used to collect these samples involved an in-line needle valve used to regulate flow into the canisters and a small stainless-steel diaphragm pump used to fill the canister once the canister vacuum was reduced to zero. An in-line vacuum gauge was used to monitor the rate of sample collection for the first half of the sample collection and an in-line pressure gauge to monitor filling of the canister from zero pressure to the final positive pressure. Figure 3-7 is a schematic of the equipment associated with pressure-filled canister collection. The equipment shown was attached to one of the duplicate lines off the main sampling manifold. The specifications for the equipment are as follows:

Connections, Tees:	316 SS, 1/4-inch tubing compression fittings
Pump:	Stainless diaphragm pump, outlet pressure ≈40 psi free air capacity ≈4 l/m
Pressure Gauge:	0-60 psi range, 1/4-inch tubing compression fittings
Needle Valve:	316 SS, 1/4-inch tubing compression fittings
Vacuum Gauge:	30-inch Hg-0, 1/4-inch tubing compression fittings

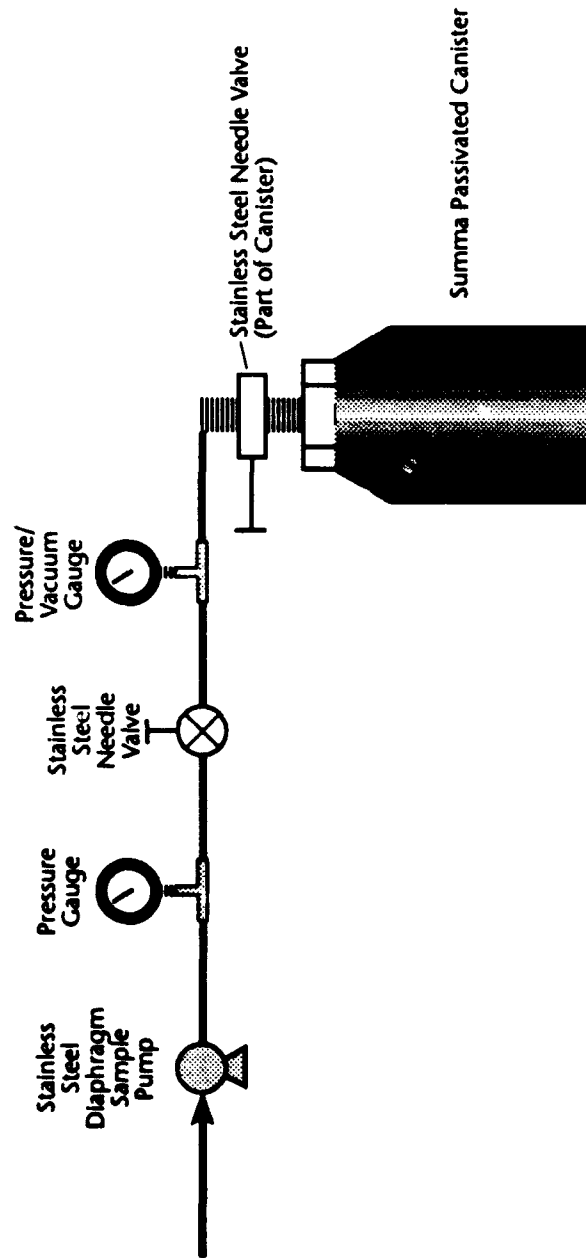


Figure 3-7
Pressure-Filled
Canister Line



The sequence of activities followed for collection of integrated pressure canister samples is as follows:

1. Assemble the sample line and leak check.
2. Draw the UHP nitrogen blank through pump and gauges into sample containers.
3. Close all valves and verify the canister vacuum.
4. Connect the canister to the sample line, close the stainless needle valve, and open the canister valve.
5. Open the stainless needle valve very slightly. Adjust the valve to fill canister at desired rate (vacuum filling), monitoring the sample rate with the vacuum gauge.
6. Once the vacuum gauge reads zero pressure, close the needle valve and start the sample pressurizing pump.
7. Observe the pressure gauge and open the needle valve only enough to observe a *slight change in the indicated pressure*.
8. Allow pump to pressurize canister (about 10 minutes for 850 ml canisters), monitoring the filling rate with the pressure vacuum gauge.
9. Close the canister valve and stainless needle valve, and shut off pump.
10. Cap canister in preparation for shipment to the laboratory.

Samples collected as described above can be integrated over an approximate 20-minute period. If more uniform rates of canister filling or longer integration periods are desired, it is recommended that specialty equipment designed and calibrated for that purpose be acquired.

Final canister pressure achieved with the equipment described was around 25 psi.

3.1.3 VENT RISER SAMPLING

To determine the concentrations of target analytes and to evaluate media effectiveness and protocols for future vent riser sampling, 10 of 32 vent risers in Area D were sampled. Condensate, which had been a limiting problem in previous sampling efforts, was expected to be collected in large quantities. The initial sampling train used for vent risers included one condensate trap per sampling line. Figure 3-8 is a schematic of that arrangement. Samples from vent risers were collected in 850-ml canisters and Tedlar bags. Solid sorbents were eliminated from the train because of the moisture expected. Quantities of condensate collected in the water traps in each sample line were much lower than expected so a modified sampling train was assembled with a single condensate trap between the well head and the first sample line. Figure 3-9 is a schematic of

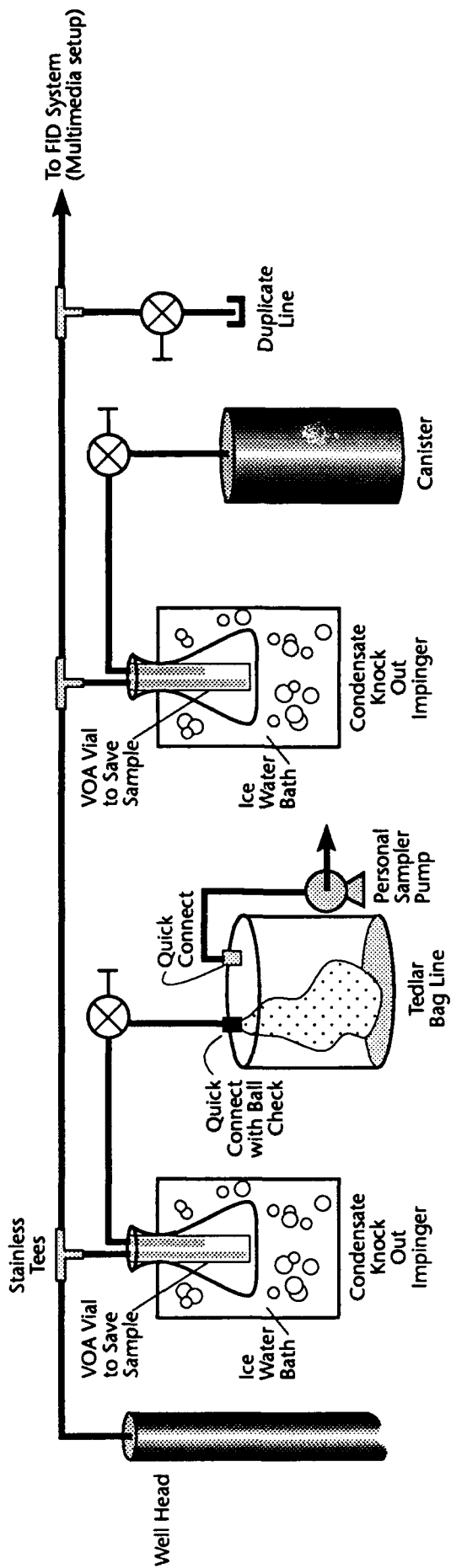


Figure 3-8
Vent Riser Sampling
Manifold-Original

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this arrangement. The ultra clean portion of this sampling train consisted of the components from the well head to the outlet side of the final sample tee. The specifications for these components (modified train) are as follows:

Well Head Fitting:	316 SS male pipe thread to 1/4-inch tube fitting adaptor, new
Well Head Connection:	316 SS, 1/4-inch tubing compression fitting
Condensate Trap:	Teflon, 250-ml Ehrlenmeyer flask, silicon 2-hole stopper
Sample Line Tees:	316 SS, 1/4-inch tubing compression fitting
Canister Line Valve:	316 SS, needle valve, 1/4-inch tubing compression fittings
Canister Line Vacuum Gauge:	30-inch Hg-0 range, 2-inch face, 1/4-inch tubing compression fittings
Tedlar Bag Line Valve:	Teflon plug valve, 1/4-inch tubing fittings
Tedlar Bag Container Connections:	316 SS, quick connect with ball check
Sample & Manifold Line:	Teflon, 1/4-inch-outside-diameter tubing, new

Components on the outlet side of the last sample tee were specified to be clean, but not necessarily ultra clean. The specifications for these components are as follows:

Sample Line:	1/4-inch-outside-diameter tubing, polyethylene or equivalent
FID Inlet Pump:	Stainless diaphragm, 4 l/m free air capacity
Connectors, Tees:	316 SS, clean

Total hydrocarbon levels were monitored during sampling to alert personnel analyzing samples to concentrations of compounds in the samples. Total hydrocarbon levels were very low at most vent risers, and the flow extracted for the FID was high enough (~4 l/m) that no stable concentrations were achieved. Sampling continued as long as concentrations could be measured. Once it was determined that condensate quantities

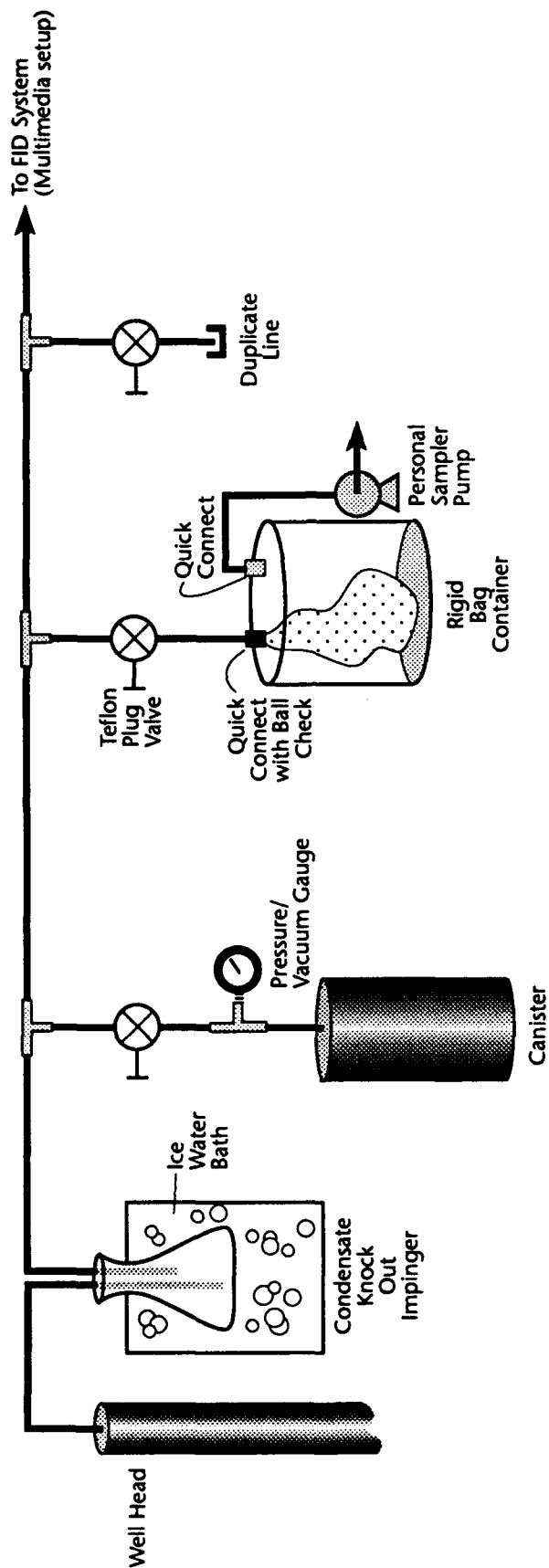


Figure 3-9
Vent Riser Sampling Manifold-Modified
(Condensate not to be analyzed)



were too low to analyze, condensate was collected for all three replicate samples and then disposed of.

Vent riser sampling was conducted in the following sequence of steps:

1. Start total hydrocarbon analyzer and inlet pump (analyzer warm-up).
2. Assemble sampling manifold with valves open and sample container connections and well-head connection sealed.
3. Connect the UHP nitrogen supply to outlet side of last sample tee and set N₂ pressure to 5 to 10 psi.
4. Apply leak detection fluid to all connections and eliminate leaks by tightening connections or replacing components.
5. Rinse off leak detection fluid with deionized water.
6. Close valves and connect sample containers to container connections.
7. Open sample line valves and withdraw UHP N₂ samples (blanks).
8. Close valves and disconnect nitrogen supply.
9. Connect to the FID and riser.
10. Zero and span the FID and set to sample.
11. Attached sample containers, open valves, and collect samples.
12. Close all valves and disconnect sample containers.
13. Prepare sample containers for storage and/or shipment.
14. Repeat steps 11-13 twice.
15. Zero and span FID.
16. Shut down system.

3.2 SAMPLE STORAGE AND PRESERVATION

Samples were sealed after collection, canister valves were closed, inlets were capped, bag valves were closed, and solid sorbent tube ends were capped tightly. Once sealed,

canisters and solid sorbent tubes are relatively stable. It may be desirable to pack canisters and tubes into shipping containers with some loose charcoal to absorb any of the target analytes that might be present in the containers, but this is not a requirement. The canisters and tubes may then be shipped as packed. All sample containers should be kept at or below room temperature (68°F) during storage and shipping. Tedlar bag samples are less stable than those collected in metal containers and must not be exposed to direct UV light during storage. The bags are also somewhat permeable, leading to reduced allowable holding times and to a requirement of clean shipping containers. The bags may be shipped with small quantities of loose charcoal to reduce contamination by compounds in the shipping containers. Allowable holding times for the sample container are usually specified in the analytical methods. For this project, these times were specified as follows:

Tedlar bags: ≤72 hours

Solid sorbent tubes and canisters: ≤14 days.

3.3 SAMPLE CUSTODY

3.3.1 CHAIN OF CUSTODY (FOR CONTRACT LAB)

A chain-of-custody record accompanied each batch of samples; each time the samples changed hands, the sender and receiver signed and dated the chain-of-custody record.

The following information was included on the chain-of-custody record:

- Sample number
- Signature of sampler(s)
- Date and time of collection
- Place of collection
- Type of sample
- Number and type of container
- Inclusive dates of possession
- Signature of receiver

Chain-of-custody records generated during sampling are included in Volume II.

4.0 ANALYTICAL PROCEDURES

4.1 CLOSE SUPPORT LABORATORY METHODS

All samples delivered to the close support laboratory were collected in Summa-passivated canisters. The samples were analyzed by EPA method TO-14, which describes a technique for air sampling and analysis using Summa-passivated canisters, cryofocusing, and full scan gas chromatography/mass spectrometry (GC/MS).

For this project, the method consisted of transferring from 10.0- to 200.0-ml volumes of sample from the sampling container to a trap immersed in liquid oxygen. Once the sample gas had passed through and components of interest had been collected in the trap, the trap was heated to 85°C to thermally desorb sample components onto the head of the capillary column. The column was a narrow-bore, 30-meter fused silica column with a 1.0-micron phase loading, and was maintained in the GC oven which was temperature programmed to 200°C. The mass spectrometer (MS) detector, tuned and operated according to specifications contained in EPA SW-846 method 8240, was scanned from 33 AMU to 250 AMU for the target analytes. Target analytes were identified and quantitated from extracted ion chromatograms using two characteristic ions and retention times. The method detection limit was listed on the analytical report, and reproducibility of the method was about 10 to 15 percent for most compounds at 1 ppbv.

Project specifications for detection limits combined with consistently high concentrations of Freon 113 created analyzer problems that required modification to TO-14. Sample volumes had to be maintained around 200 ml to achieve the low detection specified, but that volume included enough Freon 113 to increase the mass spectrometer source pressure beyond instrument limits when the Freon peak eluted. The high pressure shut off the analyzer, aborting those runs. The solution to the problem was to inject 20-ml samples with the analyzer electronics programmed to shut off during the time that the Freon 113 peak eluted. Two other analytes (1,1-dichloroethene and dichloromethane), which elute close to Freon 113, were also lost using this technique. Samples that were analyzed using this method were saved to allow reanalysis using lower volume injections. The samples analyzed in this manner recovered the blanked compound concentrations (at higher detection limits).

4.2 OFFSITE LABORATORY

Samples shipped to the offsite laboratory were collected in a variety of containers (media). These included Summa-passivated canisters, Tedlar bags, solid sorbent tubes (both charcoal and carbon molecular sieve sorbents), and condensate vials. Project specifications required samples to be analyzed to sub-ppbv detection levels using an MS detector.

4.2.1 TEDLAR BAG AND SUMMA CANISTER METHODS

These samples were analyzed using EPA method TO-14. For this project the method consisted of transferring a 10.0- to 200.00-mil sample from the sampling container to a trap immersed in liquid oxygen. Once the sample gas had passed through and components of interest had been collected in the trap, the trap was heated to 85°C to thermally desorb sample components onto the head of the capillary column. The column was a narrow-bore, 30-meter fused silica column with a 1.0-micron phase loading, and was maintained in the GC oven, which was temperature programmed to 200°C. The MS detector, tuned and operated according to specifications contained in EPA SW-846 Method 8240, was scanned from 33 AMU to 250 AMU for the target analytes. Target analytes were identified and quantitated from extracted ion chromatograms using two characteristic ions and retention times. The method detection limit was used on the analytical report, and reproducibility of the method was about 10 to 15 percent for most compounds at 1 ppbv.

4.2.2 SORBENT CARTRIDGES

Sorbent cartridges were analyzed using EPA method TO-02. Equipment used was a Nutech 8533 thermal desorber and cryogenic preconcentrator. Both charcoal and carbon molecular sieve cartridges were used, after having been precleaned according to the procedures outlined in TO-02.

The cartridges, after sampling, were attached to the Nutech 8533 and thermally desorbed at 375°C to the cryogenic trap for concentration along with gaseous internal standards. The trap was cooled to -150°C with liquid nitrogen, and the sample was concentrated. The sample was desorbed from the cryotrap at 100°C and was cryofocused onto the beginning of a narrow-bore, 30-meter fused silica capillary column with a 1.0-micron phase loading. The column was temperature programmed to 200°C. The MS was scanned from 33 AMU to 250 AMU. The GC/MS was tuned and operated according to the specifications in EPA SW-846 Method 8240. Target compounds were identified and quantitated from extracted ion chromatograms using two characteristic ions and retention times. Additional tentatively identified compounds were identified using a PBM computer search of the NIST 49,000-compound library. The method detection limit (MDL) was 0.2 ppbv for most compounds, and the reproducibility of the method was about 10 to 15 percent for compounds at 1 ppbv.

4.2.3 EPA 8240 CONDENSATE SAMPLES

The condensate samples were analyzed according to EPA 8240 using an HP 5970/5890 GC/MS and an OI Model 4460A purge and trap concentrator. The purge and trap was directly interfaced to a narrow-bore capillary column as described in EPA Method 524.2. The MDL for the system was better than 0.2 ppbv for the purgeable compounds. The samples were purged according to Method 8240 and cryofocused onto the beginning of a narrow-bore, 30-meter fused silica capillary column with a 1.0-micron phase loading. The column was temperature programmed to 200°C. The

MS was scanned from 33 AMU to 250 AMU. The GC/MS was tuned and operated according to the specifications in EPA SW-846 Method 8240. Target compounds were identified and quantitated from extracted ion chromatograms using two characteristic ions and retention times. Additional tentatively identified compounds were identified using a PBM computer search of the NIST 49,000-compound library. The MDL was 0.2 ppbv for most compounds, and the reproducibility of the method was about 10 to 15 percent for compounds at 1 ppbv. The samples were calibrated against commercial purgeable standards and internal standards.

The analysis of each type of sample was preceded by a method detection/recovery study to evaluate the ability of the method to analyze for the target compounds. The method detection studies were conducted by introducing a known concentration of the target analytes to the sample collection media and then analyzing seven replicates of this spiked mixture. Results of these analyses are included in quality control reports for both laboratories in Volume II.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

Quality control data generated during this project have been used to assess the overall quality of project sampling and analytical efforts. Data values were used as reported (unadjusted) for the media comparison and estimates of concentrations of target analytes at the 19 sampling locations. Both the close support laboratory (CSL) and offsite laboratories produced data of usable quality for the objectives of this project. A formal point-by-point data validation and adjustment, not necessary for the intended use(s) of this report, should be performed if more sensitive uses of these data (i.e., public health risk assessments) are contemplated. The following sections of this report describe data quality objectives and provide a qualitative summary of the project quality control samples and results. Specific data qualifiers or exceedances of acceptance criteria are noted, but were not incorporated into the data set prior to its use for this project. This is consistent with the project objectives, which were research oriented.

5.1 QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES

Quality assurance (QA) refers to the overall program for ensuring the reliability of analytical data generated by a laboratory. Quality control (QC) refers to the specific routine procedures performed as part of the field activities and laboratory analyses to ensure the quality of the measurements meets QC criteria considered appropriate for the intended use of the data. This section describes the process and results of evaluating data quality for specific study objectives.

The overall program QA objectives (QAOs) for field and laboratory activities were to maintain project-specific:

- **QC requirements or criteria** for the analytical methods appropriate for obtaining data that could be used to achieve both the program and specific project objectives.
- **QC procedures** to provide analytical data of known quality in terms of precision, accuracy, sensitivity, completeness, selectivity, representativeness, and comparability.

QAOs and their level of effort or frequency were included or referenced in the Quality Assurance Profit Plan (QAPP), site CSL standard operating procedures (SOPs), offsite laboratory SOPs, analytical methods, or other appropriate project documents.

QA criteria for analyzing air samples were not method-specific and were not documented because analytical procedures used for these types of analyses tend to be customized for each sample matrix and each project. The QAO criteria presented in the QAPP were target values. Actual values were adjusted to account for the sample matrix and

field conditions, as well as adherence to the project-specific protocols for non-routine analysis. The listed target values were evaluated during the data validation process and some values have been adjusted as required.

Volume II includes QA/QC reviews completed for both laboratories by CH2M HILL and the subcontractor, Environmental Analytical Service. The QA/QC reviews allow us to conclude that the data sets are usable for the objectives of this project.

Audits, internal quality control checks, preventive maintenance, data reduction, validation, reporting protocols, corrective action, and other QC procedures described later in this document, were implemented to help achieve the QAOs.

5.1.1 PRECISION

Precision of the data is a measure of the reproducibility or spread of the data when more than one measurement is taken on one sample under prescribed similar conditions. Precision is the agreement between the set of replicate measurements without assumption or knowledge of the true value.

Precision consists of sampling precision and analytical precision. Sampling precision is a function of the operating procedures used to collect, store, and transport the sample, and the variability and/or homogeneity of the media being sampled. Analytical precision is a function of the procedure used, the analysts' techniques, and instrument performance.

Sampling and analytical precision were generally determined by collecting and analyzing field duplicate samples; samples taken from the same source were put into separate containers and analyzed independently. The field duplicates were not known to the analysts.

Analytical precision was determined by analyzing laboratory duplicate samples using ordinary duplicates or matrix spike/matrix spike duplicates (MS/MSD), as appropriate to the analytical method. Being dependent on analysis, sampling precision could not be determined alone. However, sampling precision was inferred to be related to the difference in precision of field duplicates and laboratory duplicates.

For duplicate measurements, precision was expressed as the relative percent difference (RPD), the difference of duplicates as a percentage of the mean of the duplicates.

The Area D soil vapor assessment included the following requirements for precision for both the CSL and offsite laboratory:

- Collect and analyze field duplicates at an approximate frequency of 1 in 20

- Analyze laboratory duplicates at a frequency of 1 in 10 or 1 per analytical batch, whichever is more frequent

Measurements become less precise as data approach the detection or quantification limits of a method. A range of plus or minus the reporting limit is acceptable for values less than five times the reporting limit. Precision measures have little meaning for analytes at concentrations less than documented detection limits.

5.1.2 ACCURACY

Method accuracy was assessed by spiking samples with known standards or surrogate standards and calculating the average recovery by comparing results before and after spiking. Accuracy was also assessed by the routine analysis of reference samples of "known" composition, such as laboratory or field control samples and performance evaluation (PE) samples.

Unlike precision, accuracy is difficult to measure for field and laboratory activities. Sources of possible accuracy error include sampling method, field and laboratory contamination, preservation, handling, sample matrix, calibration, and analysis. Bias or systematic errors are inherent in the sampling method and idiosyncratic in the measurement system. Temperature effects or extraction inefficiencies are examples of method errors; blank, contamination, mechanical losses, and calibration shifts are examples of measurement errors.

Bias can be positive and negative, with several types concurrent so that the net result can be positive or negative. An accurate measurement system can provide precise and unbiased results within acceptable limits.

The potential for false positive results was assessed by laboratory and field blanks. The potential for false negative results was assessed by spiking. Because of the difficulties in field spiking, this method was not used to assess sampling and analytical accuracy.

Accuracy was also assessed through the analysis of duplicate samples by the offsite laboratory. Performance was assessed and the results compared to the CSL results during data validation.

5.1.3 COMPLETENESS

Completeness of the data is a measure of the amount of valid data obtained from the analytical measurement system. Completeness can be affected by sampling problems, analytical problems, and data validation problems, all of which can result in unacceptable or missing data. The quantitative definition of completeness is the percent of usable data obtained compared to the total data expected under correct, normal conditions.

Completeness is a measure which must be used with caution. Low completeness does not necessarily indicate poor laboratory performance. Matrix complications or unusual circumstances can affect analyses, which can result in low completeness.

Based on the typical performance of field and fixed laboratories, completeness of approximately 80 percent was expected for samples collected during the first phase of the Area D soil gas assessment. The actual completeness criteria was 100 percent for all field and laboratory blanks, field and laboratory control samples, and internal and external performance evaluation samples.

5.1.4 REPRESENTATIVENESS

Representativeness is a measure of how accurately and precisely the measured results reflect the actual concentration or distribution of the analytes in the environmental matrix sampled. Representativeness depends primarily on the design and implementation of the sampling program.

Representativeness of the data is partially addressed by avoiding contamination, adhering to sample handling and analysis protocols, and using proper chain-of-custody and documentation procedures. Representativeness was assessed by comparing analytical results from repeated analyses of one sample over a period of time. Requirements for representativeness were addressed in the design and implementation of the sampling program described in the Sampling Analysis Plan.

5.1.5 COMPARABILITY

Comparability is a measure of the confidence with which one data set can be compared to another. The comparison was made with data derived from the CSL and offsite laboratories. Comparability of the data was maintained using the same analytical method and procedure for analysis of charcoal tube and Tedlar bag samples in the offsite laboratory, and using the same procedure and method for canisters in both labs.

5.2 LABORATORY INSTRUMENT CALIBRATION

The GC/MS compounds were calibrated using a dilution of a National Bureau of Standards (NBS) traceable standard. The daily calibration consisted of a zero point and two calibration points (10 percent and 100 percent of range). One calibration point was run at the beginning of the day and one at the end of the day. During a periodic internal audit of the analytical system, a three-point calibration curve was run to establish performance criteria for the system. This audit was conducted monthly at the offsite laboratory and at startup at the CSL. The response factors for the initial calibration curve, performed at the beginning of the day, were within 10 percent. If the response factor for the daily standard, performed at the end of the day, was more than

30 percent from the initial calibration, a new calibration curve was prepared. Standards were prepared by using a gas dilution system on the gas chromatograph or by making static dilutions to atmospheric levels. The gas dilution system was constructed from an eight-port gas sampling valve with 0.05 ml, 0.5 ml, and 5.0 ml sample loops. The loops were filled with the standard and flushed with humidified "zero air" prepared with an AADCO Model 737 pure air generator. The three loop sizes are used to prepare a three-point calibration of the system to check the linearity in the concentration range of interest. The gas dilution system is used for the daily instrument calibration. The concentration of individual hydrocarbons was determined using response factors calculated by the integrator.

Standards at atmospheric concentration levels were prepared by diluting the NBS traceable standard in stainless steel canisters. The standards were diluted by using a calibrated syringe to inject a measured volume of the NBS traceable standard into a passivated stainless steel canister. The canister was filled with a known volume of zero air, measured using a mass flow meter, creating an ambient level standard. This ambient level standard was sent to another laboratory for calibration against the NBS 5-ppbv VOC standard. The diluted standard was analyzed in exactly the same manner as the project samples and served as a check of the sample concentration injection system.

5.2.1 CSL CALIBRATION AND TUNING

5.2.1.1 GC/MS Tuning and Internal Standard Area

The GC/MS was tuned according to EPA Method 8240.

All daily GC/MS bromofluorobenzene (BFB) tuning data provided by the CSL met ion abundance criteria guidelines.

5.2.1.2 Initial Calibration

The QC acceptance criterion for initial calibrations is less than ± 30 percent relative standard deviation (RSD).

Initial calibration (three-point curve) for the GC/MS was performed on March 27, 1990. The percent RSD for all target compounds ranged between 4.1 percent and 10.1 percent and met the QC acceptance criterion for this project.

5.2.1.3 Continuing Calibration

The QC acceptance criterion for continuing calibrations is less than ± 30 percent RSD. Continuing calibrations are compared and calculated based upon the relative response factors (RRF) of the initial instrument calibration.

Continuing calibration results generally met the QC acceptance criterion. For most of the dates samples were analyzed, the percent RSD for toluene exceeded QC acceptance limits. In addition, approximately 6 of the 17 target compounds analyzed on April 3, 5, 8, and 12, 1991, exceeded QC acceptance limits.

5.2.2 OFFSITE LABORATORY CALIBRATION

5.2.2.1 GC/MS Tuning

The GC/MS was tuned according to EPA Methods TO-14 and 8240.

5.2.2.2 Internal Standards

Except for 15 sorbent tube and 1 Tedlar bag sample with internal standards below QC acceptance criteria, all samples met QC acceptance criteria. The QC acceptance criterion for internal standards is +100 percent (upper limit) and -50 percent (lower limit).

Canisters. All canister samples met the QC acceptance criterion for internal standards.

Sorbent Tubes. The following sorbent tube samples had low internal standard recoveries on April 9, 1991. Internal standard recoveries were approximately 3 percent lower than the acceptable lower limit (-50 percent).

- MW-T-O-6-2 (10400B)
- MW-T-O-7-2 (10323)
- MW-S-O-7-3 (10324)
- MW-T-O-7-4 (10325)
- MW-BT-O-7-2 (10406)

The following solid sorbent samples had low internal standard recoveries on April 11, 1991. Internal standard recoveries were approximately 5 percent lower than the acceptable lower limit (-50 percent).

- MW-T-O-4-B (10419)
- MW-T-O-9-2 (10359)
- MW-T-O-6-2 (10400)

The following sorbent tube samples had low internal standard recoveries on March 27, April 4, and April 19, 1991, due to high concentrations of target or nontarget compounds.

- MW-S-O-022 (10262) (March 27, 1991)
- MW-T-O-2-1 (10278) (April 4, 1991)
- MW-T-O-2-3 (10280) (April 4, 1991)
- MW-S-O-3-1 (10300) (April 4, 1991)
- MW-S-O-8-B (10341) (April 4, 1991)
- MW-BT-O-7-4 (10593) (April 19, 1991)

Sorbent tube samples with high concentrations of target or nontarget analytes were not reanalyzed because analytes were thermally desorbed during the analysis. This is a limitation of thermal desorption when analyzing samples collected on sorbent tubes. All other sorbent tube samples met QC acceptance criteria for internal standards.

Tedlar Bags. The following Tedlar bag sample had low internal standard recovery on April 10, 1991. The second internal standard recovery was approximately 6 percent lower than the acceptable lower limit (-50 percent).

- VR-B-0-44-3 (10446)

All other Tedlar bag samples met QL acceptance criteria for internal standards.

Sorbent tube and Tedlar bag sample results should be qualified. However, outliers are relatively insignificant, and the majority of outliers were due to high concentrations of target or nontarget analytes. Highly concentrated samples should be diluted or a smaller aliquot of sample collected and reanalyzed.

5.2.2.3 Continuing Calibration

NBS standards were used to calibrate the GC/MS. A two-point continuing calibration was performed on each day of analysis. Continuing calibration results should not exceed the QC acceptance criteria of ± 30 percent RSD. No significant QC problems were associated with any of the calibrations. All continuing calibrations met the QC acceptance criteria of ± 30 percent RSD.

5.3 LAB QUALITY CONTROL SAMPLES

Both laboratories analyzed a daily zero blank. Blank results checked for concentrations were below 0.2 ppbv. Tedlar bags analyzed by the offsite laboratory were found to regularly contain some components at concentrations above 0.2 ppbv, and practical quantitation limits were set accordingly. Both laboratories analyzed NBS traceable standards with each sample batch. A 100 percent standard was analyzed in the morning to verify instrument response, target calibration windows, and initial calibration validity. A 50 percent calibration standard was analyzed at the end of the day to verify linearity and daily calibration.

5.3.1 CSL QC SAMPLES

5.3.1.1 CSL Daily QC Check Samples

All of the daily QA checksheet parameters provided for review were acceptable.

5.3.1.2 CSL Laboratory Blanks

Laboratory blanks should contain less than 0.2 ppbv for each target compound analyzed. Laboratory blanks are analyzed at the beginning of each day to confirm that the analytical system is free of target compound contamination.

Laboratory blanks did not indicate contribution of significant levels of target compounds from the analytical system. However, dichloromethane, 1,1-dichloroethene, trichlorofluoromethane, and trichloroethene were detected in several blanks at low ppbv levels. These data, determined acceptable for this project, should be re-examined if other uses are contemplated.

5.3.1.3 CSL Laboratory Duplicates

Laboratory duplicates monitor analytical reproducibility. The QC acceptance criterion for laboratory duplicates is ± 50 RPD.

Most of the laboratory duplicate results met the QC acceptance criterion. However, several samples had RPD results for Freon 11 that exceeded the QC acceptance criterion. For the laboratory duplicate analyzed on April 2, 1991, all target compounds detected exceeded the QC acceptance criterion.

Sample results reported at concentrations close to the method detection limit can have RPD results that exceed QC acceptance limits. Higher RPD results for these low-level samples are generally considered acceptable. For concentrations less than five times the method detection limit, acceptable RPD results can range by $\pm$ two times the method detection limit. CSL duplicates indicated that the data were acceptable for this project.

5.3.1.4 CSL Spiked Canisters

One CSL canister was spiked with known concentrations of target analytes to assess single operator and instrument precision. The percent RSD results for this exercise ranged from 5.6 to 15.4 percent. These percent RSD results are within the acceptable criterion of ± 30 percent.

5.3.2 OFFSITE LAB QC SAMPLES

5.3.2.1 Offsite Laboratory Blanks

Laboratory blanks were analyzed each day of analysis except on March 27, April 4, 9, 17, and 19, 1991. Laboratory blank results were not analyzed on these days because charcoal sorbent tube analysis was performed and blanks were not required for sorbent tubes.

Laboratory blanks did not indicate contribution of significant levels of target compounds from the analytical system, and the data met the QC acceptance criterion for blanks.

5.3.2.2 Offsite Laboratory Duplicates

Except for four different compounds analyzed on March 28 and April 3, 1991, all laboratory duplicates met the QC acceptance criterion of ± 40 percent RPD for precision.

Canisters. Dichloromethane exceeded the QC acceptance criterion of 45 percent RPD for precision on April 3, 1991. The following canister samples were associated with this laboratory duplicate:

- MW-AC-O-7-1 (10327)
- MW-AC-O-7-2 (10328)
- MW-AC-O-7-3 (10329)
- MW-AC-O-7-B (10330)

All other canister samples met the QC criterion for precision.

Sorbent Tubes. All laboratory duplicates for sorbent tube samples met QC acceptance criteria for precision.

Tedlar Bags. Trans-1,2-dichloroethene (t-1,2-DCE) exceeded the QC acceptance criterion of 59 percent RPD for precision on March 28, 1991. The following Tedlar bag samples were associated with this laboratory duplicate:

- MW-B-O-2-B (10281)
- MW-B-O-2-1 (10282)
- MW-B-O-2-2 (10283)
- MW-B-O-2-3 (10284)

Dichloromethane (45 percent RPD) and Freon 11 (42 percent RPD) exceeded QC acceptance criteria for precision on April 3, 1991. The following Tedlar bag samples were associated with this laboratory duplicate:

- MW-B-O-7-1 (10331)
- MW-B-O-7-2 (10332)
- MW-B-O-7-3 (10333)
- MW-B-O-7-4 (10334)
- MW-B-O-7-B (10335)

The noted canister and Tedlar bag samples can be considered estimates and flagged according to expected use. All data were judged acceptable for this project.

5.3.2.3 Offsite Laboratory Spiked Sampling Media

All offsite laboratory sampling media was spiked to assess single operator and instrument precision. Review of each media type follows.

Summa Canister. The percent RSD for this media ranged from 7.3 to 21.5 percent.

Tedlar Bags. The percent RSD for this media ranged from 8.4 to 19.7 percent.

Charcoal Sorbent Tubes. The percent RSD for this media ranged from 5.4 to 12.3 percent.

These RSD values are well within the QA acceptance criterion for media spikes.

5.4 FIELD INSTRUMENT CALIBRATION

5.4.1 FID

The total hydrocarbon analyzer (JUM V.E 7) was calibrated each day before sampling. Once warmed up, the instrument was set to calibration mode (calibration gas solenoid open, sample gas solenoid closed) and zero gas was introduced. The zero potentiometer was set to produce a zero indication of the meter. The chart recorder was also set to zero. The gas supply was then switched to a known concentration hydrocarbon span gas, and the span potentiometer was adjusted. Zero and span potentiometer values were recorded on the chart. After sampling at a particular site, the analyzer was calibrated again. Zero gas, chosen to avoid synergistic oxygen effect, was UHP nitrogen. Span gas, chosen to avoid synergistic oxygen effect and to be within approximately 80 percent of the normally used analyzer range, was 850 ppm propane in nitrogen.

5.4.2 CALIBRATION OF ROTAMETERS

Rotameters were calibrated with secondary standards before being used in the field. For sensitive, low-flow calibrations, a personal sampling calibrator was used. The personal sampling calibrator consists of a pair of rotameters with 10-inch scales.

Rotameters were primarily utilized for gross flow measurement, and they performed at acceptable levels for this duty. Low flow measurements, conducted to determine sample volumes drawn through sorbents, could be improved by using more sensitive flow measurement equipment. However, all flow measurement conducted during this project met project-specific quality objectives.

5.5 FIELD QUALITY CONTROL SAMPLES

Field quality control samples consisted of blanks and duplicates. Media blanks, consisting of a sample of UHP nitrogen drawn through the sampling manifold used at the site, were taken from each location in each type of container. Duplicate samples were collected during sampling at each of the locations. The duplicates consisted of simultaneous samples drawn into one type of sampling media. The duplicates were rotated between container types and locations, producing a duplicate sample frequency of about 1 in 10.

5.5.1 FIELD BLANKS ANALYZED BY THE CSL

Twelve of the 18 field blanks used contained target compounds. Concentrations ranged between the method detection limit (MDL) to 10 ppbv. One field blank analyzed on April 11, 1991, (VR-AC-C-44-B), contained 90.8 ppbv of trichlorofluoromethane. For extremely sensitive uses, these data would be adjusted or discarded. However, the data were acceptable for project-specific uses.

To further evaluate the field blank data, test results for the sample analyzed prior to the field blank were evaluated. These comparisons suggest the possibility of low-level contaminant carry-over from the analytical system. The analytical system would contribute carry-over contaminants to subsequent samples after the analysis of samples containing high concentrations of target compounds. This limited carry-over did not preclude use of these data for this project or limit this study in any way.

5.5.2 FIELD BLANKS ANALYZED BY THE OFFSITE LABORATORY

Field blanks were collected for all sampling medias. The results for each media are discussed below.

5.5.2.1 Ambient Pressure Canisters

Eight field blanks were collected in ambient pressure canisters. The field blank results were contamination-free, except for several detectable concentrations of dichloromethane and toluene (common laboratory contaminants). These data were judged usable to meet the objectives of this project.

5.5.2.2 Pressurized Canisters

One field blank was collected in pressurized canisters. The field blank results were contamination-free, except for detectable concentrations of dichloromethane, trichlorofluoromethane, benzene, and toluene. These data were judged usable to meet the objectives of this project.

5.5.2.3 Carbon Molecular Sieve Tubes

Three field blanks were collected in carbon molecular sieve tubes. The field blank results contained low concentrations of Freon 11 and 12, 1,1-dichloroethane, dichloromethane, and toluene. These data were judged usable to meet the objectives of this project.

5.5.2.4 Charcoal Sorbent Tubes

Six field blanks were collected in charcoal sorbent tubes. The field blanks contained low concentrations of one or more of the following target compounds: Freon 11, Freon 12, 1,1-dichloroethene, dichloromethane, trichlorofluoromethane, 1,1,1-trichloroethane, benzene, and toluene. These data were judged usable to meet the objectives of this project.

5.5.2.5 Tedlar Bags

Nineteen field blanks were collected in Tedlar bags. The field blanks contained low to moderately high concentrations of one or more of the following target compounds: Freon 11, Freon 12, 1,1-dichloroethene, dichloromethane, trichlorofluoromethane, 1,1,1-trichloroethane, benzene, and toluene. These data were judged usable to meet the objectives of this project.

5.6 SYSTEM AND PERFORMANCE AUDITS

5.6.1 SYSTEM AUDIT

The following paragraphs describe how the system audit was performed at the CSL.

To independently evaluate the operation of the CSL laboratory, a staff member of CH2M HILL's Applied Sciences Laboratory in Corvallis, Oregon, was present to assist Environmental Analytical Services with the analysis of samples and development of methods during the startup phase of the laboratory. During this evaluation period, the majority of analyses consisted of standards to evaluate initial system operating parameters, develop an initial calibration, and evaluate the potential for sample carry-over. By the end of the week-long evaluation period, approximately 20 samples from the field had been analyzed.

The method used to analyze the samples followed guidelines presented in EPA Method TO-14. During the evaluation period, CH2M HILL assisted in the development of the daily startup, analysis, standardization, and analytical procedures and protocols as outlined in the analytical methods. Carry-over, or residual compounds contamination of subsequent samples, was determined not to be a problem if analytical method protocols were followed. However, because of the labor-intensive nature of the

system, if any one of the protocols was not followed and documented, the possibility of carry-over was increased and the verification of proper system operation was complicated, if not impossible. Following the carry-over study and additions to the analytical method protocols, CH2M HILL is confident that if the analytical system is operated according to all procedures and protocols, data of acceptable precision and accuracy can be generated for samples collected in the field.

A non-routine procedure implemented during sample analysis was the shutdown of the detection system during the trichlorofluoromethane portion of the analysis while making runs with high sample volumes. This was done to save the filament of the mass selective detector (MSD), the loss of which would have caused significant delays in sample analysis. This procedure is outlined in EPA Method TO-14L and is commonly used to analyze samples that contain high levels of one or more of the target constituents.

5.6.2 PERFORMANCE AUDITS

Performance audits consisted of evaluations of data and QC data from proficiency testing, which is the analysis of "unknown" samples to determine the accuracy of the measurement system.

Performance audits were conducted by the submittal of "blind" samples by an external source. These samples were disguised as real samples or were submitted so that the analyst did not know the audit type. Audit types included field duplicates which were submitted blind to the two laboratories.

The data from the performance audit samples were compared with project quality assurance objectives. Performance evaluation sample data were compared with accuracy criteria. Duplicate sample data were compared with precision criteria. Blank data were compared with sensitivity criteria (instrument and method detection limits). Performance audit documentation consisted of an audit report including a statistical analysis and appended performance data. Audit reports were distributed to appropriate program and project staff and were filed in project records. Summaries of performance audits follow.

5.6.2.1 CSL Field Duplicates

Field duplicates monitor the reproducibility of sampling techniques. All 10 field duplicates were submitted to the CSL blind.

The QA acceptance criterion for routine analysis of field duplicates is ± 50 RPD. These control limits are considered too stringent for non-routine analysis.

Most of the field duplicate results produced at the CSL met the QC acceptance criterion of ± 50 RPD. Several target compounds from each set of duplicates exceeded the QC acceptance criterion. Thirty-one compounds were detected in the duplicates, with

seven exceeding the QC acceptance criteria. These data were judged acceptable to meet the objectives of this project.

5.6.2.2 Offsite Laboratory Field Duplicates

Field duplicates monitor the reproducibility of sampling techniques. All field duplicates were submitted blind.

The QC acceptance criterion for field duplicates is ± 50 RPD. These control limits are considered too stringent for non-routine analyses.

Field duplicates were collected for all sampling media. The results from each media are discussed below.

Ambient Pressure Canisters. Four field duplicates were submitted to EAS for analysis in ambient pressure canisters. Most of the RPD results exceeded the QC acceptance criterion of ± 50 . RPD results for this media ranged between 60 percent and 90 percent. Three of the four duplicates compared pressure-filled canisters to ambient pressure canisters and must be used with caution for media precision. These data were judged acceptable to meet the objectives of this project.

Pressurized Canisters. One field duplicate was submitted to EAS for analysis in a pressurized canister. All six of the target compounds detected in both samples were within the QC acceptance criterion. These data were judged acceptable to meet the objectives of this project.

Carbon Molecular Sieve Tubes. Two field duplicates were submitted to EAS for analysis in carbon molecular sieve tubes. Most of the RPD results exceeded the QC acceptance criterion of ± 50 . Of the 15 compounds detected in both samples of the duplicates, 11 exceeded the QC criterion. RPD results for this media ranged between 62 percent and 182 percent. These data indicate that charcoal molecular sieve tubes can have limitations in an application of this nature (i.e., a complex soil gas matrix).

Charcoal Tubes. One field duplicate was submitted to EAS for analysis in a charcoal tube. Four of 12 target compounds detected in both samples exceeded the QC acceptance criterion. These data indicate that charcoal sorbents can have limitations in an application of this nature (i.e., a complex soil gas matrix).

Tedlar Bags. Nine field duplicates were submitted to EAS for analysis in Tedlar bags. Most of the RPD results met the QC acceptance criterion of ± 50 . Of the 34 compounds detected in both samples of the duplicates, 22 met the QC criterion. These data met project objectives for data quality but indicate that Tedlar bags can have limitations in an application of this nature (i.e., complex soil gas matrix).

5.6.3 OFFSITE LABORATORY AUDIT SAMPLES

The audit sample for the offsite laboratory was prepared by the Oregon Graduate Institute. The audit consisted of two 850-ml canisters, which were from the same canister source as those used for the project. Canisters 152 and 368 were prepared to contain 10 of the target constituents at approximately 1 and 10 ppbv, respectively. In addition to the target compounds, eight other compounds were present at the specified levels. Each audit canister was analyzed twice. The recoveries ranged from 98.0 to 150.9 percent, and the percent RSD for the duplicate analysis ranged from -1.1 to 10.8 percent. No false positives were reported and all constituents present were identified. Overall, the results of the audit cylinders were acceptable. The results of the audit samples are included in the offsite laboratory QC report in Volume II.

6.0 RESULTS

This section presents results of some preliminary analyses conducted in support of this project. The location of most of the project data is noted. Summaries and conclusions drawn from the data are contained in Section 7.

6.1 RECOVERY STUDIES

A preliminary analysis was conducted by the subcontractor to document the recovery and quantification of the target analytes. The study required spiking 7 samples with concentrations of the 17 target analytes in the concentration range of 10 to 50 ppbv. The seven samples (one batch for each type of sample collection media) were analyzed and the recovery documented to establish method recovery and quantification of the target analytes. The results of the recovery studies are included as Tables 6-1 through 6-12.

6.2 METHOD DETECTION LIMITS

The minimum detectable level (MDL) is the lowest concentration of a substance that can be measured with confidence. It is calculated at the 99 percent confidence level from 8 repetitive measurements on a sample whose concentration does not exceed 10 times the estimated MDL. To calculate the MDL, a sample is prepared in the appropriate matrix with components near the estimated MDL (about three times the instrument noise level). This sample is run eight consecutive times and the standard deviation (S) is calculated. The MDL is determined using the following formula.

$$\text{MDL} = 3.0 * S$$

The 95 percent confidence limits derived for the chi square distribution can be calculated using the equations below.

$$\text{LCL} = 0.69 * \text{MDL}$$

$$\text{UCL} = 1.92 * \text{MDL}$$

The laboratories (CSL and offsite) reported similar detection limits for the target analytes. The average detection limit reported by the CSL was 0.75 ppbv, as was the average for the TO-14 analysis performed by the offsite laboratory. The offsite laboratory reported 0.001 micrograms as averaged detection limits for the solid sorbent analyses.

Detection limits reported by the CSL were a direct function of the volume injected into the analyzer. Detection limits increased when injection volumes decreased because of high concentrations of Freon 113. Analytical procedures agreed to in the early stages

of the field and CSL effort allowed the Freon 113 concentrations to pass through the analyzer undetected so that 200-ml injections could be used and low detection limits achieved for the majority of the target analytes. Selected samples run in this manner were reanalyzed using lower injection volumes with consequent higher detection limits (7.5 ppbv for a 20-ml injection). Detection limits associated with each CSL concentration reported are included with the data as received in Volume II of this report.

Detection limits for the offsite laboratory were also around 0.75 ppbv for TO-14 analyses. Quality control results were used to adjust these on a daily basis. Method detection limits for the solid sorbent analyses averaged 0.001 micrograms for the target analytes. The detection limits associated with each analysis are reported in the data as received in Volume II of this report.

6.3 MONITORING WELL RESULTS

The ranges of concentrations of the 17 target analytes measured at monitoring wells using CSL canister results are presented in Table 6-13. A condensed version of the complete data set is included as Appendix I of this volume of this report. The data as received from the laboratories are included in Volume II.

6.4 VENT RISER RESULTS

The ranges of concentrations of the 17 target analytes measured at vent risers using CSL canister results are presented in Table 6-14. A condensed version of the complete data set is included as Appendix II of this report. The complete data sets as received from the laboratories are included in Volume II of this report.

TABLE 6-1
OFFSITE CANISTER SPIKE CONCENTRATION

Compound	Spike Concentration (ppbv)		
	Standard Concentration	Dilution Factor	Standard Concentration
Freon 12	5.20	6.09	31.67
Vinyl Chloride	5.07	6.09	30.88
Freon 11	4.40	6.09	26.80
1,1-Dichloroethene	4.87	6.09	29.66
Dichloromethane	5.00	6.09	30.45
Trichlorotrifluoroethane	91.00	0.73	66.43
1,1-Dichloroethane	5.05	6.09	30.75
Chloroform	4.94	6.09	30.08
1,1,1-Trichloroethane	4.98	6.09	30.33
1,2-Dichloroethane	4.97	6.09	30.27
Benzene	2.01	6.09	12.24
Carbon Tetrachloride	4.81	6.09	29.29
Trichloroethene	4.95	6.09	30.15
Toluene	2.04	6.09	12.42
Tetrachloroethane	5.01	6.09	30.51

Note: The spike concentration is calculated by multiplying the standard concentration by the dilution factor. The dilution factor is the ratio of the standard concentration to the final canister volume.

TABLE 6-2
OFFSITE REPLICATE SUMMA CANISTER ANALYSIS
VOLATILE ORGANIC SPIKE RECOVERY SUMMARY SHEET
CANISTER NO. 49
MARCH 27, 1991

Compound	Concentrations (ppbv)							Percent RSD
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	
Freon 12	24.0	26.6	16.0	22.0	19.7	21.1	14.1	19.8
Vinyl Chloride	46.1	46.1	22.3	37.4	35.2	30.8	35.0	21.5
Freon 11	22.6	22.4	16.8	19.0	17.9	18.2	18.0	11.0
1,1-Dichloroethene	25.0	25.2	20.6	21.2	19.1	19.0	20.3	11.2
Dichloromethane	37.0	36.8	29.0	31.1	30.2	29.9	33.5	9.5
Trichlorotrifluoroethane	93.9	95.0	76.4	80.2	75.1	76.9	50.9	17.3
1,1-Dichloroethane	24.9	24.8	26.9	19.1	20.5	18.3	20.5	14.0
Chloroform	38.0	38.6	37.7	33.2	31.5	31.0	31.2	9.4
1,1,1-Trichloroethane	40.6	40.4	34.0	36.2	33.3	35.2	32.9	8.3
1,2-Dichloroethane	37.3	38.2	33.1	33.9	30.7	32.6	30.7	8.2
Benzene	15.5	14.9	13.1	13.8	12.8	13.7	12.6	7.3
Carbon Tetrachloride	38.6	38.6	32.8	34.8	32.0	34.1	32.0	7.6
Trichloroethene	35.1	33.7	28.8	30.8	28.2	29.2	27.5	8.8
Toluene	14.8	14.9	12.8	13.7	12.6	13.4	11.8	8.0
Tetrachloroethane	35.2	34.8	30.4	32.2	28.9	30.7	26.6	9.2

TABLE 6-3
RECOVERY STUDY
OFFSITE SPIKED SUMMA CANISTER

Compound	Recoveries (Percent)							Average Recovery
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	
Freon 12	75.8	84.1	50.4	69.3	62.2	66.5	44.5	64.7
Vinyl Chloride	149.3	149.4	72.1	121.2	114.0	99.9	113.3	117.0
Freon 11	84.2	83.5	62.7	71.0	66.7	67.8	67.2	71.9
1,1-Dichloroethene	84.2	84.9	69.5	71.5	64.2	64.0	68.5	72.4
Dichloromethane	121.5	120.9	95.1	102.0	99.3	98.1	109.9	106.7
Trichlorotrifluoroethane	141.3	143.0	115.0	120.7	113.0	115.8	76.6	117.9
1,1-Dichloroethane	81.0	80.6	87.3	62.0	66.5	59.3	66.6	71.9
Chloroform	126.4	128.4	125.2	110.5	104.6	103.0	103.6	114.5
1,1,1-Trichloroethane	134.0	133.2	112.1	119.2	109.7	116.0	108.4	119.0
1,2-Dichloroethane	123.2	126.3	109.2	112.0	101.3	107.7	101.3	111.6
Benzene	126.8	121.3	107.0	113.0	104.5	111.7	102.6	112.4
Carbon Tetrachloride	131.8	131.8	112.0	118.8	109.3	116.3	109.3	118.5
Trichloroethene	116.3	111.9	95.5	102.0	93.5	96.8	91.3	101.0
Toluene	119.1	119.8	102.8	110.0	101.2	107.6	94.6	107.9
Tetrachloroethane	115.3	114.1	99.5	105.5	94.8	100.7	87.1	102.4

TABLE 6-4
SPIKED BAG CONCENTRATION
(OFFSITE LABORATORY)

Compound	Standard Concentration	First Spike	Second Spike	Total Concentration (ppbv)
Freon 12	5.20	10.13	31.67	41.80
Vinyl Chloride	5.07	9.88	30.88	40.76
Freon 11	4.40	8.57	26.80	35.37
1,1-Dichloroethene	4.87	9.49	29.66	39.15
Dichloromethane	5.00	9.74	30.45	40.19
Trichlorotrifluoroethane	91.00	177.34	109.20	286.54
1,1-Dichloroethane	5.05	9.84	30.75	40.60
Chloroform	4.94	9.63	30.08	39.71
1,1,1-Trichloroethane	4.98	9.71	30.33	40.03
1,2-Dichloroethane	4.97	9.69	30.27	39.95
Benzene	2.01	3.92	12.24	16.16
Carbon Tetrachloride	4.81	9.37	29.29	38.67
Trichloroethene	4.95	9.65	30.15	39.79
Toluene	2.04	3.98	12.42	16.40
Tetrachloroethane	5.01	9.76	30.51	40.27

Note: Individual Tedlar bags were spiked from a single canister. The canister was prepared in two steps. First the canister was spiked and then analyzed by GC/MS. At this point the analyst determined that the F-13 concentration was too high so the canister was partially evacuated and respiked. The total concentration is the sum of the first spike remaining and the second spike. The dilution factors include the volume of spike and the final canister volume.

First Dilution Factor: 0.32

Second Dilution Factor: 6.09

TABLE 6-5
 REPLICATE TEDLAR BAG SPIKES
 VOLATILE ORGANIC SPIKE RECOVERY SUMMARY SHEET
 MARCH 15, 1991
 (OFFSITE LABORATORY)

Compound	Concentrations (ppbv)							Percent	
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	RSD	
Freon 12	43.50	44.60	39.36	32.69	53.38	47.12	54.34	15.0	
Vinyl Chloride	62.80	59.70	58.82	55.44	75.43	49.18	36.70	19.0	
Freon 11	29.70	30.70	32.11	22.00	27.57	16.75	23.23	19.0	
1,1-Dichloroethene	37.80	35.45	36.31	33.10	44.15	33.10	37.50	9.0	
Dichloromethane	55.00	48.40	41.68	45.60	61.76	38.24	41.61	16.0	
Trichlorotrifluoroethane	415.00	371.00	397.00	372.00	392.00	351.00	310.00	8.0	
1,1-Dichloroethane	39.40	35.94	37.26	34.90	45.39	33.50	37.73	9.0	
Chloroform	45.40	41.50	44.02	40.30	62.20	38.74	44.75	16.0	
1,1,1-Trichloroethane	48.20	40.60	46.96	40.20	47.56	38.33	47.18	8.0	
1,2-Dichloroethane	48.90	40.80	47.23	41.50	49.08	38.74	47.68	8.0	
Benzene	19.10	15.70	18.15	15.90	18.49	14.83	18.14	8.0	
Carbon Tetrachloride	44.40	37.30	42.68	37.70	43.77	35.20	42.77	8.0	
Trichloroethene	43.80	36.40	41.00	35.80	41.66	34.54	41.34	8.0	
Toluene	28.70	22.30	27.80	22.10	26.33	21.38	27.46	11.0	
Tetrachloroethane	39.80	33.33	37.63	32.80	25.64	30.95	36.93	13.0	

TABLE 6-6
RECOVERY STUDY
TEDLAR BAG
(OFFSITE LABORATORY)

Compound	Recoveries (Percent)							Average Recovery
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	
Freon 12	104.0	106.8	94.2	78.2	127.7	112.7	130.0	107.0
Vinyl Chloride	154.1	146.5	144.3	136.0	185.1	120.7	90.0	139.0
Freon 11	84.0	86.7	90.8	62.2	77.9	47.4	65.7	73.0
1,1-Dichloroethene	96.5	90.6	92.7	84.6	112.8	84.5	95.8	93.0
Dichloromethane	136.7	120.3	103.7	113.5	153.7	95.1	103.5	118.0
Trichlorotrifluoroethane	144.8	129.5	138.5	129.7	136.7	122.5	108.2	130.0
1,1-Dichloroethane	97.0	88.5	91.8	85.9	111.8	82.5	92.9	92.0
Chloroform	114.4	104.5	110.8	101.5	156.6	97.6	112.7	114.0
1,1,1-Trichloroethane	120.3	101.5	117.3	100.4	118.8	95.7	117.9	110.0
1,2-Dichloroethane	122.3	102.0	118.2	104.0	122.8	97.0	119.3	112.0
Benzene	117.9	97.4	112.3	98.4	114.4	91.8	112.3	106.0
Carbon Tetrachloride	114.8	96.6	110.4	97.6	113.2	91.0	110.6	104.0
Trichloroethene	110.1	91.4	103.0	90.0	104.7	86.8	103.9	98.0
Toluene	174.8	136.2	169.5	134.9	160.6	130.4	167.4	153.0
Tetrachloroethane	98.8	82.8	93.4	81.5	63.7	76.8	91.7	84.0

TABLE 6-7
SOLID SORBENT TUBE SPIKE CONCENTRATION
(ACTIVATED CARBON - OFFSITE)

Compounds	Spike Concentration (ng)
Freon-12	25.4
Vinyl Chloride	9.82
Freon-11	33.9
1,1-Dichloroethene	25.9
Dichloromethane	23.7
1,1-Dichloroethane	16.3
Chloroform	22.2
1,1,1-Trichloroethane	39.6
1,2-Dichloroethane	21.7
Benzene	6.62
Carbon Tetrachloride	54.6
Trichloroethene	67.2
Toluene	14.6
Tetrachloroethene	97.0

TABLE 6-8
 REPLICATE SOLID SORBENT TUBE
 VOLATILE ORGANIC SPIKE RECOVERY SUMMARY SHEET
 (ACTIVATED CARBON - OFFSITE)

Compounds	Run 1 (ng)	Run 2 (ng)	Run 3 (ng)	Run 4 (ng)	Run 5 (ng)	Run 6 (ng)	Run 7 (ng)	% RSD
Freon 12	23.0	29.3	25.1	24.3	23.1	23.9	21.8	9.2
Vinyl Chloride	9.7	11.2	10.0	9.4	9.4	9.0	8.4	8.6
Freon 11	24.0	31.6	27.5	26.0	24.9	24.3	22.4	10.7
1,1-Dichloroethene	19.3	24.4	21.4	20.6	19.0	18.6	17.4	10.6
Dichloromethane	16.8	19.5	19.6	16.8	17.8	14.5	16.3	9.7
1,1-Dichloroethane	16.1	20.3	16.9	20.4	18.0	18.5	17.8	8.1
Chloroform	24.0	27.6	24.1	24.7	25.2	23.1	25.0	5.4
1,1,1-Trichloroethane	34.3	32.5	36.3	32.6	36.3	36.4	38.9	6.1
1,2-Dichloroethane	20.5	20.3	22.8	20.5	22.9	20.2	23.1	6.0
Benzene	7.1	6.4	7.3	6.6	7.8	6.8	7.8	7.0
Carbon Tetrachloride	46.2	48.1	49.9	47.9	54.0	54.7	59.9	8.7
Trichloroethene	58.8	57.1	66.7	59.1	68.0	65.9	72.1	8.2
Toluene	11.9	10.8	13.4	10.6	13.9	10.0	13.5	12.3
Tetrachloroethane	112.1	104.0	129.3	106.3	130.9	107.1	134.4	10.4

TABLE 6-9
RECOVERY STUDY
SPIKED SORBENT TUBES
MARCH 26, 1991
(ACTIVATED CARBON - OFFSITE)

Compounds	Recoveries (Percent)							Average Recovery
	Tube 1	Tube 2	Tube 3	Tube 4	Tube 5	Tube 6	Tube 7	
Freon 12	90.6	115.2	99.0	95.8	90.8	94.0	85.7	95.9
Vinyl Chloride	98.8	114.1	102.0	95.9	95.3	91.4	85.3	97.6
Freon 11	70.8	93.1	81.1	76.5	73.4	71.6	66.2	76.1
1,1-Dichloroethene	74.5	94.2	82.8	79.6	73.2	71.9	67.3	77.7
Dichloromethane	70.9	82.2	82.7	71.0	74.9	61.1	68.6	73.1
1,1-Dichloroethane	98.9	124.3	103.7	125.0	110.4	113.5	109.2	112.1
Chloroform	108.2	124.3	108.4	111.0	114.8	104.1	112.4	111.9
1,1,1-Trichloroethane	86.7	82.0	91.7	82.3	91.6	91.9	98.3	89.2
1,2-Dichloroethane	94.2	93.5	105.3	94.3	105.4	92.9	106.4	98.9
Benzene	107.3	97.0	110.6	100.0	117.2	102.9	117.5	107.5
Carbon Tetrachloride	84.6	88.1	91.5	87.8	98.9	100.2	109.7	94.4
Trichloroethene	87.5	85.0	98.2	87.9	101.2	98.1	107.4	95.2
Toluene	81.4	73.6	91.7	72.8	94.9	68.2	92.3	82.1
Tetrachloroethane	115.6	107.2	133.2	109.50	134.9	110.4	138.6	121.4

TABLE 6-10
CLOSE SUPPORT LAB CANISTER
SPIKE CONCENTRATION

Compounds	Concentration (ppbv)
Freon-12	15
Vinyl Chloride	15
Freon-11	15
1,1-Dichloroethene	15
Freon-113	15
Dichloromethane	15
1,1-Dichloroethane	15
1,2-Dichloroethane	15
Chloroform	15
1,1,1-Trichloroethane	15
1,2-Dichloroethene	15
Benzene	15
Carbon Tetrachloride	15
Trichloroethene	15
Toluene	15
Tetrachloroethene	15

Spike Concentration Uncertainty 10%

TABLE 6-11
VOLATILE ORGANIC SPIKE RECOVERY SUMMARY SHEET
REPLICATE CLOSE SUPPORT LAB CANISTER

Compounds	Run 1 (ppbv)	Run 2 (ppbv)	Run 3 (ppbv)	Run 4 (ppbv)	Run 5 (ppbv)	Run 6 (ppbv)	Run 7 (ppbv)	% RSD
Freon 12	15.4	16.9	15.2	15.0	14.6	17.2	11.5	11.4
Vinyl Chloride	15.8	18.2	15.7	14.9	14.9	18.4	12.2	12.5
Freon 11	13.8	15.7	13.7	13.6	13.6	15.6	10.5	11.6
1,1-Dichloroethene	14.2	15.8	14.0	14.3	14.5	16.2	10.4	12.3
Freon 113	14.1	15.8	13.7	13.4	12.2	15.9	9.4	15.4
Dichloromethane	14.7	16.2	14.9	14.5	14.3	16.5	11.2	11.0
1,1-Dichloroethane	14.1	15.4	12.5	13.4	13.5	15.6	10.4	12.1
1,2-Dichloroethane	15.2	16.6	14.9	15.7	15.2	16.7	14	5.6
Chloroform	14.8	16.4	15.2	14.6	14.2	17.0	11.1	11.9
1,1,1-Trichloroethane	15.5	16.9	15.2	15.5	15.8	16.9	14.2	5.6
1,2-Dichloroethene	14.5	15.9	13.7	13.8	13.8	14.9	12.0	7.9
Benzene	16.0	17.4	15.3	15.7	15.5	16.8	14.0	6.5
Carbon Tetrachloride	16.6	17.9	16.0	16.1	16.3	17.5	14.7	5.9
Trichloroethene	15.0	16.2	14.4	14.7	14.8	16.1	13.7	5.5
Toluene	10.5	11.8	10.6	10.6	10.7	11.3	9.6	5.7
Tetrachloroethane	16.3	17.7	15.7	16.1	16.2	17.6	14.7	6.0

TABLE 6-12
RECOVERY STUDY
CLOSE SUPPORT LAB SUMMA CANISTER

Compounds	Recoveries (Percent)							AVERAGE RECOVERY
	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	
Freon 12	102.7	112.5	101.1	99.9	97.2	114.3	76.6	100.6
Vinyl Chloride	105.2	121.2	104.5	99.5	99.1	122.9	81.6	104.9
Freon 11	91.7	104.9	91.6	90.9	90.5	104.1	70.0	91.9
1,1-Dichloroethane	94.4	105.6	93.4	95.5	96.5	108.2	69.3	94.7
Freon 113	94	105.6	91.4	89.6	81.5	106.1	62.7	90.1
Dichloromethane	98.1	108.3	99.0	96.8	95.5	109.9	74.6	97.4
1,1-Dichloroethane	93.7	102.4	83.5	89.3	89.8	104.0	69.4	90.3
1,2-Dichloroethane	101.6	110.5	99.3	104.4	101.5	111.3	93.6	103.2
Chloroform	98.9	109.6	101.0	97.1	94.7	113.0	73.9	98.3
1,1,1-Trichloroethane	103.6	112.5	101.5	103.3	105.1	112.9	94.9	104.8
1,2-Dichloroethane	96.6	106.1	91.1	92.3	92.1	99	80.3	93.9
Benzene	106.5	116.1	101.9	104.9	103.2	112.3	93.3	105.5
Carbon Tetrachloride	110.7	119.1	106.5	107.1	108.9	116.5	97.9	109.5
Trichloroethene	100.3	107.8	96.2	97.9	98.6	107.5	91.3	99.9
Toluene	70.3	78.4	70.8	70.7	71.2	75.3	64.3	71.6
Tetrachloroethane	108.5	117.9	104.9	107.0	107.7	117.4	98.0	108.8

TABLE 6-13
MONITORING WELLS
SUMMARY OF RESULTS
DATA GENERATED AT CSL
CONCENTRATION RANGES (PPBV)

Compounds	Shallow Well (11 - 15 FT)			Mid Well (34 - 44 FT)			Deep Well (69 - 79 FT)			Ambient Air
	MW-3	MW-6	MW-9	MW-2	MW-5	MW-8	MW-1	MW-4	MW-7	
Dichlorodifluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	88-140	N.D.-21	N.D.-13.1	N.D.-4.8	N.D.-21	16-73	N.D.-150	N.D.	N.D.-385	N.D.-4
Trichlorofluoromethane	N.D.	0.8-3.3	39-65.3	26.9-38.5	N.D.-1.5	250-414	72-468	1.4-2.7	34-876	N.D.
1,1-Dichloroethene	N.D.	N.D.-490	N.D.	N.D.-280	N.D.-34	9,200-11,000	880-2,688	N.D.-120	N.D.	N.D.-3
1,1-Dichloroethane	N.D.	N.D.	N.D.-1.3	N.D.	N.D.	111-180	N.D.	2-3	8,113-16,470	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.-0.8	N.D.	5.3-8.1	N.D.	1.3-1.8	28-99.8	N.D.
1,2-Dichloroethene				3.3-7.7						N.D.
Freon 113	140-830	240-690	N.D.-166.2	2,500-15,000	N.D.-334	5,400-10,648	N.D.-4,300	N.D.-400	N.D.-7,998	N.D.
1,2-Dichloroethane	N.D.	N.D.	N.D.-1	N.D.	N.D.	13.4-18.3	N.D.	N.D.	606-1,278	N.D.
1,1,1-Trichloroethane	N.D.	N.D.	13.9-19.4	N.D.	N.D.	208-302	N.D.-3.5	1.4-2.5	120-290	N.D.
Carbon Tetrachloride	2.8-5.8	N.D.	N.D.	26-59.5	N.D.	2.4-3.4	N.D.-23.8	N.D.	N.D.-3.8	N.D.
Trichloroethene	4.4-7.9	46-59	28.4-34.5	83.8-182	103-116	175-1,312	N.D.-21.4	N.D.-126	3,743-22,049	N.D.
Tetrachloroethene	N.D.	N.D.	1.2-1.3	N.D.	N.D.	25-33	N.D.	N.D.-1.1	88-256	N.D.
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	N.D.	N.D.	N.D.	N.D.-2.3	N.D.	4.3-6.1	N.D.	N.D.	236-512	N.D.
Toluene	N.D.	N.D.	N.D.	N.D.-1.6	N.D.	N.D.	N.D.	N.D.	N.D.-11.2	N.D.
c-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
t-1,2-Dichloroethene	N.D.	3.9-4.3	N.D.		46-49	8.6-13.6	N.D.	102-237	5,343-8,457	

* N.D. - Not Detected
Ambient air results from 2 canisters collected 4/12/91 near Higgs property line

TABLE 6-14
VENT RISERS
SUMMARY OF RESULTS
DATA GENERATED AT CSL
CONCENTRATION RANGES (PPBV)

Compounds	VR-1-3	VR-3-1	VR-3-4	VR-3-5	VR-3-6	VR-3-9	VR-4-2	VR-4-3	VR-4-4	VR-6-1
Dichlorodifluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	N.D.-3	N.D.	4.3	2.6	N.D.	1.2	N.D.-8.8	1.55-2.2	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.-0.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-3.3
1,1-Dichloroethene	N.D.	N.D.	160	N.D.	240	15.8	N.D.	N.D.	1	870
1,1-Dichloroethane	N.D.	1.1-5.6	1.6-3.1	N.D.-1.3	2.5-17.2	N.D.	N.D.	N.D.	N.D.	219-550
Chloroform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-1.2
1,2-Dichloroethene	N.D.									
Freon 113	2.4-130	N.D.	123	106	200	25.8	49-63	7.5-8.9	7	450
1,2-Dichloroethane	N.D.	4.8-9.3	12.2-17.9	5.7-7.6	8.2-20.3	1.3-2.4	N.D.	N.D.	N.D.	N.D.-13.5
1,1,1-Trichloroethane	N.D.	93-178	207-308	106-141	118-252	21-37	3.6-6.5	N.D.	N.D.	40-360
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	26-53	672-110	45-63	49.3-200	7.9-11.5	N.D.	N.D.-1.7	N.D.-1.7	34-215
Tetrachloroethene	N.D.	N.D.-1.8	N.D.-2.6	1.2-1.8	N.D.-1.7	N.D.	N.D.	N.D.	N.D.	6.1-34.2
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	N.D.	N.D.-0.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-1
Toluene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
c-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-8.7
t-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.-8.6	N.D.	N.D.	N.D.	N.D.	423-530

*N.D. - Not Detected

7.0 COMPARISONS AND RECOMMENDATIONS

7.1 ADVANTAGES OF MEDIA

All the media used on this project have advantages and disadvantages. The advantages include the following:

Solid Sorbents:

- Can be used to collect large sample volumes and so can be used to analyze very low concentrations of certain analytes.
- Adsorb and desorb certain analytes very well, providing better results for those analytes (e.g., benzene).
- Media is inexpensive.

Tedlar Bags:

- Require no field volume measurement (flow rate, time).
- Media is inexpensive.
- Sample can be analyzed more than once.
- Sample transfer for analysis is readily accomplished.
- Not analyte specific, allowing detection and quantitation of a wide range of analytes.

Non-Pressurized Canisters:

- Require no field volume measurement (flow rate, time).
- Samples can be analyzed more than once.
- Sample preservation is simple.
- Media provides for very limited sample degradation because of reaction or loss through container surfaces.

Pressurized Canisters:

- Require no field volume measurement (flow rate, time).
- Collect greater sample volumes than non-pressurized canisters.
- Samples can be analyzed more than once.
- Media provides for very limited sample degradation because of reaction or loss through container surfaces.
- Excellent recovery of most organic analytes.
- Not analyte specific, allowing for detection and quantitation of wide range of analytes.

The soil gas sampled at Area D is a complex mixture of substances with high moisture content and a large number of compounds present. The target analytes for this project were found in concentrations ranging from less than 1 part per billion (ppbv) to several parts per million (ppmv), a span of four orders of magnitude. To sample this gas and analyze it for a general list of target compounds and for the first samples withdrawn from this complex matrix, canisters are the recommended sampling media. Non-pressurized canister samples, analyzed twice to adjust analysis injection volumes to quantitate both the compounds present in high concentrations and those in low concentrations, provide an optimum sampling media.

The above summary of media advantages suggests that a sampling protocol combining the advantages of more than one type of media would be successful. Such a system could be optimized for each particular situation and might include a solid sorbent sampling tube in a series arrangement with an evacuated canister. The solid sorbent could be designed to capture specific compounds, and the canister would capture any that passed through the tube.

7.2 COMPARISON OF RESULTS—CSL VERSUS OFFSITE LAB

A general comparison of results from the two laboratories can be drawn from the numbers of data flags (data that exceeded quality control criteria) for each lab over the period of the project. Quality control data flags were extracted from the subconsultant's reports on data quality presented in Volume II of this report. The CSL analyzed samples for 10 days and produced 39 data flags. The offsite laboratory analyzed 17 batches of data (17 days) and generated two data flags. This suggests that it was much more difficult to maintain data at the CSL within the QC limits. This may be due to a lack of time for optimizing the system leased for the CSL portion of the project, staff less familiar with the leased equipment than those at the offsite laboratory, and

instability of power and laboratory temperature. The recovery study data contained in Section 6 of this report indicates that the two laboratories provided a comparable recovery of target analytes and that the two data sets were of comparable (and high) quality.

7.3 MEDIA COMPARISON

CH2M HILL developed an arbitrary technique to compare the various media. Each media type was assigned a point value ranging from 1 to 5 (5 being good) for five performance criteria: accuracy, analytical precision, sampling precision, cost of media and analysis, ease of use, and holding time for a sample in the media.

Accuracy was evaluated using the results of the recovery studies, with a point value assigned for both the mean recovery for all the project analytes and the range of recoveries documented. Analytical precision was based on the relative standard deviations reported in the recovery studies, a low deviation for all analytes judged to indicate greater analytical precision. Sampling precision was determined for each type of media by comparing the number of relative percent differences (RPD) that exceeded quality control criteria to the total number of analytes detected in both samples of the field duplicates. The totals are presented in Table 7-1. Costs of media and analysis were averages of responses to a laboratory cost survey conducted as a part of the competitive bidding for the analytical work on this project. It was assumed that the solid sorbents would be sampled using two tubes in series, doubling the number of samples and thus the cost. Ease of use was a subjective judgement based on the project field experience. Holding times were those specified for the project for each media and are a quantitative indication of the degradation of sample in the media.

Table 7-2 is a summary of the point values assigned to each media; Table 7-3 presents the supporting information for the point values; Table 7-4 presents the laboratory cost survey results.

Pressure-filled canister samples were compared to non-pressurized canisters as part of this project. The two types of procedures produce samples that differ primarily in the quantity of sample gas; for this project, pressurized samples contained approximately twice as much gas as the non-pressurized canisters. The advantages of the pressurized samples are that they provide extra samples for reanalysis if that is necessary and they do not require laboratory pressurization for sample transfer. The drawbacks associated with pressurized canisters include the in-line pump (a source of contamination) necessary to fill them, and a considerable increase in the complexity of the sampling equipment. Pressurized canister duplicates of non-pressurized canisters indicated that sampling precision was quite low for this technique early in the sampling program. As the project progressed, the precision improved. Information published on the topic indicates that there should be good stability of the target analytes in pressurized canisters. Two different sources of poor precision have been documented: uncertainty

due to the in-line pump, and laboratory sample-transfer routines. Pressure-filled canister sampling is not recommended for the type of matrix and practical limitations associated with subsurface gas sampling in Area D. The RPD values for pressure-filled versus non-pressure-filled canister duplicates are presented in Table 7-5.

7.4 COMPARISON OF PROJECT DATA TO HISTORICAL DATA

The results of our media comparison for accuracy and precision were used to select the most representative media and laboratory for the target analytes (close support lab canisters). The results for each monitoring well (Table 7-6) and vent riser (Table 7-7) are summarized in a format similar to that for the historical data (Table 7-8) to allow the reader to compare the values. Certain target analytes were consistently present at such high concentration that the CSL could not use the same volume injection as was providing the specified sub-ppbv detection for the remaining compounds. Where this was true and where samples were not re-run to quantitate the high concentration compounds, results from the offsite canister collected at the same time are used for the three compounds in question (Freon 113, dichloromethane, and 1,1-dichloroethene). The ambient air concentrations in Table 7-6 are the result of two canisters collected April 12, 1991, next to the McClellan property-line fence on Mr. Higgs' property.

7.5 MEDIA RECOMMENDATIONS

CH2M HILL has prepared standard operating procedures (SOPs) for each of the types of media used on this project (Appendix IV). The soil gas at Area D is a complex mixture, containing a large number of compounds and a wide range of analyte concentrations. For general sampling of this type of matrix, non-pressurized canister sampling is recommended with two analyses of each sample, tailored to analyze separately for compounds found in high concentrations and compounds in low concentrations. If the gas can be characterized and sampling conditions optimized, a combination of solid sorbent and canister in series may be an optimum solution. The solid sorbent could be designed to collect compounds known to be in the sample in low concentrations, with the canister collecting any that passed through and providing sample-volume measurement and control. Sample breakthrough of solid sorbent media is a source of uncertainty in a sorbent collection strategy. During this project, solid sorbent breakthrough occurred to different degrees at the different locations. Our media selection criteria did not include this factor, but it should be considered if solid sorbents are to be used as a stand-alone collection media. Table 7-18 presents project break-through results.

7.6 DEPLETION-RECHARGE EFFECTS

Sampling was conducted at all monitoring wells to determine the effect that withdrawing gas had on the analyte concentrations. As described earlier in this report, this draw-down/recharge sampling included a low-flow and a high-flow series of samples. A total hydrocarbon analyzer was used to evaluate general trends, and canister samples were withdrawn periodically to speciate the gas being extracted. Results from the draw-down canister samples collected at the monitoring wells are shown in Tables 7-9 through 7-17. The data were evaluated to determine if differential species migration (i.e., more volatile compounds entering the extraction zone more rapidly than others) was occurring. No significant trends in species migration were observed.

Results from the total hydrocarbon analysis during draw-down sampling are summarized in Figures 7-1 through 7-9. The well concentrations were variable in response to extraction of sample; some were initially at higher concentrations than the stabilized value observed after a period of time; some showed the reverse trend. These data were evaluated to determine the volume of gas that must be extracted before the monitoring wells reach a stable concentration. Recommendations for other landfill sampling have suggested that two to three well volumes purged is adequate before sampling for analysis. Our results suggest that a considerably larger volume will have to be purged from these wells for steady-state concentrations to be observed.

The approximate volume withdrawn from each well before concentrations stabilized at the indicated total hydrocarbon concentration is as follows:

	<u>Volume (cf)</u>	<u>Number of Well Volumes</u>	<u>THC (ppm)</u>
Monitoring Well 1	23	39	120
Monitoring Well 2	12	20	90
Monitoring Well 3	5	8	12
Monitoring Well 4	1	2	9
Monitoring Well 5	7	12	2
Monitoring Well 6	20	34	2
Monitoring Well 7	20	34	450
Monitoring Well 8	8	14	190
Monitoring Well 9	2	4	50

Monitoring wells 4, 6, and 8 show anomalies that were of unclear origin. The hydrocarbon analyzer was operated in its most sensitive range for wells 4 and 6 so these data

might be showing the effect of analyzer noise. At monitoring well 8 the analyzer indicated fluctuating concentrations that may also have been related to analyzer response rather than unstable concentrations.

The well profiles (Figures 7-1 through 7-9) were evaluated to determine any trends in behavior (concentration versus time) associated with depth of well. None were observed. The trends observed were limited to the observation that well concentrations were higher in deep wells and that the highest concentrations were observed in the cluster of wells numbered 7, 8, and 9 (the cluster on the Higgs' property).

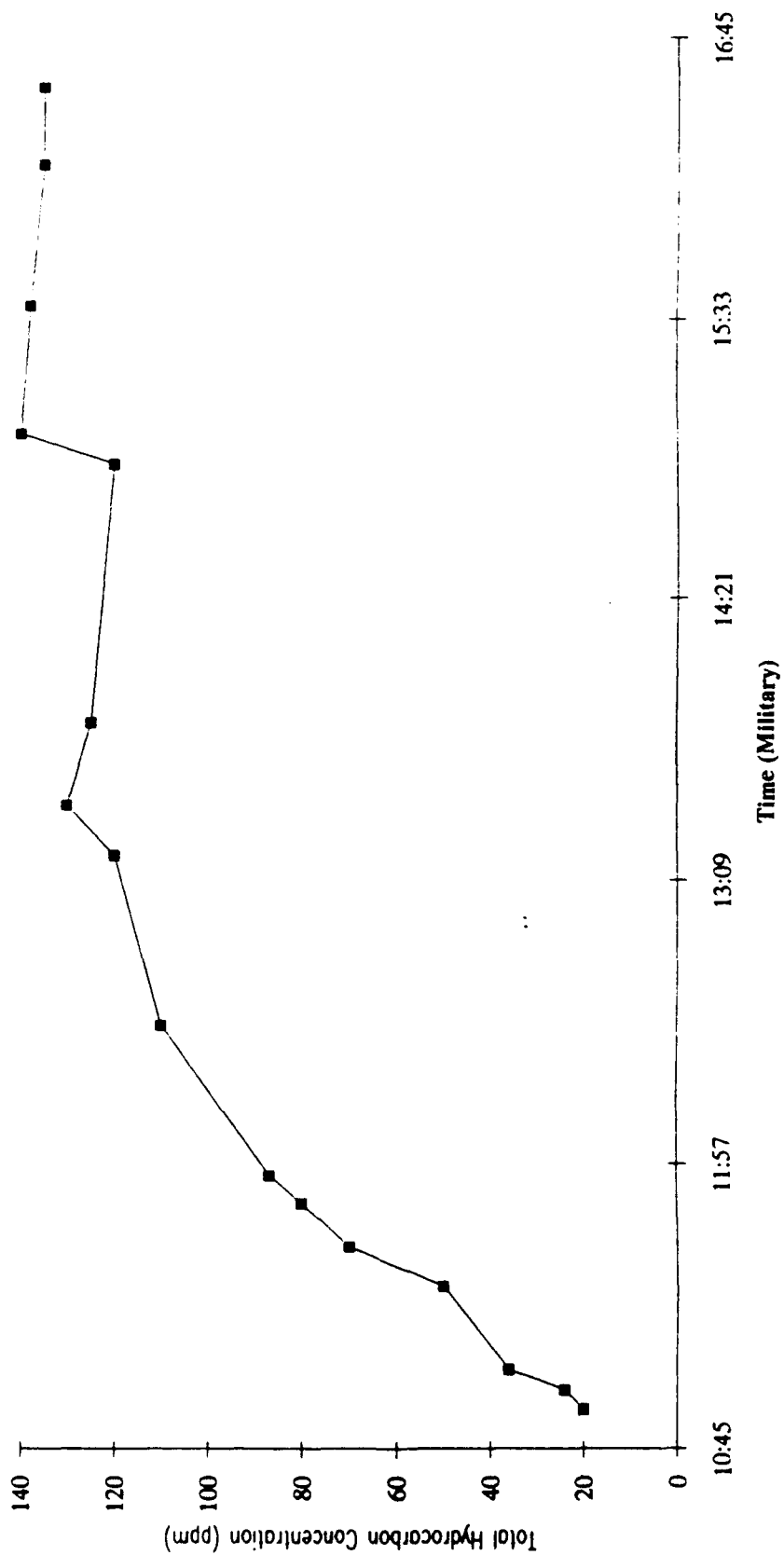


Figure 7-1
Low Flow Drawdown Concentrations
Monitoring Well #1



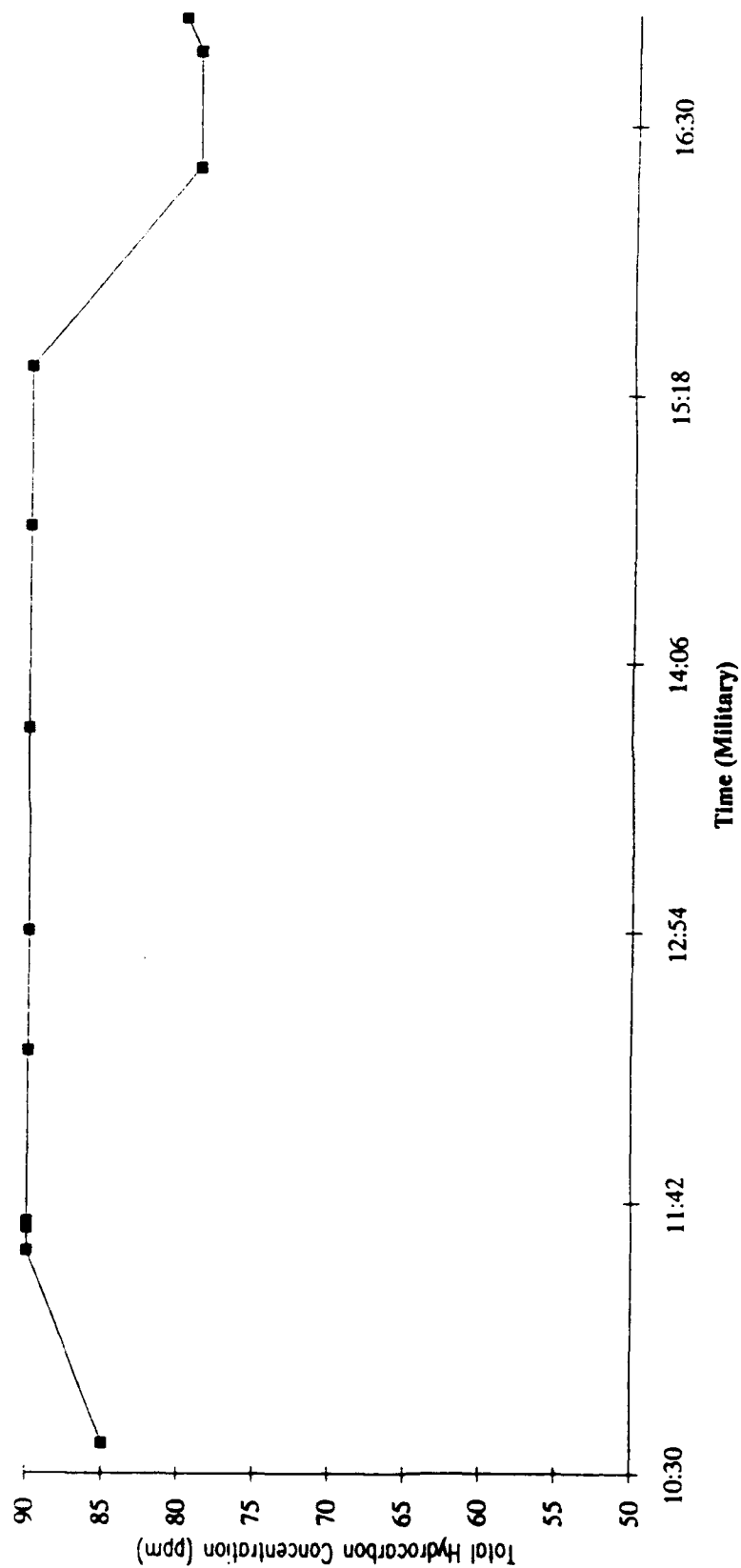


Figure 7-2
Low Flow Drawdown Concentrations
Monitoring Well #2



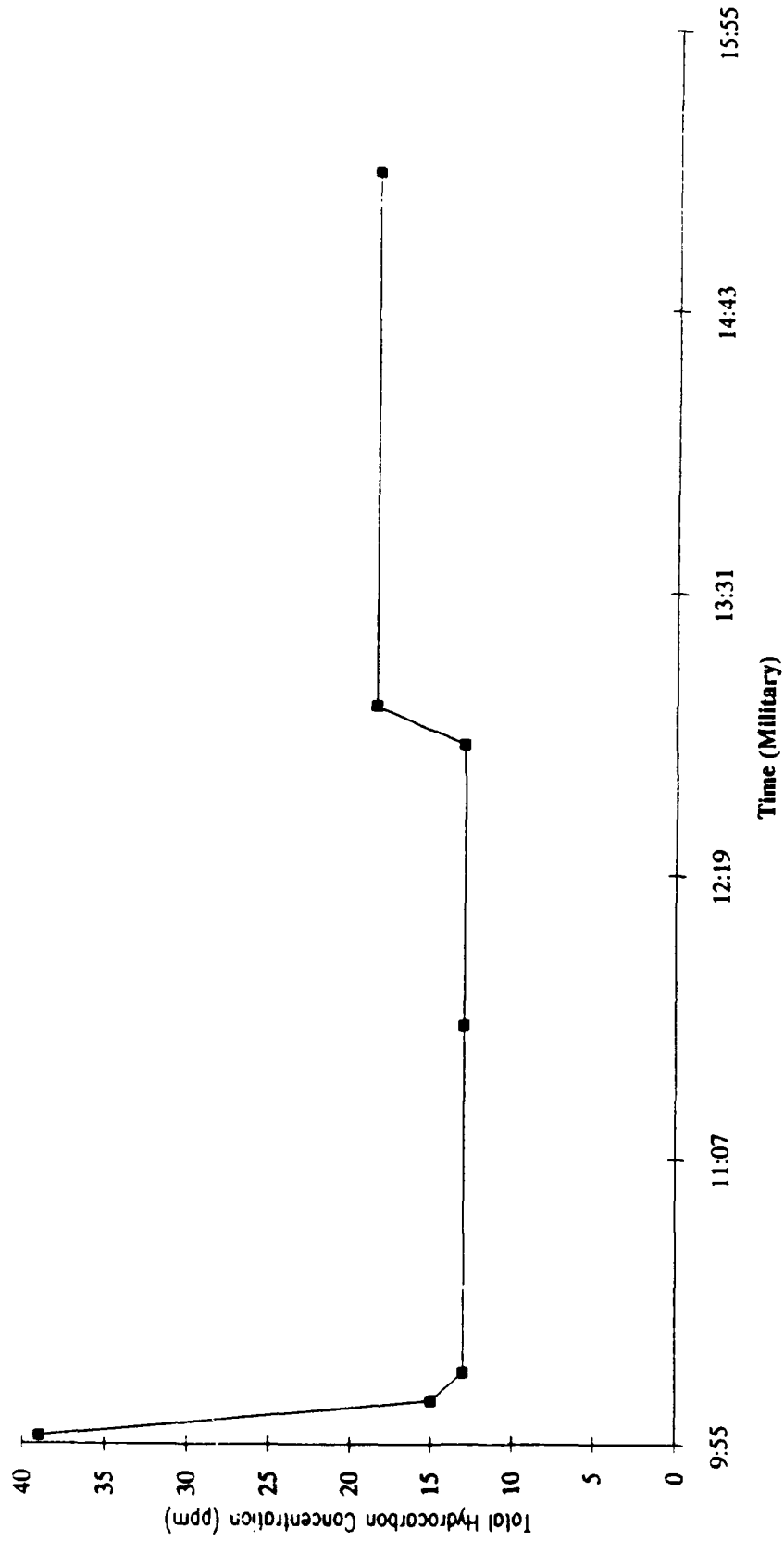


Figure 7-3
Low Flow Drawdown Concentrations
Monitoring Well #3



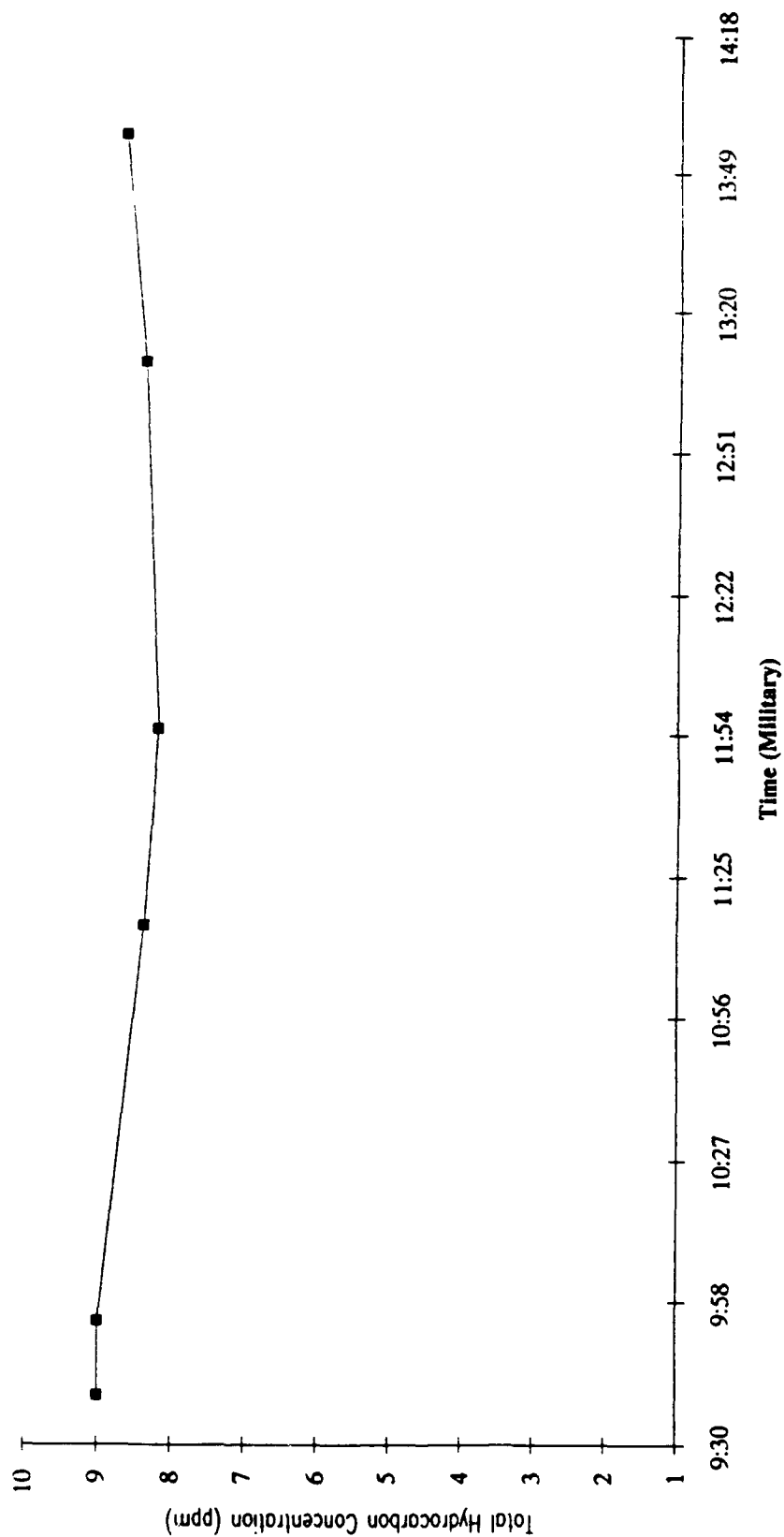


Figure 7-4
Low Flow Drawdown Concentrations
Monitoring Well #4



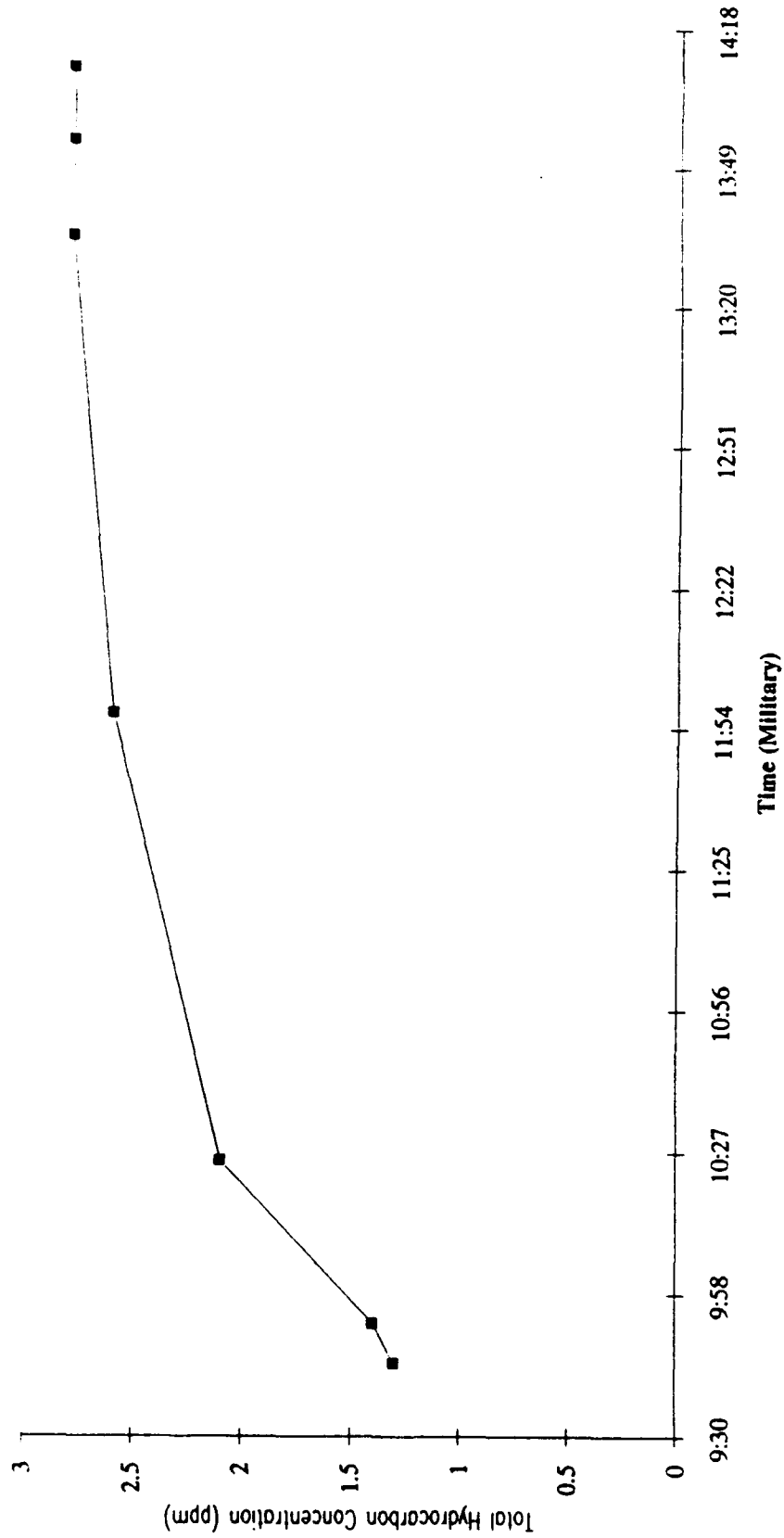


Figure 7-5
Low Flow Drawdown Concentrations
Monitoring Well #5

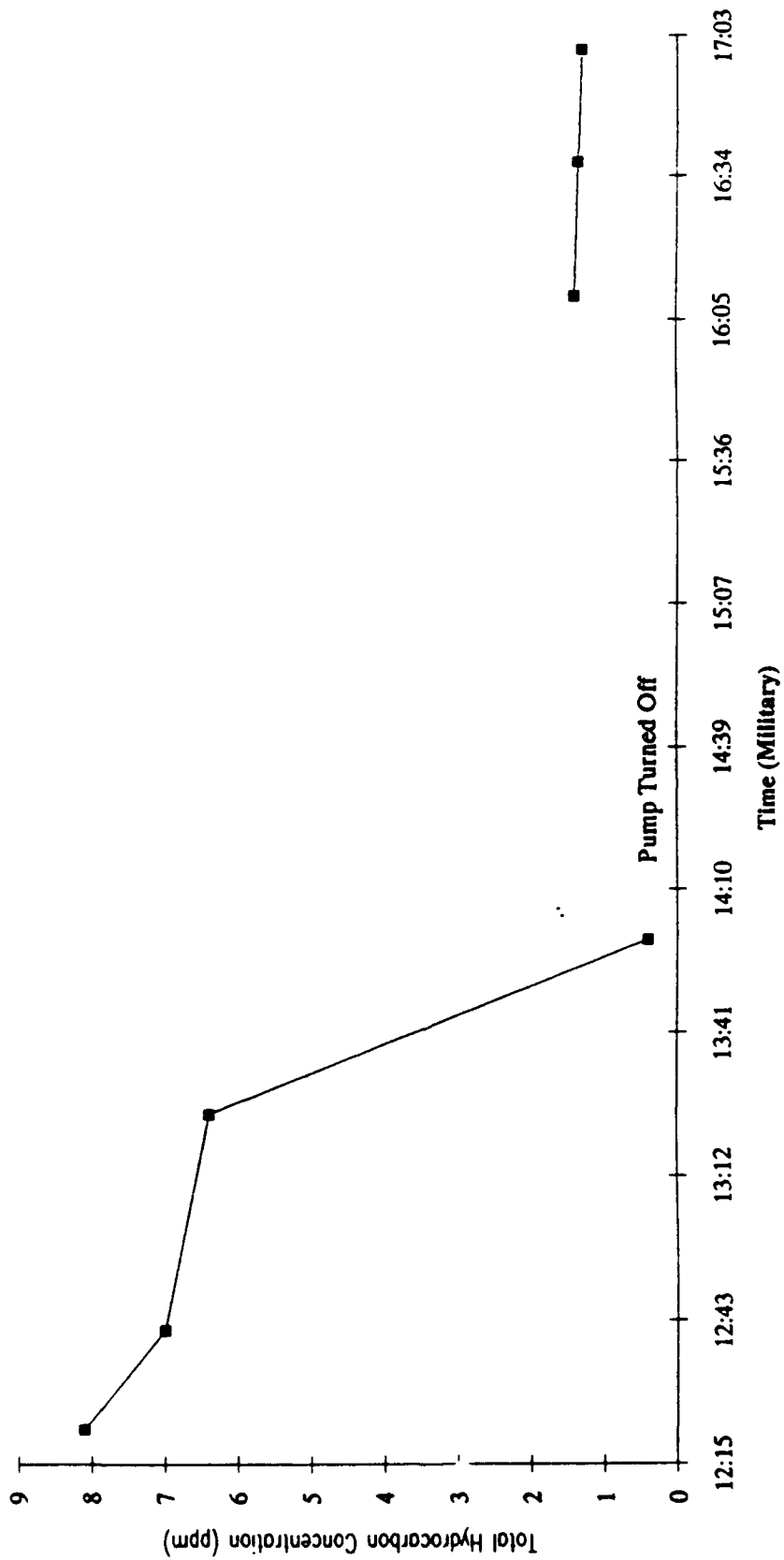


Figure 7-6
Low Flow Drawdown Concentrations
Monitoring Well #6

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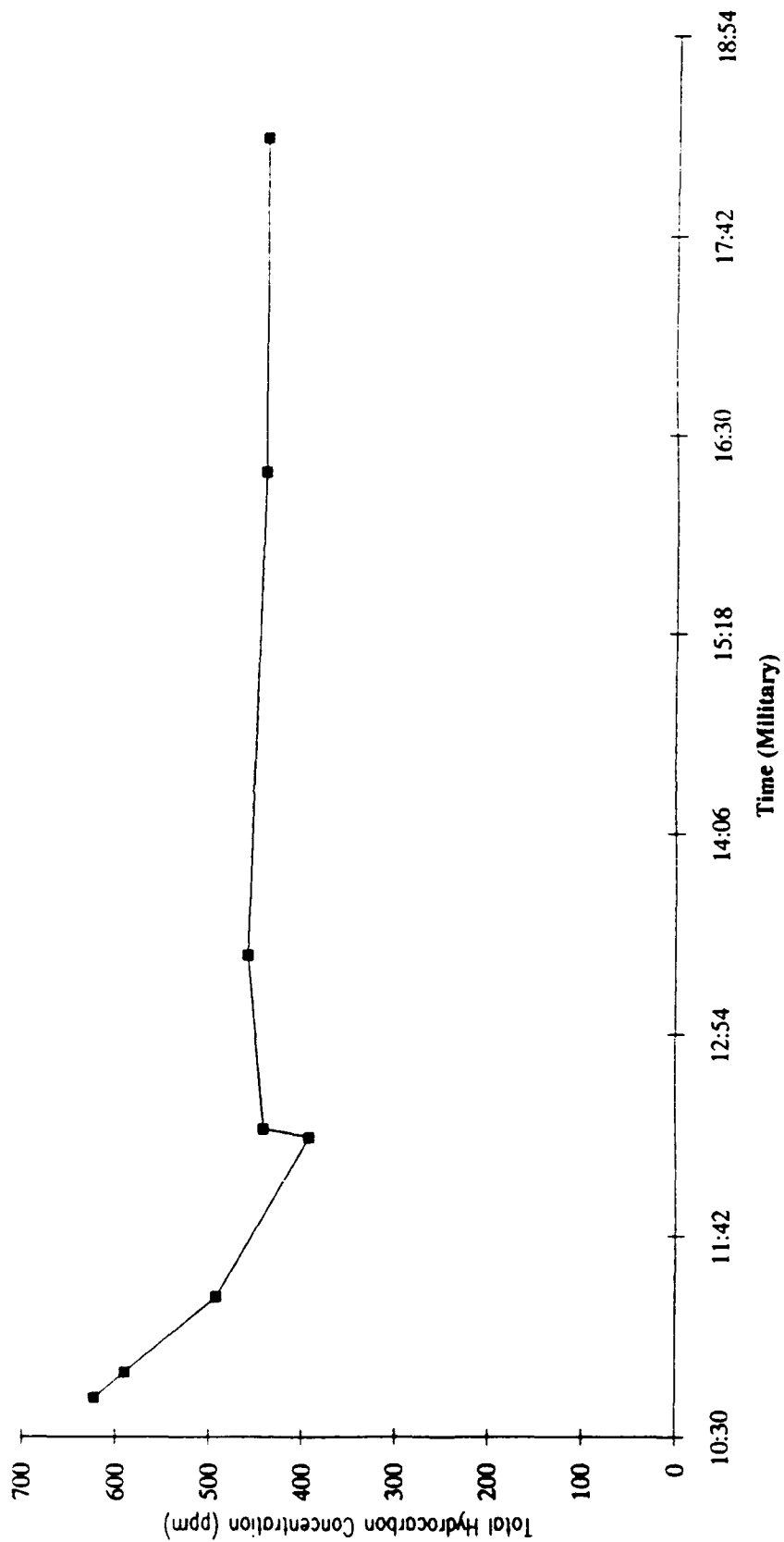


Figure 7-7
Low Flow Drawdown Concentrations
Monitoring Well #7



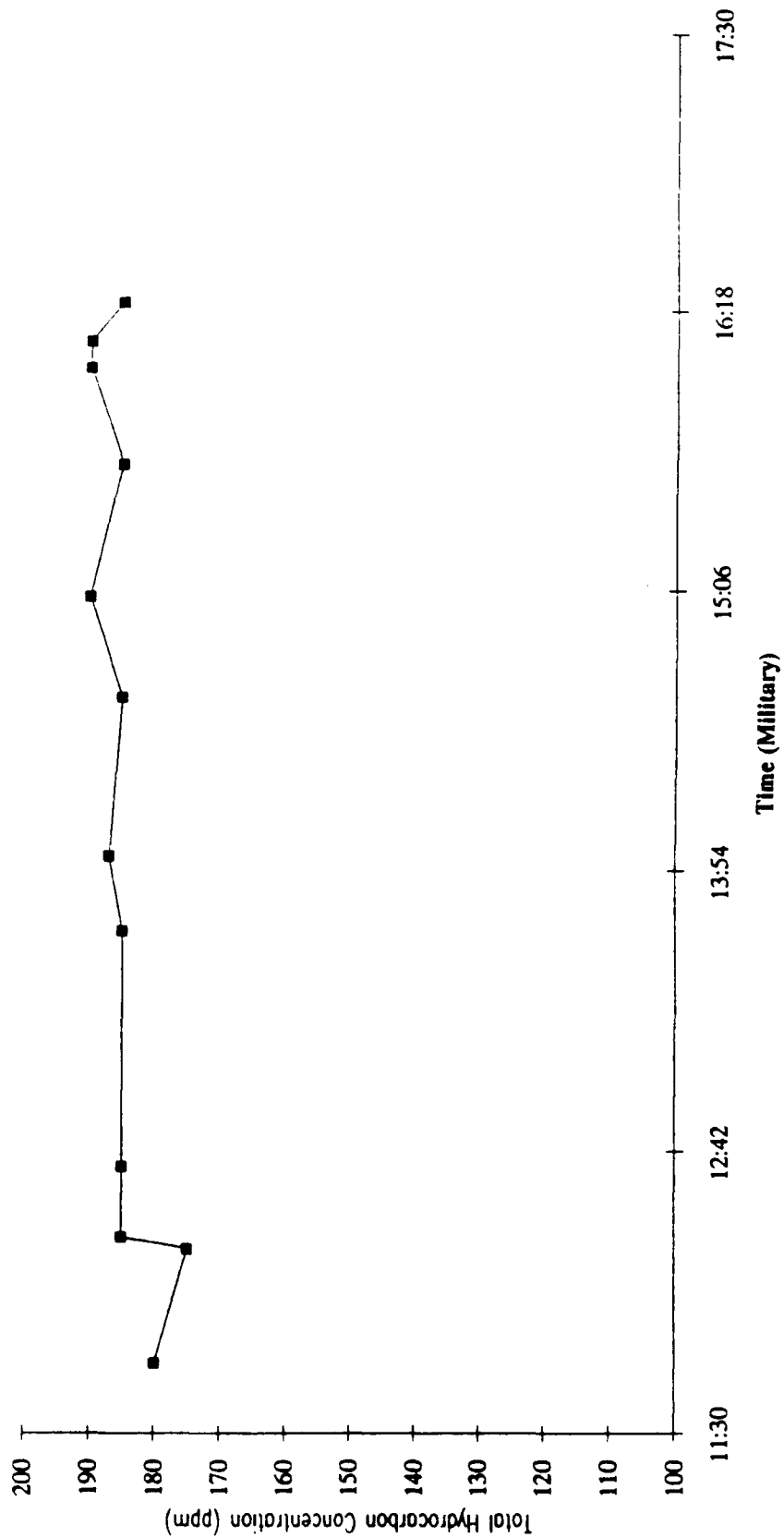


Figure 7-8
Low Flow Drawdown Concentrations
Monitoring Well #8



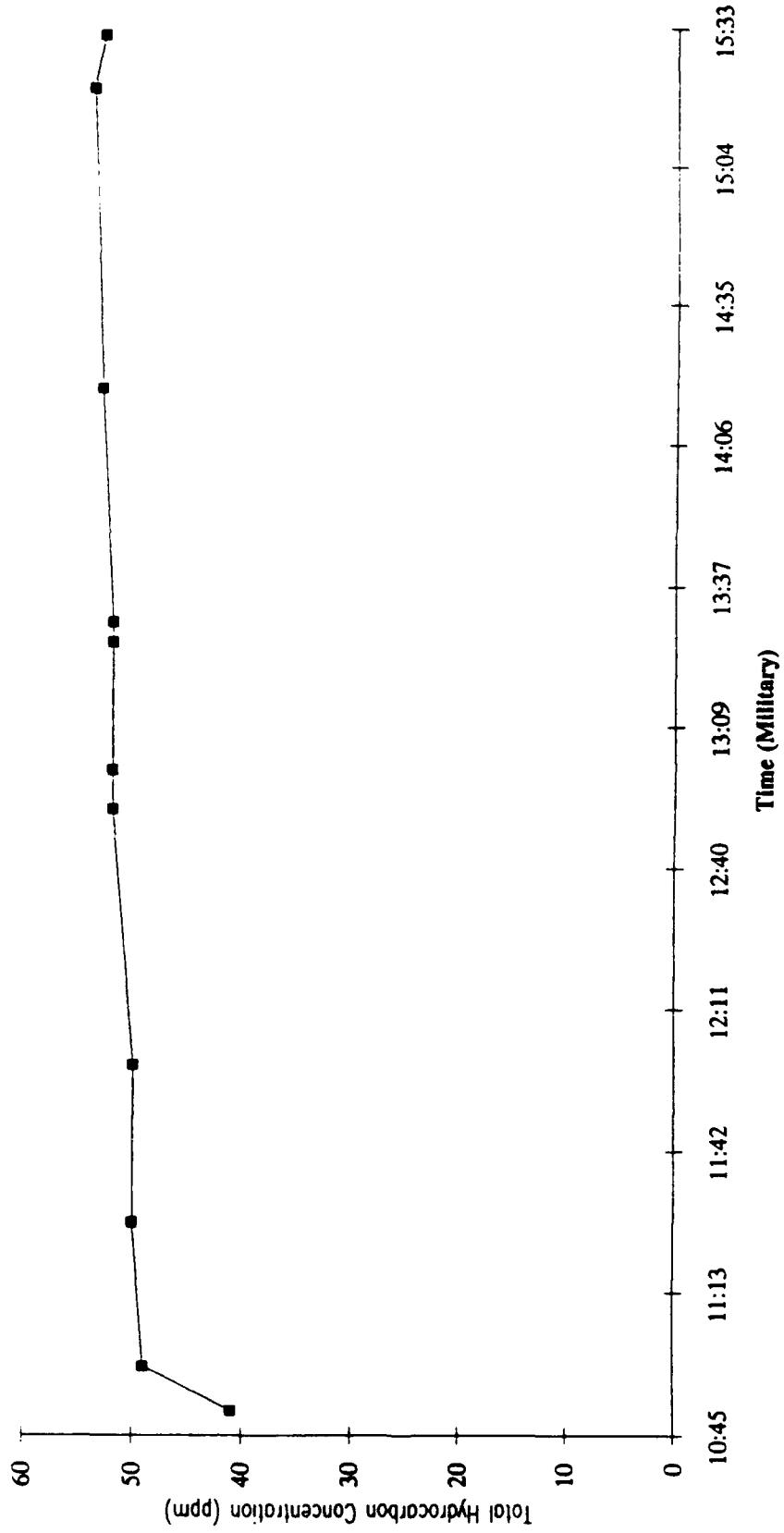


Figure 7-9
Low Flow Drawdown Concentrations
Monitoring Well #9

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TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ppbv mwpc020d	ppbv mwpc023	%RPD	ppbv mwpc02-2	ppbv mwpc22d	%RPD	ppbv mwbo33	ppbv mwbo33d	%RPD
Freon 12	nd	nd	NA	nd	nd		nd	nd	NA
Vinyl Chloride	nd	nd	NA	nd	nd		nd	nd	NA
Freon 11	39	49	-22.73	33.3	36	-7.79	nd	nd	NA
1,1-Dichloroethene	200	280	-33.33	nd	nd		nd	nd	NA
Dichloromethane	nd	nd	NA	nd	nd		nd	nd	NA
Trichlorotrifluoroethane	15000	12000	22.22	nd	nd		2300	2000	13.95
1,1-Dichloroethane	nd	nd	NA	nd	nd		nd	nd	NA
c-1,2-Dichloroethene	nd	nd	NA	nd	nd		nd	nd	NA
t-1,2-Dichloroethene	3.6	3	18.18	nd	nd		nd	nd	NA
Chloroform	nd	nd	NA	0.8	0.8	0.00	nd	nd	NA
1,1,1-Trichloroethane	nd	nd	NA	nd	nd		nd	nd	NA
1,2-Dichloroethane	nd	nd	NA	nd	nd		nd	nd	NA
Benzene	nd	nd	NA	nd	nd		nd	nd	NA
Carbon Tetrachloride	87	61	35.14	50.2	59.5	-16.96	7.8	7.5	3.92
Trichloroethene	240	170	34.15	151	182	-18.62	12	11	8.70
Toluene	nd	nd	NA	nd	nd		nd	nd	NA
Tetrachloroethene	nd	nd	NA	nd	nd		nd	nd	NA
1,2-Dichloroethene				5.8	7.7	-28.15	nd	nd	NA

TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ppbv mwbo51	ppbv mwbo54	%RPD	ppbv mwaco62	ppbv mwaco64	%RPD	ppbv mwbo72	ppbv mwbo74	%RPD
Freon 12	nd	nd	NA	14	nd	NA	nd	180	NA
Vinyl Chloride	nd	nd	NA	nd	nd	NA	nd	180	NA
Freon 11	nd	nd	NA	nd	nd	NA	62	270	-125.30
1,1-Dichloroethene	12	9.4	24.30	nd	24	NA	30000	60000	-66.67
Dichloromethane	12	5.3	77.46	nd	4.6	NA	15	160	-165.71
Trichlorotrifluoroethane	91	92	-1.09	270	540	-66.67	16000	23000	-35.90
1,1-Dichloroethane	nd	nd	NA	nd	nd	NA	2600	1300	66.67
c-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	9.9	nd	NA
t-1,2-Dichloroethene	4.8	4.5	6.45	nd	nd	NA	450	120	115.79
Chloroform	nd	nd	NA	nd	nd	NA	30	15	66.67
1,1,1-Trichloroethane	18	nd	NA	nd	nd	NA	140	32	125.58
1,2-Dichloroethane	nd	nd	NA	nd	nd	NA	330	91	113.54
Benzene	nd	0.93	NA	nd	nd	NA	83	27	101.82
Carbon Tetrachloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Trichloroethene	39	37	5.26	29	75	-88.46	4900	3400	36.14
Toluene	nd	1.5	NA	nd	nd	NA	4.6	nd	NA
Tetrachloroethene	nd	nd	NA	nd	nd	NA	100	56	56.41
1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA

TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ng mwto71	ng mwto74	%RPD	ppbv mwbo63	ppbv mwbo94	%RPD	ppbv mwacc91	ppbv mwacc94	%RPD
Freon 12	nd	0.896	NA	170	nd	NA	nd	nd	NA
Vinyl Chloride	3.84	2.36	47.74	nd	nd	NA	nd	nd	NA
Freon 11	0.379	0.353	7.10	83	120	-36.45	65.3	58.7	10.65
1,1-Dichloroethene	20.03	18.37	8.65	15000	11000	30.77	nd	nd	NA
Dichloromethane	nd	nd	NA	nd	nd	NA	13.1	nd	NA
Trichlorotrifluoroethane	25.01	31.16	-21.90	8200	7100	14.38	166.2	nd	NA
1,1-Dichloroethane	3.58	2.3	43.54	nd	nd	NA	1.3	1.2	8.00
c-1,2-Dichloroethene	0.008	0.003	90.91	nd	nd	NA	nd	nd	NA
t-1,2-Dichloroethene	0.331	0.277	17.76	nd	nd	NA	nd	nd	NA
Chloroform	nd	nd	NA	nd	nd	NA	nd	nd	NA
1,1,1-Trichloroethane	0.715	0.321	76.06	29	31	-6.67	19.4	14.3	30.27
1,2-Dichloroethane	0.712	nd	NA	nd	nd	NA	1	nd	NA
Benzene	0.136	0.064	72.00	nd	nd	NA	nd	nd	NA
Carbon Tetrachloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Trichloroethene	7.67	5.26	37.28	51	53	-3.85	34.5	26.8	25.12
Toluene	0.049	0.18	-114.41	nd	nd	NA	nd	nd	NA
Tetrachloroethene	0.398	0.258	42.68	nd	nd	NA	1.2	nd	NA
1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA

TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ppbv vrb0311	ppbv vrb0314	%RPD	ppbv vrb0432	ppbv vrb0434	%RPD	ppbv vrb0431	ppbv vrb0434	%RPD
Freon 12	nd	nd	NA	nd	nd	NA	nd	nd	NA
Vinyl Chloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Freon 11	32	35	-8.96	nd	nd	NA	nd	nd	NA
1,1-Dichloroethene	280	340	-19.35	nd	nd	NA	nd	nd	NA
Dichloromethane	nd	nd	NA	nd	nd	NA	2.2	nd	NA
Trichlorotrifluoroethane	260	170	41.86	nd	20	NA	7.49	nd	NA
1,1-Dichloroethane	nd	nd	NA	nd	nd	NA	nd	nd	NA
c-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA
t-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Chloroform	nd	nd	NA	nd	nd	NA	nd	nd	NA
1,1,1-Trichloroethane	140	150	-6.90	nd	nd	NA	nd	nd	NA
1,2-Dichloroethane	nd	nd	NA	nd	nd	NA	nd	nd	NA
Benzene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Carbon Tetrachloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Trichloroethene	31	33	-6.25	nd	nd	NA	nd	1.7	NA
Toluene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Tetrachloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA
1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA

TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ppbv vrb0441	ppbv vrb0444	%RPD	ppbv vrb0421	ppbv vrb0424	%RPD	ppbv vrbcc611	ppbv vrbcc614	%RPD
Freon 12	nd	nd	NA	nd	nd	NA	nd	nd	NA
Vinyl Chloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Freon 11	nd	nd	NA	nd	nd	NA	nd	3.3	NA
1,1-Dichloroethene	nd	nd	NA	nd	nd	NA	243.4	870	-112.56
Dichloromethane	nd	nd	NA	nd	nd	NA	nd	nd	NA
Trichlorotrifluoroethane	4.5	nd	NA	nd	52	NA	nd	450	NA
1,1-Dichloroethane	nd	nd	NA	nd	nd	NA	nd	550	NA
c-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	8.7	NA
t-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	444.3	530	-17.59
Chloroform	nd	nd	NA	nd	nd	NA	1.1	nd	NA
1,1,1-Trichloroethane	nd	nd	NA	nd	nd	NA	103.1	360	-110.95
1,2-Dichloroethane	nd	nd	NA	nd	nd	NA	7	nd	NA
Benzene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Carbon Tetrachloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Trichloroethene	nd	nd	NA	nd	nd	NA	184.2	34	137.67
Toluene	nd	nd	NA	nd	10	NA	nd	nd	NA
Tetrachloroethene	nd	nd	NA	nd	nd	NA	34.2	6.1	139.45
1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA

TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ppbv vrb0341	ppbv vrb0344	%RPD	ppbv vrb0331	ppbv vrb0334	%RPD	ppbv vrb0332	ppbv vrb0335	%RPD
Freon 12	nd	nd	NA	nd	nd	NA	nd	nd	NA
Vinyl Chloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Freon 11	nd	nd	NA	nd	nd	NA	nd	nd	NA
1,1-Dichloroethene	740	680	8.45	nd	nd	NA	nd	nd	NA
Dichloromethane	nd	nd	NA	2.1	nd	NA	3	2.2	30.77
Trichlorotrifluoroethane	350	340	2.90	2.4	74	-187.43	130	120	8.00
1,1-Dichloroethane	nd	nd	NA	nd	nd	NA	nd	nd	NA
c-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA
t-1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Chloroform	nd	nd	NA	nd	nd	NA	nd	nd	NA
1,1,1-Trichloroethane	500	280	56.41	nd	nd	NA	nd	nd	NA
1,2-Dichloroethane	nd	nd	NA	nd	nd	NA	nd	nd	NA
Benzene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Carbon Tetrachloride	nd	nd	NA	nd	nd	NA	nd	nd	NA
Trichloroethene	93	63	38.46	nd	nd	NA	nd	nd	NA
Toluene	nd	nd	NA	nd	nd	NA	nd	nd	NA
Tetrachloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA
1,2-Dichloroethene	nd	nd	NA	nd	nd	NA	nd	nd	NA

TABLE 7-1
SAMPLING PRECISION-FIELD DUPLICATES

Sample	ng mws062	ng mws0622	ng mws0621	ng mws064	ng mws0641	ng mws0642	%RPD	ng mws031	ng mws031dup	%RPD
Freon 12	0.55	0.166	0.384	0.266	0.096	0.17	69.61	0.326	0.037	159.23
Vinyl Chloride										
Freon 11	0.059	0.014	0.045	0.014		0.014	123.29	0.037	0.014	90.20
1,1-Dichloroethene	0.041	0.016	0.025	0.012		0.012	109.43		0.021	
Dichloromethane	0.07	0.005	0.065	0.102	0.003	0.099	-37.21	0.019		
Trichlorotrifluoroethane	2.601	0.031	2.57	0.32		0.32	156.18	18.24	8.031	77.72
1,1-Dichloroethane										
c-1,2-Dichloroethene				0.007	0.007					
t-1,2-Dichloroethene	0.006		0.006	0.013	0.013		-73.68			
Chloroform				0.018	0.018					
1,1,1-Trichloroethane	0.007	0.007		0.023		0.023	-106.67		0.003	
1,2-Dichloroethane										
Benzene				0.006		0.006		0.004	0.002	66.67
Carbon Tetrachloride								0.011	0.021	-62.50
Trichloroethene	0.09	0.016	0.074	0.065	0.062	0.003	32.26	0.024	0.027	-11.76
Toluene	0.07	0.012	0.058	0.067	0.048	0.019	4.38	0.02		
Tetrachloroethene				0.012	0.008	0.004			0.032	
1,2-Dichloroethene										

TABLE 7-1

[illegible]

**TABLE 7-2
QUALITATIVE COMPARISON OF MEDIA**

	CMS	Charcoal	Canister Offsite	Tedlar Bags	Canister CSL
Accuracy					
Mean Recovery	3	3	5	1	4
Range	4	4	2	1	5
Analytical Precision	5	5	2	1	4
Sampling Precision	4	4	5	4	5
Media & Analytical Cost	1.3	1.3	3.4	3.7	2.2
Ease of Use	2	2	5	3	5
Holding Times	2.5	2.5	5	1	5
	22	22	27	15	30

Notes:

Solid sorbents are assumed to be equivalent in this analysis. They were assumed to consist of two tubes in series (requiring two analyses).

Accuracy data were extracted from recovery studies (Tables 6-1 through 6-12).

Precision was determined for sampling from field duplicate RPDs (Table 7-1). Analytical precision was determined from the RSDs in the recovery studies (Tables 6-2, 6-5, and 6-8).

Costs were extracted from the responses of seven laboratories to a cost survey (Table 7-3) conducted during project analytical subcontracting.

Ease of use was a subjective summary of sampling experience gained during the month-long sampling program. It is a measure of sampling difficulty and an indication of this source of uncertainty in associated analyses.

TABLE 7-3
MEDIA COMPARISON
BACKGROUND INFORMATION

Mean recovery/all analytes—Summa canisters = 100.65		Range = 44.5 to 149.4	
Number within 3 percent of 100 = 2			
Lowest Recovery = Freon 12, Freon 11			
Highest Recovery = carbon tetrachloride, 111TCA, F113			
Mean recovery/all analytes—Tedlar bags = 108.9		Range = 47.4 to 174.8	
Number within 3 percent of 100 = 1			
Lowest Recovery = Freon 11, tetrachloroethane			
Highest Recovery = toluene, vinyl chloride			
Mean recovery/all analytes—charcoal tubes = 95.22		Range = 61.1 to 138.6	
Number within 3 percent of 100 = 2			
Mean recovery/all analytes—Summa canister CSL = 97.8		Range = 64.3 to 116.5	
Number within 3 percent of 100 = 3			
Lowest Recovery = toluene			
Highest Recovery = carbon tetrachloride, vinyl chloride			
Canister offsite recovery range = 104.9			
Tedlar bag recovery range = 127.4			
Charcoal tube recovery range = 77.5			
Canister CSL recovery range = 52.2			
MEDIA AND ANALYTICAL COSTS			
	<u>Solid Sorbent Tubes</u>	<u>Tedlar</u>	<u>Canisters (rent)</u>
Number required	2	1	1
Cost, each	\$54.00	\$27.80	\$82.00
Total/Media	\$108.00	\$27.80	\$82.00
Analysis, each	\$312.00	\$240.00	\$233.00
Total/Media	\$624.00	\$240.00	\$233.00
Total Media/Analysis	\$732.00	\$267.80	\$315.00
Note: CSL = 82 + 462 = \$544.00			
RANK BY MEDIA AND ANALYTICAL COST			
Best ----> Worst			
Tedlar ----> Canister Offsite ----> Canister CSI ----> Solid Sorbent			
3.7 ----> 3.43 ----> 2.28 ----> 1.3			
5 = Best, 0 to 5 on analytical and media cost			
ANALYTICAL PRECISION			
MS/MSD %RSD =	11.4 canister offsite		
	11.7 Tedlar		
	8.6 charcoal tubes		
	9.18 canister CSL		
Best ----> Worst			
Charcoal ----> Canister CSL ----> Canister Offsite ----> Tedlar			

TABLE 7-4

Component 1 = Tedlar Bags, GC/MS , 97 Samples
Component 2 = Solid Sorbent Analysis, Thermal Desorb, GC/MS , 51 Samples
Component 3 = Summa Canister, GC/MS, 72 Samples
Component 4 = Condensate Analysis , 86 Samples
Component 5 = Close Support Laboratory, 157 Canister Samples

Component 1 = Tedlar Bags, GC/MS , 97 Samples
Component 2 = Solid Sorbent Analysis, Thermal Desorb, GC/MS , 51 Samples
Component 3 = Summa Canister, GC/MS, 72 Samples
Component 4 = Condensate Analysis , 86 Samples
Component 5 = Close Support Laboratory, 157 Canister Samples

TABLE 7-5
PRESSURE VERSUS NONPRESSURE CANISTERS

Sample	mwc001	inmp001	%RPD	mwc002	inmp002	%RPD	mwc003	inmp003	%RPD	mwc004	inmp004	%RPD	mwc005	inmp005	%RPD	mwc006	inmp006	%RPD	mwc007	inmp007	%RPD
Freon 12		260	-140.43	160			170	85	68.67												
Vinyl Chloride	28	160	-62.50	110	260	-81.08	140	310	-75.56												
Freon 11	110	210	-71.84	9200	27000	-96.34	11000	26000	-81.08												
1,1-Dichloroethene	9800	21000	-71.84																		
Dichloromethane	16			73	38	60.71	28	21	28.57												
Trichlorotrifluoroethane	5900	10000	-51.57	5400	18000	-99.07	5500	13000	-81.08												
1,1-Dichloroethane	42	90	-72.73	43	140	-108.01	62	130	-70.83												
c-1,2-Dichloroethene																					
t-1,2-Dichloroethene																					
Chloroform																					
1,1,1-Trichloroethane	80	240	-100.00	71	240	-108.68	160	310	-63.83												
1,2-Dichloroethane																					
Benzene																					
Carbon Tetrachloride																					
Trichloroethene	370	820	-75.63	320	1100	-109.86	440	950	-73.38												
Toluene																					
Tetrachloroethene	11	38	-110.20	11	32	-37.67	18	43	-81.97												
1,2-Dichloroethene																					

TABLE 7-5
PRESSURE VERSUS NONPRESSURE CANISTERS

Sample	wacc352	vpcc355	%RPD	wacc361	vpcc364	%RPD	wacc363	vpcc365	%RPD
Freon 12									
Vinyl Chloride									
Freon 11									
1,1-Dichloroethane					240				
Dichloromethane									
Trichlorotrifluoroethane					200				
1,1-Dichloroethane	1.3			17.2			2.5	2.7	-7.69
c-1,2-Dichloroethane									
t-1,2-Dichloroethane				8.6					
Chloroform									
1,1,1-Trichloroethane	141.4	133.4	5.82	252.8	180	33.64	156	146.7	6.14
1,2-Dichloroethane		7.4							
Benzene									
Carbon Tetrachloride									
Trichloroethane	62.7	67.6	-7.82	199.6	20	163.57	62.1	56.9	8.74
Toluene									
Tetrachloroethane	1.2	2.1	-54.55				1.7	2.3	-30.00
1,2-Dichloroethane				20.3			10.5	9.8	6.90

TABLE 7-6
MONITORING WELLS
SUMMARY OF RESULTS

Compounds	Shallow Well (11 - 15 FT)			Mid Well (34 - 44 FT)			Deep Well (69 - 79 FT)			Ambient Air
	MW-3	MW-6	MW-9	MW-2	MW-5	MW-8	MW-1	MW-4	MW-7	
Dichlorodifluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	88-140	N.D.-21	N.D.-13.1	N.D.-4.8	N.D.-21	16-73	N.D.-150	N.D.	N.D.-385	N.D.-4
Trichlorofluoromethane	N.D.	0.8-3.3	39-65.3	26.9-38.5	N.D.-1.5	250-414	72-468	1.4-2.7	34-876	N.D.
1,1-Dichloroethene	N.D.	N.D.-490	N.D.	N.D.-280	N.D.-34	9,200-11,000	880-2,688	N.D.-120	N.D.	N.D.-3
1,1-Dichloroethane	N.D.	N.D.	N.D.-1.3	N.D.	N.D.	111-180	N.D.	2-3	8,113-16,470	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.-0.8	N.D.	5.3-8.1	N.D.	1.3-1.8	28-99.8	N.D.
1,2-Dichloroethene				3.3-7.7						N.D.
Freon 113	140-830	240-690	N.D.-166.2	2,500-15,000	N.D.-334	5,400-10,648	N.D.-4,300	N.D.-400	N.D.-7,998	N.D.
1,2-Dichloroethane	N.D.	N.D.	N.D.-1	N.D.	N.D.	13.4-18.3	N.D.	N.D.	606-1,278	N.D.
1,1,1-Trichloroethane	N.D.	N.D.	13.9-19.4	N.D.	N.D.	208-302	N.D.-3.5	1.4-2.5	120-290	N.D.
Carbon Tetrachloride	2.8-5.8	N.D.	N.D.	26-59.5	N.D.	2.4-3.4	N.D.-23.8	N.D.	N.D.-3.8	N.D.
Trichloroethene	4.4-7.9	46-59	28.4-34.5	83.8-182	103-116	175-1,312	N.D.-21.4	N.D.-126	3,743-22,049	N.D.
Tetrachloroethene	N.D.	N.D.	1.2-1.3	N.D.	N.D.	25-33	N.D.	N.D.-1.1	88-256	N.D.
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	N.D.	N.D.	N.D.	N.D.-2.3	N.D.	4.3-6.1	N.D.	N.D.	236-512	N.D.
Toluene	N.D.	N.D.	N.D.	N.D.-1.6	N.D.	N.D.	N.D.	N.D.	N.D.-11.2	N.D.
c-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
t-1,2-Dichloroethene	N.D.	3.9-4.3	N.D.		46-49	8.6-13.6	N.D.	102-237	5,343-8,457	

* N.D. - Not Detected
Ambient air results from 2 canisters collected 4/12/91 near Higgs property line

TABLE 7-7
VENT RISERS
SUMMARY OF RESULTS

Compounds	VR-1-3	VR-3-1	VR-3-4	VR-3-5	VR-3-6	VR-3-9	VR-4-2	VR-4-3	VR-4-4	VR-6-1
Dichlorodifluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	N.D.-3	N.D.	4.3	2.6	N.D.	1.2	N.D.-8.8	1.55-2.2	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.-0.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-3.3
1,1-Dichloroethene	N.D.	N.D.	160	N.D.	240	15.8	N.D.	N.D.	1	870
1,1-Dichloroethane	N.D.	1.1-5.6	1.6-3.1	N.D.-1.3	2.5-17.2	N.D.	N.D.	N.D.	N.D.	219-550
Chloroform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-1.2
1,2-Dichloroethene	N.D.									
Freon 113	2.4-130	N.D.	123	106	200	25.8	49-63	7.5-8.9	7	450
1,2-Dichloroethane	N.D.	4.8-9.3	12.2-17.9	5.7-7.6	8.2-20.3	1.3-2.4	N.D.	N.D.	N.D.	N.D.-13.5
1,1,1-Trichloroethane	N.D.	93-178	207-308	106-141	118-252	21-37	3.6-6.5	N.D.	N.D.	40-360
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	26-53	872-110	45-63	49.3-200	7.9-11.5	N.D.	N.D.-1.7	N.D.-1.7	34-215
Tetrachloroethene	N.D.	N.D.-1.8	N.D.-2.6	1.2-1.8	N.D.-1.7	N.D.	N.D.	N.D.	N.D.	6.1-34.2
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	N.D.	N.D.-0.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-1
Toluene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
c-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.-8.7
t-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.-8.6	N.D.	N.D.	N.D.	N.D.	423-530

*N.D. - Not Detected

TABLE 7-8
HISTORICAL RESULTS
SOIL GAS MONITORING (PPB)

Compounds	Shallow Well (11-15 FT)	Mid Well (34-44 FT)	Deep Well (69-79 FT)	Ambient Air
Dichlorodifluoromethane	9-360	20-240	30-350	N.D.-4
Methylene Chloride	4-80	7-160	6-120	9-40
Trichlorofluoromethane	3-100	5-300	3-300	0.2-0.8
1,1-Dichloroethene	N.D.-18,700	20-132,000	20-245,000	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.-18,300	N.D.
Chloroform	N.D.-2	0.5-4	0.5-60	N.D.-0.2
1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.
Freon 113	115-19,200	175-71,600	100-130,000	N.D.-10
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.
1,1,1-Trichloroethane	N.D.-15	0.3-185	1-160	0.2-2
Carbon Tetrachloride	N.D.-12	N.D.-50	N.D.-15	N.D.-0.1
Trichloroethene	14-25	110-770	13-36,200	1-6
Tetrachloroethene	N.D.-13	0.2-20	0.3-80	N.D.-0.3
Vinyl Chloride	N.D.	N.D.	N.D.-4,400	
Benzene	N.D.	N.D.-260	N.D.-140	
Toluene	N.D.	N.D.-600	N.D.-500	
c-1,2-Dichloroethene				
l-1,2-Dichloroethene				

*N.D. - Not Detected

TABLE 7-9
MONITORING WELL 1
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-1-1	MW-DR-C-1-2	MW-DR-C-1-3	MW-HDR-C-1-2	MW-HDR-C-1-3	April 8, 1991 ~7:30 p.m.	April 8, 1991 8:04 p.m.	April 9, 1991 10:10 a.m.	April 9, 1991 11:35 a.m.
DATE:	March 22, 1991	March 22, 1991	March 22, 1991	April 8, 1991	April 8, 1991	~7:30 p.m.	8:04 p.m.	10:10 a.m.	11:35 a.m.
TIME:	11:14 a.m.	3:07 p.m.	4:48 p.m.	8:00 a.m.	8:04 p.m.	~7:30 p.m.	8:04 p.m.	10:10 a.m.	11:35 a.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow	High Flow	High Flow	High Flow	High Flow	High Flow	High Flow
Compounds									
Freon 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vinyl Chloride	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Freon 11	81.90	122.10	21.20	102.90	188.10	135.80	237.30	0.00	0.00
1,1-Dichloroethene		2310.55				3038.50			7554.20
Dichloromethane		41.82				41.38			
Trichlorofluoroethane		548.09				411.78			806.10
1,1-Dichloroethane	0.10	0.10	0.20	0.20	0.20	0.30	0.30	0.30	2.50
c-1,2-Dichloroethene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l-1,2-Dichloroethene	0.00	0.00	0.10	0.30	0.20	0.30	0.80	0.20	1.90
Chloroform	0.00	0.10	0.10	0.20	0.20	0.26	0.20	0.20	0.30
1,1,1-Trichloroethane	0.60	1.60	1.80	3.10	3.40	3.70	6.30	6.30	3.60
1,2-Dichloroethane (ion 62)		0.10	0.10	0.20	0.30	0.30	0.50	0.50	0.60
Benzene	0.20	0.10	0.20	0.10	0.10	0.20	0.30	0.30	0.20
Carbon Tetrachloride	4.20	12.00	14.40	19.10	19.60	20.70	29.80	29.80	20.30
Trichloroethene	3.40	10.30	12.80	22.30	24.20	25.90	19.70	19.70	53.70
Toluene	0.30	0.10	0.10	0.10	0.10	0.10	0.30	0.30	0.10
Tetrachloroethene	0.10	0.10	0.20	0.30	0.40	0.40	19.70	19.70	0.50
Bromochloromethane									9.3
1-4 Difluorobenzene									9.3
Trichloroethene									47.5

TABLE 7-10
MONITORING WELL 2
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-2-1	MW-DR-C-2-2	MW-DR-C-2-3
DATE:	March 23, 1991	March 23, 1991	March 23, 1991
TIME:	10:37 a.m.	1:47 p.m.	4:54 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow
Compound			
Freon 12	0.00	0.00	0.10
Vinyl Chloride	0.10	0.97	0.00
Freon 11	31.60	64.51	26.40
1,1-Dichloroethene		362.29	
Dichloromethane		34.84	
Trichlorotrifluoroethane		248.10	
1,1-Dichloroethane	0.00	0.00	0.00
c-1,2-Dichloroethene	0.00		0.00
t-1,2-Dichloroethene	4.00		4.30
Chloroform	0.40	1.00	0.60
1,1,1-Trichloroethane	0.00	0.00	0.10
1,2-Dichloroethane (ion 62)	0.00	0.00	0.00
Benzene	0.00	0.29	0.10
Carbon Tetrachloride	38.90	46.85	43.30
Trichloroethene	109.10	175.94	120.00
Toluene	0.00	0.17	0.10
Tetrachloroethene	0.10	0.00	0.10
Bromochloromethane			
1-4 Difluorobenzene			
Trichloroethene			
1,2-Dichloroethene		7.31	

TABLE 7-11
MONITORING WELL 3
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-3-1	MW-DR-C-3-2	MW-DR-C-3-3
DATE:	March 25, 1991	March 25, 1991	March 25, 1991
TIME:	10:16 a.m.	12:55 p.m.	4:57 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow
Compound			
Freon 12	*	0.10	0.00
Vinyl Chloride		0.00	0.10
Freon 11		0.40	0.90
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane		0.10	0.00
c-1,2-Dichloroethene		0.00	0.00
t-1,2-Dichloroethene		0.00	0.00
Chloroform		0.10	0.10
1,1,1-Trichloroethane		0.00	0.00
1,2-Dichloroethane (ion 62)		0.00	0.00
Benzene		0.00	0.10
Carbon Tetrachloride		8.60	5.80
Trichloroethene		12.00	7.90
Toluene		0.00	0.00
Tetrachloroethene		0.00	0.00
Bromochloromethane			
1-4 Difluorobenzene			
Trichloroethene			
1,2-Dichloroethane			

* Sample results are not available for drawdown sample.

TABLE 7-12
MONITORING WELL 4
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-4-1	MW-DR-C-4-2	MW-DR-C-4-3
DATE:	April 4, 1991	April 4, 1991	April 4, 1991
TIME:	9:55 a.m.	11:57 a.m.	1:57 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow
Compound			
Freon 12	0.0	0.0	0.0
Vinyl Chloride	0.0	0.0	0.0
Freon 11	1.5	1.7	0.7
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	3.5	2.4	3.0
c-1,2-Dichloroethene	0.0	0.0	0.0
t-1,2-Dichloroethene	105.7	118.4	98.5
Chloroform	1.7	2.1	1.7
1,1,1-Trichloroethane	1.7	2.0	1.7
1,2-Dichloroethane (ion 62)	0.3	0.3	0.3
Benzene	0.3	0.2	0.2
Carbon Tetrachloride	0.0	0.0	0.0
Trichloroethene	522.3	77.2	71.6
Toluene	0.2	0.1	0.0
Tetrachloroethene	1.0	1.1	1.1
Bromochloromethane			
1-4 Difluorobenzene			
Trichloroethene			
1,2-Dichloroethene			

TABLE 7-13
MONITORING WELL 5
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-5-1	MW-DR-C-5-2	MW-DR-C-5-3
DATE:	April 3, 1991	April 3, 1991	April 3, 1991
TIME:	9:53 a.m.	11:56 a.m.	1:57 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow
Compound			
Freon 12	0.0	0.0	0.1
Vinyl Chloride	0.0	0.0	0.0
Freon 11	0.5	0.8	1.6
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.2	0.9	1.5
c-1,2-Dichloroethene	0.0	0.0	0.0
t-1,2-Dichloroethene	5.7	48.5	69.4
Chloroform	0.1	0.5	0.7
1,1,1-Trichloroethane	0.5	0.3	0.2
1,2-Dichloroethane (ion 62)	0.1	0.0	0.1
Benzene	1.6	0.5	0.4
Carbon Tetrachloride	0.1	0.1	0.1
Trichloroethene	10.5	116.5	158.2
Toluene	1.9	0.4	0.3
Tetrachloroethene	0.2	0.4	0.5
Bromochloromethane			
1-4 Difluorobenzene			
Trichloroethene			
1,2-Dichloroethene			

TABLE 7-14
MONITORING WELL 6
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-6-1	MW-DR-C-6-2	MW-DR-C-6-3	MW-DR-C-6-4
DATE:	April 2, 1991	April 2, 1991	April 2, 1991	April 2, 1991
TIME:	12:50 p.m.	1:50 p.m.	4:10 p.m.	5:00 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow	Low Flow
Compound				
Freon 12	0.0	0.0	0.0	0.0
Vinyl Chloride	0.0	0.0	0.0	0.0
Freon 11	0.4	0.3	0.0	2.1
1,1-Dichloroethene				
Dichloromethane				
Trichlorofluoroethane				
1,1-Dichloroethane	0.3	0.2	0.7	0.2
c-1,2-Dichloroethene	0.0	0.0	0.0	0.0
t-1,2-Dichloroethene	4.1	3.7	1.6	3.4
Chloroform	0.2	0.2	0.2	0.2
1,1,1-Trichloroethane	0.1	0.2	0.2	0.2
1,2-Dichloroethane (Ion 62)	0.0	0.0	0.0	0.0
Benzene	0.1	0.1	0.5	0.2
Carbon Tetrachloride	0.1	0.0	0.0	0.0
Trichloroethene	46.4	42.5	49.0	44.8
Toluene	0.1	0.0	1.3	0.1
Tetrachloroethene	0.3	0.2	0.3	0.3
Bromochloromethane				
1-4 Difluorobenzene				
Trichloroethene				
1,2-Dichloroethene				

TABLE 7-15
MONITORING WELL 7
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-7-1	MW-DR-C-7-2	MW-DR-C-7-3	MW-HDR-C-7-1	MW-HDR-C-7-2	MW-HDR-C-7-3	MW-HDR-C-7-4
DATE:	March 30, 1991	March 30, 1991	March 30, 1991	April 10, 1991	April 10, 1991	April 11, 1991	April 11, 1991
TIME:	10:55 a.m.	12:29 p.m.	6:16 p.m.	7:30 a.m.	12:24 p.m.	11:19 a.m.	12:33 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow	High Flow	High Flow	High Flow	High Flow
Compound							
Freon 12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vinyl Chloride	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freon 11	263.2	42.9	224.2	7717.9	104.7	140.4	502.0
1,1-Dichloroethene		5157.0					
Dichloromethane		64.4					
Trichlorotrifluoroethane		5571.6					
1,1-Dichloroethane	7374.8	680.6	1707.5	125805.8	3493.6	1905.3	4490.3
c-1,2-Dichloroethene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
i-1,2-Dichloroethene	10411.6	1477.7	2190.0	4029.5	3415.7	1005.9	4128.7
Chloroform	45.7	16.4	22.5	769.7	29.2	16.2	36.8
1,1,1-Trichloroethane	409.9	147.2	148.9	265.3	180.6	64.2	224.4
1,2-Dichloroethane (Ion 62)	854.3	299.9	304.9	581.1	441.6	168.5	480.4
Benzene	291.0	116.5	119.7	249.4	152.9	59.4	203.6
Carbon Tetrachloride	0.0	0.6	0.5	2.3	0.0	0.0	1.5
Trichloroethene	6001.7	100.6	652.9	2981.0	1523.2	121.1	1389.3
Toluene	0.0	1.3	1.5	5.9	2.9	2.0	5.0
Tetrachloroethene	86.5	26.8	44.9	131.3	80.5	48.1	150.8
Bromochloromethane							
1-4 Difluorobenzene							
Trichloroethene							
1,2-Dichloroethene							

TABLE 7-16
MONITORING WELL 8
DRAWDOWN RESULTS SPECIATED

	MW-DR-C-8-1	MW-DR-C-8-2	MW-DR-C-8-3
DATE:	March 31, 1991	March 31, 1991	March 31, 1991
TIME:	12:17 p.m.	2:02 p.m.	4:02 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow
Compound			
Freon 12	0.0	0.1	0.0
Vinyl Chloride	0.0	0.5	0.0
Freon 11	184.7	399.2	103.9
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	75.8	173.4	81.2
c-1,2-Dichloroethene	0.0	0.0	0.0
t-1,2-Dichloroethene	8.1	24.9	14.3
Chloroform	4.0	8.1	3.7
1,1,1-Trichloroethane	176.7	365.8	225.9
1,2-Dichloroethane (ion 62)	10.8	22.9	14.4
Benzene	3.4	6.6	4.4
Carbon Tetrachloride	1.9	3.4	2.2
Trichloroethene	141.6	976.2	246.2
Toluene	0.1	0.0	0.2
Tetrachloroethene	14.3	13.6	25.4
Bromochloromethane	29.3	35.1	
1-4 Difluorobenzene	0.1	0.0	
Trichloroethene	1.4	2.1	
1,2-Dichloroethene			

TABLE 7-17
MONITORING WELL 9
DRAWDOWN RESULTS SPECIATED

	MW-DP-C-9-1	MW-DP-C-9-2	MW-DP-C-9-3	MW-HDR-C-9-1	MW-HDR-C-9-2	MW-HDR-C-9-3	MW-HDR-C-9-4
DATE:	April 1, 1991	April 1, 1991	April 1, 1991	April 10, 1991	April 10, 1991	April 11, 1991	April 11, 1991
TIME:	11:20 a.m.	1:23 p.m.	3:30 p.m.	12:47 p.m.	4:45 p.m.	12:47 p.m.	2:59 p.m.
DRAWDOWN TYPE:	Low Flow	Low Flow	Low Flow	High Flow	High Flow	High Flow	High Flow
Compound							
Freon 12	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Vinyl Chloride	0.00	0.00	0.20	0.00	0.00	0.00	0.00
Freon 11	63.17	47.15	69.10	47.70	54.85	35.10	14.20
1,1-Dichloroethene					0.00		
Dichloromethane					6.42		
Trichlorofluoroethane					306.00		
1,1-Dichloroethane	1.19	1.00	0.90	1.80	1.40	317.40	3.90
c-1,2-Dichloroethene	0.00	0.00	0.00	0.00		0.00	0.00
t-1,2-Dichloroethene	0.00	0.09	0.00	0.70		400.60	3.90
Chloroform	0.56	0.53	0.60	0.50	0.53	5.80	0.50
1,1,1-Trichloroethane	17.40	21.53	23.60	18.50	16.11	42.30	16.10
1,2-Dichloroethane (Ion 62)	0.94	1.28	1.30	1.20	1.22	72.40	2.20
Benzene	0.31	0.31	0.30	0.50	0.24	24.80	0.70
Carbon Tetrachloride	0.59	0.64	0.70	0.60	0.57	0.80	0.60
Trichloroethene	29.27	35.12	30.50	48.10	40.41	110.20	153.80
Toluene	0.12	0.00	0.00	0.20	0.10	0.70	0.10
Tetrachloroethene	1.36	2.06	0.40	1.90	1.80	21.90	2.30
Bromochloromethane							
1-4 Difluorobenzene							
Trichloroethene							
1,2-Dichloroethene					0.55		

TABLE 7-18
BREAKTHROUGH RESULTS

Sample	mw0611	mw0612	Percent Bk Thru	mws0621	mws0622	Percent Bk Thru	mw0631	mw0632	Percent Bk Thru	mws0641	mws0642	Percent Bk Thru
Freon 12		0.252		0.384	0.166	43	0.302	0.061	20	0.096	0.17	177
Vinyl Chloride												
Freon 11		0.009		0.045	0.014	31	0.028		0		0.014	
1,1-Dichloroethene		0.037		0.025	0.016	64	0.014	0.006	43		0.012	
Dichloromethane		0.012		0.065	0.005	8	0.006	0.01	167	0.003	0.099	3300
Trichlorotrifluoroethane		0.467		2.57	0.031	1	2.3		0		0.32	
1,1-Dichloroethane												
c-1,2-Dichloroethene										0.007		0
t-1,2-Dichloroethene				0.006		0	0.002		0	0.013		0
Chloroform										0.018		0
1,1,1-Trichloroethane		0.048			0.007			0.007			0.023	
1,2-Dichloroethane												
Benzene		0.005					0.002	0.001	50		0.006	
Carbon Tetrachloride		0.007										
Trichloroethene	0.057	0.038	67	0.074	0.016	22	0.024	0.011	46	0.062	0.003	5
Toluene	0.064	0.074	116	0.058	0.012	21	0.01	0.017	170	0.048	0.019	40
Tetrachloroethene	0.007	0.022	314				0.002		0	0.008	0.004	50
1,2-Dichloroethene												

TABLE 7-18
BREAKTHROUGH RESULTS

Sample	mwbto721	mwbto722	Percent BkThru	mwbto711	mwbto712	Percent BkThru	mwbto921	mwbto922	Percent BkThru	mwbto931	mwbto932	Percent BkThru
Freon 12	1.147	0.01	1	0.032		0	1.26	0.075	6	0.038	0.076	200
Vinyl Chloride	4.979		0	2.604		0	0.054		0			
Freon 11	0.594	0.009	2	0.32		0	3.92		0		0.008	
1,1-Dichloroethene	32.19	0.041	0	27.172	0.002	0	6.5	0.028	0		0.091	
Dichloromethane		0.024			0.013			0.01			0.013	
Trichlorotrifluoroethane	134.7	0.275	0	3.704		0	19.05	0.045	0		0.132	
1,1-Dichloroethane	5.979		0	4.072		0						
c-1,2-Dichloroethene				0.004		0						
1-1,2-Dichloroethene	0.62		0	0.43		0						
Chloroform	0.31		0	0.035		0						
1,1,1-Trichloroethane	0.985	0.004	0	0.489		0	0.06		0		0.049	
1,2-Dichloroethane	1.664		0	0.127		0						
Benzene	0.145	0.031	21	0.095	0.002	2	0.134		0		0.109	
Carbon Tetrachloride												
Trichloroethene	7.837	0.04	1	6.123	0.015	0	0.02	0.044	220		0.028	
Toluene	0.003	0.022	733	0.011	0.003	27	0.339	0.013	4		0.181	
Tetrachloroethene	0.052	0.003	6				0.01		0			
1,2-Dichloroethene												

TABLE 7-18
BREAKTHROUGH RESULTS

Sample	mwlo71	mwlo72	Percent BkThru	mwlo22	mwlo21	Percent BkThru
Freon 12	0.413	0.215	52	0.048		0
Vinyl Chloride	0.741	0.003	0			
Freon 11	0.155		0		0.208	0
1,1-Dichloroethene	11.93	0.005	0	0.144	0.681	21
Dichloromethane		0.011		0.014	0.011	127
Trichlorotrifluoroethane	18.7		0	0.495	57.3	1
1,1-Dichloroethane	0.99		0	0.004	0.004	100
c-1,2-Dichloroethene	0.003		0			
t-1,2-Dichloroethene	0.125		0		0.002	0
Chloroform	0.003		0			
1,1,1-Trichloroethane	0.069	0.002	3	0.003	0.018	17
1,2-Dichloroethane	0.031		0			
Benzene	0.026	0.003	12	0.002	0.004	50
Carbon Tetrachloride					0.033	0
Trichloroethene	1.29		0	0.099	0.096	103
Toluene	0.015	0.006	40	0.004	0.015	27
Tetrachloroethene	0.059		0			
1,2-Dichloroethene						

8.0 GLOSSARY

Accuracy	-	A measure of the closeness or degree of agreement of a measured value (or mean of a set of values) to the true value; a measure of the bias of the measurement system.
Capability	-	A measure of the confidence with which one data set can be compared to another.
Completeness	-	A measure of the amount of valid data obtained from the analytical measurement system; the quantitative definition is the percent of usable data obtained compared to the total data expected under correct normal conditions.
CSL	-	Close Support Laboratory.
Performance Audit	-	An evaluation of data and QC data from proficiency testing, which is an analysis of "unknown" samples to determine the accuracy of the measurement system.
Precision	-	A measure of the reproducibility or spread of the data when more than one measurement is taken on the same sample under prescribed similar conditions; the agreement between the set of replicate measurements without assumption or knowledge of the true value.
Quality Assurance	-	Refers to the overall program for ensuring the reliability of analytical data generated by a laboratory.
QAPP	-	Quality Assurance Project Plan.
Quality Control	-	Refers to the specific routine procedures performed as part of the field activities and laboratory analysis to help ensure that the quality of the measurements meet the QC criteria considered appropriate for the intended use of the data.
Representativeness	-	A measure of how accurately and precisely the measured results reflect the actual concentration or distribution of the analytes in the environmental matrix sample.
SAP	-	Sampling Analysis Plan.
SOP	-	Standard Operating Procedures.
System Audits	-	An evaluation of all components of the measurement systems to determine their proper selection and use, including field, laboratory, and data management procedures.

APPENDIX I
CONDENSED MONITORING WELL DATA

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-1-1

Compound	Carbon Molecular Sieve		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.74	3.26	16	0.75	0.85	4.2
Vinyl Chloride	0.74	not detected	not detected	0.75	not detected	not detected
Freon 11	0.74	1.82	10	0.75	not detected	not detected
1,1-Dichloroethene	0.74	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.74	61.28	213	0.75	2.3	7.9
Trichlorotrifluoroethane	0.74	not detected	not detected	0.75	7.9	60
1,1-Dichloroethane	0.74	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethane	0.74	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethane	0.74	not detected	not detected	0.75	not detected	not detected
Chloroform	0.74	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.74	2.02	11	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.74	not detected	not detected	0.75	not detected	not detected
Benzene	0.74	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.74	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.74	not detected	not detected	0.75	not detected	not detected
Toluene	0.74	2.93	11	0.75	not detected	not detected
Tetrachloroethene	0.74	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-1-1

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected
Vinyl Chloride	0.75	not detected	not detected
Freon 11	0.75	not detected	not detected
1,1-Dichloroethene	0.75	not detected	not detected
Dichloromethane	0.75	5.9	20
Trichlorotrifluoroethane	0.75	not detected	not detected
1,1-Dichloroethane	0.75	not detected	not detected
c-1,2-Dichloroethene	0.75	not detected	not detected
t-1,2-Dichloroethene	0.75	not detected	not detected
Chloroform	0.75	not detected	not detected
1,1,1-Trichloroethane	0.75	not detected	not detected
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected
Benzene	0.75	not detected	not detected
Carbon Tetrachloride	0.75	not detected	not detected
Trichloroethene	0.75	not detected	not detected
Toluene	0.75	not detected	not detected
Tetrachloroethene	0.75	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-1-2

Compound	Activated Carbon Tube		Tedlar Bags			Tedlar Bags (lab duplicate)			
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	35.68	177	0.75	29	140	0.75	28	140
Vinyl Chloride	0.77	7.51	19	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.77	115.61	654	0.75	370	2100	0.75	300	1700
1,1-Dichloroethene	0.77	445.50	1769	0.75	2200	8600	0.75	1800	7300
Dichloromethane	0.77	3.54	12	0.75	17	60	0.75	16	55
Trichlorotrifluoroethane	0.77	371.37	2846	0.75	29000	220000	0.75	21000	160000
1,1-Dichloroethane	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.77	0.69	4	0.75	4.5	25	0.75	3.5	19
1,2-Dichloroethane (ion 62)	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.77	0.65	4	0.75	29	180	0.75	23	140
Trichloroethene	0.77	0.91	5	0.75	25	140	0.75	19	100
Toluene	0.77	2.86	11	0.75	1.4	5.1	0.75	1.1	4.1
Tetrachloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
Client: CH2M Hill
Site: MW-1-2

Compound	Offsite Non-pressurized Canisters		CSL Non-pressurized Canisters #1		CSL Non-pressurized Canisters #2	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	0.75	22	7.5	150	7.5	44
Vinyl Chloride	0.75	not detected	7.5	not detected	7.5	not detected
Freon 11	0.75	530	7.5	72	7.5	100
1,1-Dichloroethene	0.75	3100	7.5	880	7.5	1100
Dichloromethane	0.75	30	7.5	79	7.5	150
Trichlorotrifluoroethane	0.75	29000	7.5	3900	7.5	4300
1,1-Dichloroethane	0.75	not detected	7.5	not detected	7.5	not detected
c-1,2-Dichloroethene	0.75	not detected	7.5	not detected	7.5	not detected
t-1,2-Dichloroethene	0.75	not detected	7.5	not detected	7.5	not detected
Chloroform	0.75	not detected	7.5	not detected	7.5	not detected
1,1,1-Trichloroethane	0.75	4.9	7.5	not detected	7.5	not detected
1,2-Dichloroethane (ion 62)	0.75	not detected	7.5	not detected	7.5	not detected
Benzene	0.75	not detected	7.5	not detected	7.5	not detected
Carbon Tetrachloride	0.75	32	7.5	not detected	7.5	not detected
Trichloroethene	0.75	31	7.5	not detected	7.5	7.6
Toluene	0.75	0.95	7.5	not detected	7.5	not detected
Tetrachloroethene	0.75	0.85	7.5	not detected	7.5	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-1-2

Compound	CSL Non-pressurized Canisters #3		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.3	1.49
Vinyl Chloride	0.75	0.3	0.77
Freon 11	0.75	150.3	850.06
1,1-Dichloroethene	0.75		
Dichloromethane	0.75		
Trichlorotrifluoroethane	0.75		
1,1-Dichloroethane	0.75	0.2	0.81
c-1,2-Dichloroethene	0.75	0	0.00
t-1,2-Dichloroethene	0.75	0.1	0.40
Chloroform	0.75	0.2	0.98
1,1,1-Trichloroethane	0.75	3.5	19.08
1,2-Dichloroethane (Ion 62)	0.75	0.2	0.81
Benzene	0.75	0.1	0.32
Carbon Tetrachloride	0.75	23.8	150.21
Trichloroethene	0.75	21.4	114.89
Toluene	0.75	0.1	0.38
Tetrachloroethene	0.75	0.3	2.04

EPA Method TO-14: GC/MS Full Scan
Client: CH2M Hill
Site: MW-1-3

Compound	Carbon Molecular Sieve			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.83	1.18	6	0.75	12	58	0.75	10	50
Vinyl Chloride	0.83	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.83	206.28	1167	0.75	460	2600	0.75	340	1900
1,1-Dichloroethene	0.83	755.42	3000	0.75	2600	10000	0.75	2900	11000
Dichloromethane	0.83	3.59	13	0.75	41	140	0.75	52	180
Trichlorotrifluoroethane	0.83	826.38	6333	0.75	25000	190000	0.75	28000	210000
1,1-Dichloroethane	0.83	not detected	not detected	0.75	1.4	5.6	0.75	not detected	not detected
c-1,2-Dichloroethene	0.83	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.83	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.83	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.83	3.82	21	0.75	4.7	26	0.75	4.4	24
1,2-Dichloroethane (Ion 62)	0.83	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.83	0.76	2	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.83	11.09	70	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.83	10.71	58	0.75	28	180	0.75	30	190
Toluene	0.83	6.63	25	0.75	25	130	0.75	27	150
Tetrachloroethene	0.83	0.21	1	0.75	1.3	4.9	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-1-3

Compound	CSL Non-pressurized Canisters #1			CSL Non-pressurized Canisters #2			CSL Non-pressurized Canisters #3		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	7.5	120	580	0.75	0.3	1.5	0.75	0	0.0
Vinyl Chloride	7.5	not detected	not detected	0.75	0	0.0	0.75	0.2	0.5
Freon 11	7.5	270	1500	0.75	129.7	733.5	6.94	468.26	2648.4
1,1-Dichloroethene	7.5	2500	10000	6.94	2509.68	9966.7	6.94	2687.8	10674.1
Dichloromethane	7.5	not detected	not detected	6.94	62.42	217.2	6.94	149.54	520.3
Trichlorotrifluoroethane	7.5	not detected	not detected	6.94	824.55	6319.3	6.94	1840.74	14107.3
1,1-Dichloroethane	7.5	not detected	not detected	0.75	0.2	0.8	0.75	0.2	0.8
c-1,2-Dichloroethene	7.5	not detected	not detected	0.75	0	0.0	0.75	0	0.0
t-1,2-Dichloroethene	7.5	not detected	not detected	0.75	0.2	0.8	0.75	0.1	0.4
Chloroform	7.5	not detected	not detected	0.75	0.2	1.0	0.75	0.2	1.0
1,1,1-Trichloroethane	7.5	not detected	not detected	0.75	3.4	18.5	0.75	3.2	17.4
1,2-Dichloroethane (Ion 62)	7.5	not detected	not detected	0.75	0.1	0.4	0.75	0.2	0.8
Benzene	7.5	not detected	not detected	0.75	0.1	0.3	0.75	0.1	0.3
Carbon Tetrachloride	7.5	21	130	0.75	23.1	145.8	0.75	21.2	133.8
Trichloroethene	7.5	20	110	0.75	20.5	110.1	0.75	19.9	106.8
Toluene	7.5	not detected	not detected	0.75	0.1	0.4	0.75	0.1	0.4
Tetrachloroethene	7.5	not detected	not detected	0.75	0.2	1.4	0.75	0.3	2.0

EPA Method TO-14: GC/MS Full Scan
Client: CH2M Hill
Site: MW-1-4

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	1.40	7	0.75	not detected	not detected	0.75	11	56
Vinyl Chloride	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.77	1.17	7	0.75	290	1700	0.75	480	2700
1,1-Dichloroethene	0.77	1.43	6	0.75	25000	98000	0.75	2500	9900
Dichloromethane	0.77	16.14	56	0.75	73	250	0.75	41	140
Trichlorofluoroethane	0.77	5.62	43	0.75	520	4000	0.75	25965	200000
1,1,1-Dichloroethane	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.77	0.49	3	0.75	2.5	14	0.75	4.9	26
1,2-Dichloroethane (Ion 62)	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.77	0.31	1	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.77	not detected	not detected	0.75	17	110	0.75	34	210
Toluene	0.77	7.96	30	0.75	14	76	0.75	31	160
Tetrachloroethene	0.77	not detected	not detected	0.75	4.5	17	0.75	not detected	not detected
	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-1-4

Compound	CSL Non-pressurized Canisters #1			CSL Non-pressurized Canisters #2			CSL Non-pressurized Canisters #3		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0	0.00	0.75	0	0.00	0.75	0	0.00
Vinyl Chloride	0.75	0.5	1.28	0.75	0	0.00	0.75	0.2	0.51
Freon 11	0.75	302.4	1710.30	0.75	259.1	1465.40	0.75	13.5	76.35
1,1-Dichloroethene									
Dichloromethane									
Trichlorotrifluoroethane									
1,1-Dichloroethane	0.75	0	0.00	0.75	0.2	0.81	0.75	0.2	0.81
c-1,2-Dichloroethene	0.75	0	0.00	0.75	0	0.00	0.75	0	0.00
t-1,2-Dichloroethene	0.75	0.1	0.40	0.75	0.1	0.40	0.75	0.1	0.40
Chloroform	0.75	0	0.00	0.75	0.2	0.98	0.75	0.1	0.49
1,1,1-Trichloroethane	0.75	0.2	1.09	0.75	3	16.35	0.75	3	16.35
1,2-Dichloroethane (Ion 62)	0.75	0	0.00	0.75	0.1	0.41	0.75	0.1	0.41
Benzene	0.75	0.2	0.64	0.75	0.1	0.32	0.75	0.1	0.32
Carbon Tetrachloride	0.75	0.1	0.63	0.75	22.2	140.11	0.75	20.2	127.49
Trichloroethene	0.75	21.8	117.04	0.75	19.2	103.08	0.75	18.3	98.25
Toluene	0.75	0.6	2.26	0.75	0.2	0.75	0.75	0.1	0.38
Tetrachloroethene	0.75	0.1	0.68	0.75	0.3	2.04	0.75	0.2	1.36

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-2-1

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.83	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.83	not detected	not detected	0.75	not detected	not detected
Freon 11	0.83	not detected	not detected	0.75	18	100
1,1-Dichloroethene	0.83	not detected	not detected	0.75	300	1200
Dichloromethane	0.83	not detected	not detected	0.75	not detected	not detected
Trichlorotrifluoroethane	0.83	not detected	not detected	0.75	12000	92000
1,1-Dichloroethane	0.83	34.5	140.0	0.75	not detected	not detected
c-1,2-Dichloroethene	0.83	16.1	64.2	0.75	not detected	not detected
t-1,2-Dichloroethene	0.83	24.1	95.8	0.75	1.9	7.4
Chloroform	0.83	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.83	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (ion 62)	0.83	not detected	not detected	0.75	not detected	not detected
Benzene	0.83	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.83	0.3	1.7	0.75	42	260
Trichloroethene	0.83	7.0	37.5	0.75	110	610
Toluene	0.83	3.1	11.7	0.75	0.77	2.9
Tetrachloroethene	0.83	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethene	0.83	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-2-1

Compound	Offsite Pressurized Canisters (lab duplicate)			CSL Pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	not detected	not detected	not detected	0.75	0.0	0.0
Vinyl Chloride	not detected	not detected	not detected	0.75	0.0	0.0
Freon 11	210	29	170	0.75	26.9	152.1
1,1-Dichloroethene	570	93	370			
Dichloromethane	not detected	not detected	not detected			
Trichlorofluoroethane	26000	2400	19000			
1,1-Dichloroethane	not detected	not detected	not detected	0.75	0.0	0.0
c-1,2-Dichloroethene	not detected	not detected	not detected	0.75		
t-1,2-Dichloroethene	5.1	1.5	5.9	0.75		
Chloroform	not detected	not detected	not detected	0.75	0.4	2.0
1,1,1-Trichloroethane	not detected	not detected	not detected	0.75	0.1	0.5
1,2-Dichloroethane (ion 62)	not detected	not detected	not detected	0.75	0.0	0.0
Benzene	9.1	2.8	9	0.75	1.9	6.1
Carbon Tetrachloride	190	28	170	0.75	26.0	164.1
Trichloroethene	460	78	420	0.75	83.8	449.9
Toluene	28	6.2	23	0.75	1.2	4.5
Tetrachloroethene	not detected	not detected	not detected	0.75	0.1	0.7
1,2-Dichloroethene				0.75	3.3	13.1

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-2-2

Compound	Carbon Molecular Sieve			Tedlar Bags			Offsite Pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.04	28.4	140.6	0.75	not detected	not detected	0.75	19	93
Vinyl Chloride	1.04	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	1.04	123.4	697.9	0.75	12	65	0.75	27	150
1,1-Dichloroethene	1.04	39.4	156.3	0.75	300	1200	0.75	110	440
Dichloromethane	1.04	44.1	49.0	0.75	not detected	not detected	0.75	not detected	not detected
Trichlorotrifluoroethane	1.04	938.6	7193.0	0.75	12000	91000	0.75	2500	19000
1,1-Dichloroethane	1.04	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	1.04	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	1.04	not detected	not detected	0.75	2.5	10	0.75	0.98	3.9
Chloroform	1.04	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	1.04	1.3	7.3	0.75	1.1	6.1	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	1.04	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	1.04	1.6	5.2	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	1.04	not detected	not detected	0.75	51	320	0.75	2.9	9.3
Trichloroethene	1.04	1.7	9.4	0.75	130	720	0.75	19	120
Toluene	1.04	5.5	20.8	0.75	1.8	6.7	0.75	55	300
Tetrachloroethene	1.04	not detected	not detected	0.75	not detected	not detected	0.75	7.3	28
1,2-Dichloroethene	1.04	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-2-2

Compound	CSL Pressurized Canisters		CSL Pressurized Canisters (duplicate)	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.75	0.00
Vinyl Chloride	0.75	0.0	0.75	0.51
Freon 11	0.75	33.3	0.75	203.61
1,1-Dichloroethene	6.94	162.08		
Dichloromethane	6.94	16.26		
Trichlorotrifluoroethane	6.94	6561.91		
1,1-Dichloroethane	0.75	0.2	0.75	0.81
c-1,2-Dichloroethene				
t-1,2-Dichloroethene				
Chloroform	0.75	0.8	0.75	3.90
1,1,1-Trichloroethane	0.75	0.1	0.75	0.55
1,2-Dichloroethane (ion 62)	0.75	0.1	0.75	0.00
Benzene	0.75	0.6	0.75	0.32
Carbon Tetrachloride	0.75	50.2	0.75	375.53
Trichloroethene	0.75	151.0	0.75	977.13
Toluene	0.75	0.3	0.75	0.38
Tetrachloroethene	0.75	0.1	0.75	1.36
1,2-Dichloroethene	0.75	10.94	0.75	30.61

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-2-3

Compound	Activated Carbon Tube		Tedlar Bags			Tedlar Bags (lab duplicate)		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	1.40	1.4	6.9	0.75	not detected	not detected	0.75	not detected
Vinyl Chloride	1.40	not detected	not detected	0.75	not detected	not detected	0.75	not detected
Freon 11	1.40	1.2	6.9	0.75	17	95	0.75	19
1,1-Dichloroethene	1.40	1.7	6.9	0.75	260	1000	0.75	270
Dichloromethane	1.40	9.2	31.9	0.75	not detected	not detected	0.75	not detected
Trichlorotrifluoroethane	1.40	262.0	2008.3	0.75	12000	90000	0.75	11000
1,1-Dichloroethane	1.40	not detected	not detected	0.75	not detected	not detected	0.75	not detected
c-1,2-Dichloroethene	1.40	not detected	not detected	0.75	not detected	not detected	0.75	not detected
t-1,2-Dichloroethene	1.40	not detected	not detected	0.75	3.5	14	0.75	1.9
Chloroform	1.40	not detected	not detected	0.75	101	5.1	0.75	0.91
1,1,1-Trichloroethane	1.40	not detected	not detected	0.75	102	6.7	0.75	1.5
1,2-Dichloroethane (Ion 62)	1.40	not detected	not detected	0.75	not detected	not detected	0.75	not detected
Benzene	1.40	not detected	not detected	0.75	0.92	2.9	0.75	1.1
Carbon Tetrachloride	1.40	not detected	not detected	0.75	42	260	0.75	40
Trichloroethene	1.40	not detected	not detected	0.75	110	600	0.75	110
Toluene	1.40	not detected	not detected	0.75	1.4	5.3	0.75	1.6
Tetrachloroethene	1.40	not detected	not detected	0.75	not detected	not detected	0.75	not detected
1,2-Dichloroethene	1.40	not detected	not detected	0.75	not detected	not detected	0.75	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-2-3

Compound	Offsite Pressurized Canisters			Offsite Pressurized Canisters (lab duplicate)			Offsite Pressurized Canisters (field duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.75	49	280	0.75	60	340	0.75	39	220
1,1-Dichloroethene	0.75	280	1100	0.75	270	1100	0.75	200	790
Dichloromethane	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Trichlorotrifluoroethane	0.75	12000	89000	0.75	13000	11000	0.75	15000	110000
1,1-Dichloroethane	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.75	3	12	0.75	2.7	11	0.75	3.6	14
Chloroform	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.75	61	390	0.75	64	410	0.75	87	550
Trichloroethene	0.75	170	910	0.75	170	920	0.75	240	1300
Toluene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Tetrachloroethene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-2-3

Compound	CSL Pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	38.5	217.75
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene			
t-1,2-Dichloroethene			
Chloroform	0.75	0.5	2.44
1,1,1-Trichloroethane	0.75	0.1	0.55
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	2.3	7.35
Carbon Tetrachloride	0.75	28.2	177.98
Trichloroethene	0.75	90.8	487.49
Toluene	0.75	1.6	6.03
Tetrachloroethene	0.75	0.1	0.68
1,2-Dichloroethene	0.75	3.4	13.52

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-2-B

Compound	Carbon Molecular Sieve		Tedlar Bags		Offsite Pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.91	18.9	93.6	0.75	1.6	7.8
Vinyl Chloride	0.91	not detected	not detected	0.75	not detected	not detected
Freon 11	0.91	9.2	52.1	0.75	290	1600
1,1-Dichloroethene	0.91	0.9	3.6	0.75	not detected	not detected
Dichloromethane	0.91	13.1	45.5	0.75	15	53
Trichlorofluoroethane	0.91	not detected	not detected	0.75	4.8	11
1,1-Dichloroethane	0.91	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.91	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.91	not detected	not detected	0.75	not detected	not detected
Chloroform	0.91	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.91	1.2	6.4	0.75	3.3	18
1,2-Dichloroethane (ion 62)	0.91	not detected	not detected	0.75	not detected	not detected
Benzene	0.91	1.1	3.6	0.75	1.8	5.8
Carbon Tetrachloride	0.91	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.91	not detected	not detected	0.75	2.3	12
Toluene	0.91	3.9	14.5	0.75	38	140
Tetrachloroethene	0.91	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethene	0.91	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-2-B

Compound	CSL Pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	0.0	0.00
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.0	0.00
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.0	0.00
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.1	0.32
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	0.0	0.00
Toluene	0.75	0.1	0.38
Tetrachloroethene	0.75	0.0	0.00
1,2-Dichloroethene	0.75	0.0	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-3-1

Compound	Carbon Molecular Sieve			Carbon Molecular Sieve (duplicate)			Tedlar Bags		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.91	6.8	33.6	0.96	63.2	313.5	0.75	not detected	not detected
Vinyl Chloride	0.91	not detected	not detected	0.96	not detected	not detected	0.75	not detected	not detected
Freon 11	0.91	2.3	12.7	0.96	6.3	35.6	0.75	not detected	not detected
1,1-Dichloroethene	0.91	4.8	19.1	0.96	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.91	not detected	not detected	0.96	5.3	18.3	0.75	90	310
Trichlorotrifluoroethane	0.91	952.6	7300.9	0.96	2288.4	17538.5	0.75	4500	35000
1,1-Dichloroethane	0.91	not detected	not detected	0.96	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.91	not detected	not detected	0.96	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.91	not detected	not detected	0.96	not detected	not detected	0.75	not detected	not detected
Chloroform	0.91	not detected	not detected	0.96	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.91	0.5	2.7	0.96	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.91	not detected	not detected	0.96	not detected	not detected	0.75	not detected	not detected
Benzene	0.91	0.6	1.8	0.96	1.2	0.0	0.75	not detected	not detected
Carbon Tetrachloride	0.91	3.0	19.1	0.96	1.7	10.6	0.75	9	57
Trichloroethene	0.91	4.6	24.5	0.96	4.3	23.1	0.75	8.5	46
Toluene	0.91	not detected	not detected	0.96	5.1	19.2	0.75	not detected	not detected
Tetrachloroethene	0.91	4.3	29.1	0.96	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
Client: CH2M Hill
Site: MW-3-1

Compound	Offsite Non-pressurized Canisters			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	0.75	not detected	not detected	0.75	0.0	0.00
Freon 11	0.75	not detected	not detected	0.75	0.3	1.70
1,1-Dichloroethene	0.75	not detected	not detected			
Dichloromethane	0.75	110	370			
Trichlorotrifluoroethane	0.75	830	6400			
1,1-Dichloroethane	0.75	not detected	not detected	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	not detected	not detected	0.75	0.0	0.00
Chloroform	0.75	not detected	not detected	0.75	0.1	0.49
1,1,1-Trichloroethane	0.75	not detected	not detected	0.75	0.1	0.55
1,2-Dichloroethane (Ion 62)	0.75	not detected	not detected	0.75	0.1	0.41
Benzene	0.75	not detected	not detected	0.75	0.0	0.00
Carbon Tetrachloride	0.75	5.1	32	0.75	4.8	30.30
Trichloroethene	0.75	9.5	51	0.75	7.9	42.41
Toluene	0.75	not detected	not detected	0.75	0.0	0.00
Tetrachloroethene	0.75	2	13	0.75	0.1	0.68

EPA Method TO-14: GC/MS Full Scan
Client: CH2M Hill
Site: MW-3-2

Compound	Carbon Molecular Sieve			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	31.2	154.6	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.77	6.4	36.2	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	310
Trichlorotrifluoroethane	0.77	2351.7	18023.1	0.75	2500	20000	0.75	660	5100
1,1-Dichloroethane	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.77	0.7	3.8	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.77	2.2	13.8	0.75	7.4	47	0.75	3.7	23
Trichloroethene	0.77	5.2	27.7	0.75	11	60	0.75	11	60
Toluene	0.77	1.0	3.8	0.75	not detected	not detected	0.75	not detected	not detected
Tetrachloroethene	0.77	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-3-2

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.00	0.00
Vinyl Chloride	0.75	0.00	0.00
Freon 11	0.75	0.50	2.83
1,1-Dichloroethene	6.94	4.33	17.20
Dichloromethane	6.94	20.51	71.36
Trichlorotrifluoroethane	6.94	1037.21	7949.11
1,1-Dichloroethane	6.94	0.20	0.81
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.0	0.00
Chloroform	6.94	0.20	0.98
1,1,1-Trichloroethane	6.94	0.00	0.00
1,2-Dichloroethane (Ion 62)	6.94	0.19	0.77
Benzene	6.94	0.00	0.00
Carbon Tetrachloride	0.75	5.80	36.61
Trichloroethene	6.94	7.80	41.88
Toluene	6.94	0.00	0.00
Tetrachloroethene	6.94	0.00	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-3-3

Compound	Activated Carbon Tube			Tedlar Bags			Tedlar Bags (lab duplicate)		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.25	87.0	431.3	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	1.25	9.1	51.3	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	1.25	1.3	5.0	0.75	not detected	not detected	0.75	not detected	not detected
Dichloromethane	1.25	3.2	11.3	0.75	not detected	not detected	0.75	not detected	not detected
Trichlorotrifluoroethane	1.25	3023.9	23175.0	0.75	2700	21000	0.75	2300	18000
1,1-Dichloroethane	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	1.25	1.1	6.3	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	1.25	0.8	2.5	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	1.25	not detected	not detected	0.75	7.4	46	0.75	7.8	49
Trichloroethene	1.25	1.4	7.5	0.75	8.8	47	0.75	12	67
Toluene	1.25	76.3	287.5	0.75	not detected	not detected	0.75	not detected	not detected
Tetrachloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-3-3

Compound	Tedlar Bags (field duplicate)			Offsite Non-pressurized Canisters			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.3	0.77
Freon 11	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.1	0.57
1,1-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected			
Dichloromethane	0.75	not detected	not detected	0.75	140	490			
Trichlorotrifluoroethane	0.75	2000	15000	0.75	670	5100			
1,1-Dichloroethane	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.0	0.00
Chloroform	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.1	0.55
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.1	0.41
Benzene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.1	0.32
Carbon Tetrachloride	0.75	7.5	47	0.75	5.3	33	0.75	2.8	17.67
Trichloroethene	0.75	11	62	0.75	9.4	50	0.75	4.4	23.62
Toluene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.1	0.38
Tetrachloroethene	0.75	not detected	not detected	0.75	not detected	not detected	0.75	0.1	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-3-B

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.63	0.9	3.1	0.75	6.1	21	0.75	7.5	26
Trichlorotrifluoroethane	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethane	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.63	0.5	2.5	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Toluene	0.63	not detected	not detected	0.75	2.5	9.5	0.75	0.8	3
Tetrachloroethene	0.63	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-3-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.2	0.51
Freon 11	0.75	0.0	0.00
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.1	0.41
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.0	0.00
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.0	0.00
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.0	0.00
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	0.0	0.00
Toluene	0.75	0.0	0.00
Tetrachloroethene	0.75	0.0	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-4-1

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.60	10.0	49.4	0.75	not detected	not detected
Vinyl Chloride	0.60	2.1	5.4	0.75	not detected	not detected
Freon 11	0.60	1.5	14.3	0.75	not detected	not detected
1,1-Dichloroethene	0.60	28.0	111.3	0.75	48	190
Dichloromethane	0.60	3.1	10.7	0.75	4.9	17
Trichlorotrifluoroethane	0.60	135.1	1035.7	0.75	280	2100
1,1-Dichloroethane	0.60	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.60	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.60	4.5	17.9	0.75	27	110
Chloroform	0.60	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.60	not detected	not detected	0.75	1.7	9.3
1,2-Dichloroethane (Ion 62)	0.60	not detected	not detected	0.75	not detected	not detected
Benzene	0.60	0.7	2.4	0.75	not detected	not detected
Carbon Tetrachloride	0.60	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.60	35.9	192.9	0.75	510	2700
Toluene	0.60	1.7	6.5	0.75	1.4	5.3
Tetrachloroethene	0.60	0.3	2.4	0.75	1.7	12
					2	6.3
					2	34
					2	not detected
					2	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-4-1

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.29	0.0	0.00
Vinyl Chloride	1.29	0.0	0.00
Freon 11	1.29	2.7	15.27
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	1.29	2.6	10.55
c-1,2-Dichloroethene	1.29	0.0	0.00
t-1,2-Dichloroethene	1.29	122.8	488.18
Chloroform	1.29	1.6	7.80
1,1,1-Trichloroethane	1.29	1.7	9.27
1,2-Dichloroethane (ion 62)	1.29	0.3	1.22
Benzene	1.29	0.4	1.28
Carbon Tetrachloride	1.29	0.0	0.00
Trichloroethene	1.29	106.0	569.10
Toluene	1.29	0.3	1.13
Tetrachloroethene	1.29	0.9	6.12

EPA Method TO-14: GC/MS Full Scan
Client: CH2M Hill
Site: MW-4-2

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.57	5.4	26.7	1.5	11	56	1.5	not detected	not detected
Vinyl Chloride	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
Freon 11	0.57	1.5	8.5	1.5	not detected	not detected	1.5	not detected	not detected
1,1-Dichloroethene	0.57	13.2	52.3	1.5	97	390	1.5	120	480
Dichloromethane	0.57	3.1	10.8	1.5	3.6	13	1.5	not detected	not detected
Trichlorotrifluoroethane	0.57	74.0	567.0	1.5	320	2400	1.5	400	3100
1,1-Dichloroethane	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
c-1,2-Dichloroethene	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
t-1,2-Dichloroethene	0.57	4.3	17.0	1.5	29	120	1.5	43	170
Chloroform	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	0.57	not detected	not detected	1.5	7	38	1.5	not detected	not detected
1,2-Dichloroethane (ion 62)	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
Benzene	0.57	0.9	2.8	1.5	1.8	5.7	1.5	not detected	not detected
Carbon Tetrachloride	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
Trichloroethene	0.57	24.1	129.5	1.5	500	2700	1.5	720	3800
Toluene	0.57	1.4	5.1	1.5	3.2	12	1.5	not detected	not detected
Tetrachloroethene	0.57	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-4-2

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	1.4	7.92
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	2.0	8.11
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	101.9	405.09
Chloroform	0.75	1.3	6.34
1,1,1-Trichloroethane	0.75	1.4	7.63
1,2-Dichloroethane (ion 62)	0.75	0.4	1.62
Benzene	0.75	0.4	1.28
Carbon Tetrachloride	0.75	0.1	0.63
Trichloroethene	0.75	0.0	0.00
Toluene	0.75	0.4	1.51
Tetrachloroethene	0.75	1.1	7.48

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-4-3

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.59	10.0	49.4	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.59	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.59	2.5	14.1	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	0.59	27.3	108.2	0.75	36	140	0.75	33	130
Dichloromethane	0.59	2.0	2.1	0.75	3.3	11	0.75	not detected	not detected
Trichlorotrifluoroethane	0.59	132.8	1017.6	0.75	120	920	0.75	210	1700
1,1-Dichloroethane	0.59	0.9	3.5	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethane	0.59	0.1	0.6	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethane	0.59	7.0	27.6	0.75	9.3	37	0.75	28	110
Chloroform	0.59	0.5	2.4	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.59	0.4	2.4	0.75	2.2	12	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.59	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.59	0.9	2.9	0.75	1.2	4	0.75	not detected	not detected
Carbon Tetrachloride	0.59	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.59	4.4	23.0	0.75	190	1000	0.75	520	2800
Toluene	0.59	15.6	58.8	0.75	2	7.4	0.75	not detected	not detected
Tetrachloroethene	0.59	0.4	2.9	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-4-3

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	2.4	13.57
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	3.0	12.17
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	236.7	940.98
Chloroform	0.75	1.8	8.78
1,1,1-Trichloroethane	0.75	2.5	13.63
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.7	2.24
Carbon Tetrachloride	0.75	0.1	0.63
Trichloroethene	0.75	126.4	678.62
Toluene	0.75	0.3	1.13
Tetrachloroethene	0.75	0.9	6.12

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-4-B

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	4.5	22.3	0.75	not detected	not detected
Vinyl Chloride	0.77	not detected	not detected	0.75	not detected	not detected
Freon 11	0.77	1.2	6.9	0.75	not detected	not detected
1,1-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.77	2.4	8.5	0.75	7.6	26
Trichlorotrifluoroethane	0.77	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethane	0.77	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected
Chloroform	0.77	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.77	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.77	not detected	not detected	0.75	not detected	not detected
Benzene	0.77	1.2	3.8	0.75	not detected	not detected
Carbon Tetrachloride	0.77	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.77	0.3	1.5	0.75	not detected	not detected
Toluene	0.77	4.7	17.7	0.75	7.8	29
Tetrachloroethene	0.77	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-4-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	0.0	0.00
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.1	0.40
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.0	0.00
1,2-Dichloroethane (ion 62)	0.75	0.0	0.00
Benzene	0.75	0.0	0.00
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	0.2	1.07
Toluene	0.75	0.0	0.00
Tetrachloroethene	0.75	0.0	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-5-1

Compound	Activated Carbon Tube		Tedlar Bags		Tedlar Bags (duplicate)	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.91	not detected	not detected	1.5	not detected	not detected
Vinyl Chloride	0.91	not detected	not detected	1.5	not detected	not detected
Freon 11	0.91	not detected	not detected	1.5	not detected	not detected
1,1-Dichloroethene	0.91	not detected	not detected	1.5	12	46
Dichloromethane	0.91	not detected	not detected	1.5	12	42
Trichlorotrifluoroethane	0.91	not detected	not detected	1.5	91	690
1,1-Dichloroethane	0.91	not detected	not detected	1.5	not detected	not detected
c-1,2-Dichloroethene	0.91	not detected	not detected	1.5	not detected	not detected
t-1,2-Dichloroethene	0.91	not detected	not detected	1.5	4.8	19
Chloroform	0.91	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	0.91	not detected	not detected	1.5	18	97
1,2-Dichloroethane (Ion 62)	0.91	not detected	not detected	1.5	not detected	not detected
Benzene	0.91	0.6	1.8	1.5	not detected	not detected
Carbon Tetrachloride	0.91	not detected	not detected	1.5	not detected	not detected
Trichloroethene	0.91	4.7	25.5	1.5	39	210
Toluene	0.91	1.7	6.4	1.5	not detected	not detected
Tetrachloroethene	0.91	0.3	1.8	1.5	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-5-1

Compound	Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv
Freon 12	1.5	not detected
Vinyl Chloride	1.5	not detected
Freon 11	1.5	not detected
1,1-Dichloroethene	1.5	not detected
Dichloromethane	1.5	11
Trichlorotrifluoroethane	1.5	not detected
1,1-Dichloroethane	1.5	not detected
c-1,2-Dichloroethene	1.5	not detected
t-1,2-Dichloroethene	1.5	not detected
Chloroform	1.5	not detected
1,1,1-Trichloroethane	1.5	not detected
1,2-Dichloroethane (Ion 62)	1.5	not detected
Benzene	1.5	not detected
Carbon Tetrachloride	1.5	not detected
Trichloroethene	1.5	not detected
Toluene	1.5	not detected
Tetrachloroethene	1.5	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-5-2

Compound	Activated Carbon Tube			Tedlar Bags			Onsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	1.4	6.9	0.75	not detected	not detected	3	not detected	not detected
Vinyl Chloride	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
Freon 11	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
1,1-Dichloroethene	0.77	not detected	not detected	0.75	11	44	3	not detected	not detected
Dichloromethane	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
Trichlorotrifluoroethane	0.77	not detected	not detected	0.75	160	1300	3	not detected	not detected
1,1-Dichloroethane	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
c-1,2-Dichloroethene	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
t-1,2-Dichloroethene	0.77	not detected	not detected	0.75	11	45	3	not detected	not detected
Chloroform	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
1,1,1-Trichloroethane	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
Benzene	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
Carbon Tetrachloride	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
Trichloroethene	0.77	not detected	not detected	0.75	86	460	3	not detected	not detected
Toluene	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected
Tetrachloroethene	0.77	not detected	not detected	0.75	not detected	not detected	3	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-5-2

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.1	0.26
Freon 11	0.75	0.5	2.83
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.6	2.43
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	46.1	183.27
Chloroform	0.75	0.4	1.95
1,1,1-Trichloroethane	0.75	0.2	1.09
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.4	1.28
Carbon Tetrachloride	0.75	0.1	0.63
Trichloroethene	0.75	103.5	555.68
Toluene	0.75	0.3	1.13
Tetrachloroethene	0.75	0.2	1.36

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-5-3

Compound	Carbon Molecular Sieve			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Vinyl Chloride	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Freon 11	1.04	5.9	33.3	0.75	not detected	not detected	1.5	not detected	not detected
1,1-Dichloroethene	1.04	24.1	95.8	0.75	18	73	1.5	not detected	not detected
Dichloromethane	1.04	5.1	17.7	0.75	3.2	11	1.5	not detected	not detected
Trichlorotrifluoroethane	1.04	318.0	2437.5	0.75	280	2100	1.5	not detected	not detected
1,1-Dichloroethane	1.04	1.5	6.3	0.75	not detected	not detected	1.5	not detected	not detected
c-1,2-Dichloroethene	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
t-1,2-Dichloroethene	1.04	5.8	22.9	0.75	15	59	1.5	not detected	not detected
Chloroform	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
1,2-Dichloroethane (Ion 62)	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Benzene	1.04	0.3	1.0	0.75	not detected	not detected	1.5	not detected	not detected
Carbon Tetrachloride	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Trichloroethene	1.04	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Toluene	1.04	2.2	8.3	0.75	110	590	1.5	not detected	not detected
Tetrachloroethene	1.04	0.6	4.2	0.75	not detected	not detected	1.5	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-5-3

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	1.4	7.92
1,1-Dichloroethene	7.50	33.94	134.79
Dichloromethane	7.50	21.10	73.42
Trichlorotrifluoroethane	7.50	333.64	2557.00
1,1-Dichloroethane	0.75	0.7	2.84
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	49.9	198.37
Chloroform	0.75	0.5	2.44
1,1,1-Trichloroethane	0.75	0.1	0.55
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.3	0.96
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	115.9	622.25
Toluene	0.75	0.3	1.13
Tetrachloroethene	0.75	0.3	2.04

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-5-B

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.25	0.8	3.8	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	1.25	4.1	16.3	0.75	not detected	not detected	0.75	not detected	not detected
Dichloromethane	1.25	4.7	16.3	0.75	not detected	not detected	0.75	not detected	44
Trichlorotrifluoroethane	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethane	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	1.25	4.3	13.8	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected
Toluene	1.25	6.6	25.0	0.75	not detected	not detected	0.75	not detected	not detected
Tetrachloroethene	1.25	not detected	not detected	0.75	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-5-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.1	0.26
Freon 11	0.75	0.0	0.00
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.1	0.40
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.0	0.00
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.0	0.00
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	0.1	0.54
Toluene	0.75	0.0	0.00
Tetrachloroethene	0.75	0.0	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-6-1

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.32	66.9	331.6	1.5	16	77	1.5	not detected	not detected
Vinyl Chloride	1.32	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
Freon 11	1.32	2.1	11.8	1.5	not detected	not detected	1.5	not detected	not detected
1,1-Dichloroethene	1.32	12.3	48.7	1.5	not detected	not detected	1.5	490	2000
Dichloromethane	1.32	4.5	15.8	1.5	16	56	1.5	7.8	27
Trichlorotrifluoroethane	1.32	80.2	614.5	1.5	740	5700	1.5	440	3400
1,1-Dichloroethane	1.32	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
c-1,2-Dichloroethene	1.32	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
t-1,2-Dichloroethene	1.32	not detected	not detected	1.5	1.9	7.6	1.5	not detected	not detected
Chloroform	1.32	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	1.32	11.6	63.2	1.5	not detected	not detected	1.5	not detected	not detected
1,2-Dichloroethane (Ion 62)	1.32	not detected	not detected	1.5	not detected	not detected	1.5	not detected	not detected
Benzene	1.32	2.1	6.6	1.5	not detected	not detected	1.5	not detected	not detected
Carbon Tetrachloride	1.32	1.5	9.2	1.5	not detected	not detected	1.5	not detected	not detected
Trichloroethene	1.32	23.3	125.0	1.5	44	240	1.5	20	110
Toluene	1.32	48.2	181.6	1.5	4.3	16	1.5	not detected	not detected
Tetrachloroethene	1.32	5.6	38.2	1.5	not detected	not detected	1.5	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-6-1

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	3.3	18.66
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.2	0.81
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	3.9	15.50
Chloroform	0.75	0.1	0.49
1,1,1-Trichloroethane	0.75	0.2	1.09
1,2-Dichloroethane (Ion 62)	0.75	0.1	0.41
Benzene	0.75	0.1	0.32
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	56.5	303.34
Toluene	0.75	0.2	0.75
Tetrachloroethene	0.75	0.2	1.36

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-6-2

Compound	Carbon Molecular Sieve		Carbon Molecular Sieve (duplicate)		Tedlar Bags	
	MDL ug	Concentration ppbv	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	1.67	184.8	0.001	0.056	1.5	7
Vinyl Chloride	1.67	not detected	0.001	not detected	1.5	not detected
Freon 11	1.67	17.4	0.001	0.003	1.5	not detected
1,1-Dichloroethene	1.67	17.2	0.001	0.003	1.5	not detected
Dichloromethane	1.67	33.5	0.001	0.031	1.5	21
Trichlorotrifluoroethane	1.67	565.6	0.001	0.043	1.5	690
1,1-Dichloroethane	1.67	not detected	0.001	not detected	1.5	not detected
c-1,2-Dichloroethene	1.67	not detected	0.001	0.002	1.5	not detected
t-1,2-Dichloroethene	1.67	2.5	0.001	0.003	1.5	1.9
Chloroform	1.67	not detected	0.001	0.004	1.5	not detected
1,1,1-Trichloroethane	1.67	2.1	0.001	0.004	1.5	11
1,2-Dichloroethane (Ion 62)	1.67	not detected	0.001	not detected	1.5	not detected
Benzene	1.67	not detected	0.001	0.002	1.5	not detected
Carbon Tetrachloride	1.67	not detected	0.001	not detected	1.5	not detected
Trichloroethene	1.67	27.9	0.001	0.013	1.5	61
Toluene	1.67	30.9	0.001	0.019	1.5	37
Tetrachloroethene	1.67	not detected	0.001	0.002	1.5	not detected

EPA Method TO-14: GCMS
 Client: CH2M Hill
 Site: MW-6-2

Compound	Offsite Non-pressurized Canisters			Offsite Non-pressurized Canisters (duplicate)			CSL Pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	14	67	1.5	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.0	0.00
Freon 11	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.8	4.52
1,1-Dichloroethene	1.5	not detected	not detected	1.5	24	94			
Dichloromethane	1.5	not detected	not detected	1.5	4.6	16			
Trichlorotrifluoroethane	1.5	270	2100	1.5	540	4100			
1,1-Dichloroethane	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.2	0.81
c-1,2-Dichloroethene	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	1.5	not detected	not detected	1.5	not detected	not detected	0.75	4.3	17.09
Chloroform	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.2	0.98
1,1,1-Trichloroethane	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.0	0.00
1,2-Dichloroethane (Ion 62)	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.0	0.00
Benzene	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.1	0.32
Carbon Tetrachloride	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.0	0.00
Trichloroethene	1.5	29	150	1.5	75	400	0.75	59.3	318.37
Toluene	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.2	0.75
Tetrachloroethene	1.5	not detected	not detected	1.5	not detected	not detected	0.75	0.2	1.36

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-6-3

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	Concentration ug/m3
Freon 12	2.27	166.4	825.0	1.5	9.3	46	57
Vinyl Chloride	2.27	not detected	not detected	1.5	not detected	not detected	not detected
Freon 11	2.27	11.3	63.6	1.5	not detected	not detected	not detected
1,1-Dichloroethene	2.27	11.4	45.5	1.5	not detected	not detected	not detected
Dichloromethane	2.27	10.5	36.4	1.5	11	38	not detected
Trichlorotrifluoroethane	2.27	682.1	5227.3	1.5	630	4800	1800
1,1-Dichloroethane	2.27	not detected	not detected	1.5	not detected	not detected	not detected
c-1,2-Dichloroethene	2.27	not detected	not detected	1.5	not detected	not detected	not detected
t-1,2-Dichloroethene	2.27	1.1	4.5	1.5	2.1	8.2	not detected
Chloroform	2.27	not detected	not detected	1.5	not detected	not detected	not detected
1,1,1-Trichloroethane	2.27	2.9	15.9	1.5	not detected	not detected	not detected
1,2-Dichloroethane (Ion 62)	2.27	not detected	not detected	1.5	not detected	not detected	not detected
Benzene	2.27	2.1	6.8	1.5	not detected	not detected	not detected
Carbon Tetrachloride	2.27	not detected	not detected	1.5	not detected	not detected	not detected
Trichloroethene	2.27	14.8	79.5	1.5	65	350	140
Toluene	2.27	16.3	61.4	1.5	4.6	18	not detected
Tetrachloroethene	2.27	0.7	4.5	1.5	not detected	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-6-3

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.44	0.0	0.00
Vinyl Chloride	1.44	0.0	0.00
Freon 11	1.44	3.0	16.97
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	1.44	0.3	1.22
c-1,2-Dichloroethene	1.44	0.0	0.00
t-1,2-Dichloroethene	1.44	3.8	15.11
Chloroform	1.44	0.3	1.46
1,1,1-Trichloroethane	1.44	0.2	1.09
1,2-Dichloroethane (Ion 62)	1.44	0.0	0.00
Benzene	1.44	0.2	0.64
Carbon Tetrachloride	1.44	0.0	0.00
Trichloroethene	1.44	46.2	248.04
Toluene	1.44	0.0	0.00
Tetrachloroethene	1.44	0.3	2.04

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-6-B

Compound	Activated Carbon Tube			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.56	4.7	23.3	0.75	27	130	1.5	not detected	not detected
Vinyl Chloride	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Freon 11	0.56	0.5	2.8	0.75	not detected	not detected	1.5	not detected	not detected
1,1-Dichloroethene	0.56	1.1	4.4	0.75	not detected	not detected	1.5	not detected	not detected
Dichloromethane	0.56	5.4	18.9	0.75	7.2	25	1.5	not detected	not detected
Trichlorotrifluoroethane	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	39
1,1-Dichloroethane	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
c-1,2-Dichloroethene	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
t-1,2-Dichloroethene	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Chloroform	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
1,2-Dichloroethane (ion 62)	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Benzene	0.56	1.0	3.3	0.75	not detected	not detected	1.5	not detected	not detected
Carbon Tetrachloride	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Trichloroethene	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected
Toluene	0.56	2.1	7.8	0.75	not detected	not detected	1.5	not detected	not detected
Tetrachloroethene	0.56	not detected	not detected	0.75	not detected	not detected	1.5	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-6-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	0.0	0.00
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.0	0.00
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.0	0.00
1,2-Dichloroethane (Ion 62)	0.75	0.0	0.00
Benzene	0.75	0.0	0.00
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	0.1	0.54
Toluene	0.75	0.0	0.00
Tetrachloroethene	0.75	0.0	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-7-1

Compound	Activated Carbon Tube			Activated Carbon Tube (duplicate)			Tedlar Bags		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.00	not detected	not detected	0.77	139.0	689.2	7.5	250	1200
Vinyl Chloride	1.00	1499.1	3840.0	0.77	708.7	1815.4	7.5	2300	5800
Freon 11	1.00	67.0	379.0	0.77	48.0	271.5	7.5	110	600
1,1-Dichloroethene	1.00	5043.7	20030.0	0.77	3558.2	14130.8	7.5	57000	230000
Dichloromethane	1.00	not detected	not detected	0.77	not detected	not detected	7.5	150	540
Trichlorotrifluoroethane	1.00	3263.3	25010.0	0.77	3127.5	23969.2	7.5	29000	20000
1,1-Dichloroethane	1.00	882.3	3580.0	0.77	436.1	1769.2	7.5	3500	14000
c-1,2-Dichloroethene	1.00	2.0	8.0	0.77	0.6	2.3	7.5	not detected	not detected
t-1,2-Dichloroethene	1.00	83.3	331.0	0.77	53.6	213.1	7.5	610	2400
Chloroform	1.00	not detected	not detected	0.77	not detected	not detected	7.5	37	180
1,1,1-Trichloroethane	1.00	131.2	715.0	0.77	45.3	246.9	7.5	170	940
1,2-Dichloroethane (Ion 62)	1.00	175.5	712.0	0.77	not detected	not detected	7.5	480	1900
Benzene	1.00	42.5	136.0	0.77	15.4	49.2	7.5	140	450
Carbon Tetrachloride	1.00	not detected	not detected	0.77	not detected	not detected	7.5	not detected	not detected
Trichloroethene	1.00	1428.6	7670.0	0.77	753.6	646.2	7.5	9200	50000
Toluene	1.00	13.0	49.0	0.77	36.7	138.5	7.5	not detected	not detected
Tetrachloroethene	1.00	58.5	398.0	0.77	29.2	198.5	7.5	180	1200

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-7-1

Compound	Offsite Non-pressurized Canisters			CSL Non-pressurized Canisters			Offsite Breakthrough Tubes		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	5	280	1400	0.75	0.0	0.0	0.001	0.005	0.024
Vinyl Chloride	5	2300	5800	0.75	0.0	0.0	0.001	0.748	1.915
Freon 11	5	120	680	0.75	875.5	4951.6	0.001	0.042	0.235
1,1-Dichloroethene	5	38000	150000				0.001	5.031	19.981
Dichloromethane	5	150	520				0.001	0.003	0.010
Trichlorotrifluoroethane	5	14000	110000				0.001	0.355	2.724
1,1-Dichloroethane	5	1700	6800	0.75	16470.6	66827.4	0.001	0.738	2.994
c-1,2-Dichloroethene	5	not detected	not detected	0.75	0.0	0.0	0.001	0.001	0.003
t-1,2-Dichloroethene	5	380	1500	0.75	8457.4	33621.6	0.001	0.080	0.316
Chloroform	5	20	98	0.75	99.8	486.7	0.001	0.005	0.026
1,1,1-Trichloroethane	5	120	680	0.75	608.3	3304.8	0.001	0.066	0.360
1,2-Dichloroethane (Ion 62)	5	360	1500	0.75	1278.1	5185.7	0.001	0.023	0.093
Benzene	5	98	310	0.75	512.7	1639.0	0.001	0.022	0.071
Carbon Tetrachloride	5	not detected	not detected	0.75	3.8	24.0	0.001	not detected	not detected
Trichloroethene	5	6700	36000	0.75	6367.0	34183.5	0.001	0.841	4.513
Toluene	5	not detected	not detected	0.75	11.2	42.2	0.001	0.003	0.010
Tetrachloroethene	5	140	970	0.75	255.6	1738.9	0.001	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-7-2

Compound	Activated Carbon Tube		Tedlar Bags			Tedlar Bags (duplicate)		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	0.74	not detected	not detected	1.5	not detected	not detected	3.75	180
Vinyl Chloride	0.74	1865.9	4779.4	1.5	not detected	not detected	3.75	180
Freon 11	0.74	33.5	189.7	1.5	62	350	3.75	270
1,1-Dichloroethene	0.74	5347.2	21235.3	1.5	30000	120000	3.75	60000
Dichloromethane	0.74	not detected	not detected	1.5	15	52	3.75	160
Trichlorotrifluoroethane	0.74	2354.4	18044.1	1.5	16000	120000	3.75	23000
1,1-Dichloroethane	0.74	755.7	3066.2	1.5	2600	10000	3.75	1300
c-1,2-Dichloroethene	0.74	2.0	8.1	1.5	9.9	39	3.75	not detected
t-1,2-Dichloroethene	0.74	106.2	422.1	1.5	450	1800	3.75	120
Chloroform	0.74	not detected	not detected	1.5	30	150	3.75	15
1,1,1-Trichloroethane	0.74	53.3	290.4	1.5	140	770	3.75	32
1,2-Dichloroethane (Ion 62)	0.74	not detected	not detected	1.5	330	1400	3.75	91
Benzene	0.74	17.0	54.4	1.5	83	260	3.75	27
Carbon Tetrachloride	0.74	not detected	not detected	1.5	not detected	not detected	3.75	not detected
Trichloroethene	0.74	610.8	3279.4	1.5	4900	26000	3.75	3400
Toluene	0.74	0.6	2.2	1.5	4.6	17	3.75	not detected
Tetrachloroethene	0.74	0.0	0.2	1.5	100	680	3.75	56

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-7-2

Compound	Offsite Non-pressurized Canisters			Offsite Non-pressurized Canisters (lab duplicate)			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	5	230	1100	5	260	1300	6.94	0.00	0.0
Vinyl Chloride	5	2300	6000	5	2800	7100	6.94	-1.31	-3.4
Freon 11	5	170	940	5	230	1300	6.94	0.00	0.0
1,1-Dichloroethene	5	42000	170000	5	62000	250000	6.94	0.00	0.0
Dichloromethane	5	120	401	5	190	660	6.94	385.11	1340.0
Trichlorotrifluoroethane	5	20000	150000	5	26000	200000	6.94	7997.68	61293.7
1,1-Dichloroethane	5	2300	9500	5	2700	11000	6.94	16365.78	66402.1
c-1,2-Dichloroethene	5	not detected	not detected	5	not detected	not detected			
t-1,2-Dichloroethene	5	460	1800	5	360	1400			
Chloroform	5	28	130	5	29	140	6.94	75.07	366.1
1,1,1-Trichloroethane	5	140	750	5	140	790	6.94	330.03	1798.9
1,2-Dichloroethane (Ion 62)	5	360	1500	5	440	1800	6.94	712.52	2891.0
Benzene	5	110	340	5	120	380	6.94	341.75	1092.5
Carbon Tetrachloride	5	not detected	not detected	5	not detected	not detected	6.94	0.00	0.0
Trichloroethene	5	6900	37000	5	7600	41000	6.94	3742.58	20093.4
Toluene	5	not detected	not detected	5	not detected	not detected	6.94	0.00	0.0
Tetrachloroethene	5	160	1100	5	170	1200	6.94	85.67	582.8

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-7-2

Compound	Offsite Breakthrough Tubes		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.001	0.224	1.11
Vinyl Chloride	0.001	1.869	4.79
Freon 11	0.001	0.103	0.58
1,1-Dichloroethene	0.001	7.804	30.99
Dichloromethane	0.001	0.007	0.02
Trichlorotrifluoroethane	0.001	16.934	129.78
1,1-Dichloroethane	0.001	1.417	5.75
c-1,2-Dichloroethene	0.001	not detected	not detected
t-1,2-Dichloroethene	0.001	0.150	0.60
Chloroform	0.001	0.061	0.30
1,1,1-Trichloroethane	0.001	0.174	0.95
1,2-Dichloroethane (Ion 62)	0.001	0.394	1.60
Benzene	0.001	0.053	0.17
Carbon Tetrachloride	0.001	not detected	not detected
Trichloroethene	0.001	1.411	7.57
Toluene	0.001	0.006	0.02
Tetrachloroethene	0.001	0.008	0.05

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-7-3

Compound	Carbon Molecular Sieve		Tedlar Bags		Orisite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	0.96	not detected	not detected	7.5	54	5	not detected
Vinyl Chloride	0.96	140.8	3065.8	7.5	1200	5	2200
Freon 11	0.96	79.4	449.0	7.5	150	5	160
1,1-Dichloroethene	0.96	2757.8	10951.9	7.5	54000	5	36000
Dichloromethane	0.96	not detected	not detected	7.5	91	5	110
Trichlorotrifluoroethane	0.96	3911.9	29980.8	7.5	27000	5	18000
1,1-Dichloroethane	0.96	1014.3	4115.4	7.5	3100	5	2200
c-1,2-Dichloroethene	0.96	not detected	not detected	7.5	not detected	5	8.2
t-1,2-Dichloroethene	0.96	145.8	579.8	7.5	610	5	440
Chloroform	0.96	not detected	not detected	7.5	37	5	26
1,1,1-Trichloroethane	0.96	154.9	844.2	7.5	170	5	140
1,2-Dichloroethane (Ion 62)	0.96	not detected	not detected	7.5	450	5	380
Benzene	0.96	37.3	119.2	7.5	140	5	100
Carbon Tetrachloride	0.96	not detected	not detected	7.5	not detected	5	18
Trichloroethene	0.96	1558.1	8365.4	7.5	8900	5	3800
Toluene	0.96	11.2	42.3	7.5	9.8	5	not detected
Tetrachloroethene	0.96	56.5	384.6	7.5	180	5	160
							not detected
							1100

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-7-3

Compound	CSL Non-pressurized Canisters			Breakthrough Tubes		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.95	0.0	0.0	0.001	0.900	4.465
Vinyl Chloride	0.95	0.0	0.0	0.001	1.878	4.810
Freon 11	0.95	617.2	3490.7	0.001	0.029	0.165
1,1-Dichloroethene				0.001	2.265	8.995
Dichloromethane				0.001	0.004	0.015
Trichlorotrifluoroethane				0.001	0.143	1.095
1,1-Dichloroethane	0.95	8113.4	32919.1	0.001	0.014	0.056
c-1,2-Dichloroethene	0.95	0.0	0.0	0.001	not detected	not detected
t-1,2-Dichloroethene	0.95	5343.0	21240.6	0.001	0.015	0.060
Chloroform	0.95	48.7	237.5	0.001	not detected	not detected
1,1,1-Trichloroethane	0.95	290.8	1585.1	0.001	0.001	0.003
1,2-Dichloroethane (Ion 62)	0.95	606.9	2462.4	0.001	not detected	not detected
Benzene	0.95	236.2	755.1	0.001	0.074	0.237
Carbon Tetrachloride	0.95	0.0	0.0	0.001	not detected	not detected
Trichloroethene	0.95	22048.7	118376.2	0.001	0.209	1.122
Toluene	0.95	5.1	19.2	0.001	0.013	0.048
Tetrachloroethene	0.95	88.4	601.4	0.001	0.009	0.064

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-7-4

Compound	Breakthrough Tubes		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.001	0.010	0.049
Vinyl Chloride	0.001	0.782	2.003
Freon 11	0.001	0.003	0.019
1,1-Dichloroethene	0.001	2.723	10.813
Dichloromethane	0.001	0.001	0.003
Trichlorotrifluoroethane	0.001	0.719	5.507
1,1-Dichloroethane	0.001	0.020	0.081
c-1,2-Dichloroethene	0.001	0.065	0.260
t-1,2-Dichloroethene	0.001	0.044	0.174
Chloroform	0.001	0.032	0.158
1,1,1-Trichloroethane	0.001	0.008	0.045
1,2-Dichloroethane (Ion 62)	0.001	0.012	0.049
Benzene	0.001	0.004	0.012
Carbon Tetrachloride	0.001	not detected	not detected
Trichloroethene	0.001	0.130	0.696
Toluene	0.001	0.021	0.079
Tetrachloroethene	0.001	0.001	0.007

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-7-B

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.63	1.3	1.3	0.75	not detected	not detected
Vinyl Chloride	0.63	not detected	not detected	0.75	not detected	not detected
Freon 11	0.63	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	0.63	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.63	0.9	3.1	0.75	5.3	18
Trichlorotrifluoroethane	0.63	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethane	0.63	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethane	0.63	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethane	0.63	not detected	not detected	0.75	not detected	not detected
Chloroform	0.63	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.63	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (Ion 62)	0.63	not detected	not detected	0.75	not detected	not detected
Benzene	0.63	0.4	1.3	0.75	not detected	not detected
Carbon Tetrachloride	0.63	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.63	not detected	not detected	0.75	not detected	not detected
Toluene	0.63	4.8	18.1	0.75	not detected	not detected
Tetrachloroethene	0.63	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GCMS
 Client: CH2M Hill
 Site: MW-7-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.12	0.4	1.98
Vinyl Chloride	1.12	0.0	0.00
Freon 11	1.12	0.2	1.13
1,1-Dichloroethene			0.00
Dichloromethane			0.00
Trichlorotrifluoroethane			0.00
1,1-Dichloroethane	1.12	1.0	4.06
c-1,2-Dichloroethene	1.12	0.0	0.00
t-1,2-Dichloroethene	1.12	1.1	4.37
Chloroform	1.12	0.0	0.00
1,1,1-Trichloroethane	1.12	0.4	2.18
1,2-Dichloroethane (ion 62)	1.12	0.3	1.22
Benzene	1.12	0.5	1.60
Carbon Tetrachloride	1.12	0.0	0.00
Trichloroethene	1.12	10.7	57.45
Toluene	1.12	2.3	8.67
Tetrachloroethene	1.12	0.1	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: MW-8-1

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.69	1.1	5.6	1.5	not detected	not detected
Vinyl Chloride	0.69	314.5	805.6	1.5	28	72
Freon 11	0.69	130.2	736.1	1.5	110	640
1,1-Dichloroethene	0.69	4056.9	16111.1	1.5	9900	39000
Dichloromethane	0.69	not detected	not detected	1.5	16	57
Trichlorotrifluoroethane	0.69	3443.3	26388.9	1.5	5900	45000
1,1-Dichloroethane	0.69	43.1	175.0	1.5	42	170
c-1,2-Dichloroethene	0.69	0.3	1.4	1.5	not detected	not detected
t-1,2-Dichloroethene	0.69	1.4	5.6	1.5	not detected	not detected
Chloroform	0.69	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	0.69	80.3	437.5	1.5	80	440
1,2-Dichloroethane (Ion 62)	0.69	not detected	not detected	1.5	not detected	not detected
Benzene	0.69	3.9	12.5	1.5	not detected	not detected
Carbon Tetrachloride	0.69	not detected	not detected	1.5	not detected	not detected
Trichloroethene	0.69	152.6	819.4	1.5	370	2000
Toluene	0.69	14.9	56.3	1.5	not detected	not detected
Tetrachloroethene	0.69	17.0	116.0	1.5	11	75

EPA Method TO-14: GC/MS
Client: CH2M HILL
Site: MW-8-1

Compound	Offsite Non-pressurized Canisters (lab duplicate)			Offsite Pressurized Canisters			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	not detected	not detected	3	280	1400	0.94	0.0	0.0
Vinyl Chloride	1.5	36	91	3	160	400	0.94	0.0	0.0
Freon 11	1.5	71	400	3	210	1200	0.94	413.5	2338.6
1,1-Dichloroethene	1.5	8100	32000	3	21000	84000			
Dichloromethane	1.5	19	67	3	not detected	not detected			
Trichlorotrifluoroethane	1.5	5000	37000	3	10000	79000			
1,1-Dichloroethane	1.5	40	160	3	90	360	0.94	180.3	731.5
c-1,2-Dichloroethene	1.5	not detected	not detected	3	not detected	not detected	0.94	0.0	0.0
t-1,2-Dichloroethene	1.5	not detected	not detected	3	not detected	not detected	0.94	13.6	54.1
Chloroform	1.5	not detected	not detected	3	not detected	not detected	0.94	8.1	39.5
1,1,1-Trichloroethane	1.5	68	370	3	240	1300	0.94	301.9	1645.6
1,2-Dichloroethane (Ion 62)	1.5	not detected	not detected	3	not detected	not detected	0.94	18.3	74.3
Benzene	1.5	not detected	not detected	3	not detected	not detected	0.94	6.1	19.5
Carbon Tetrachloride	1.5	not detected	not detected	3	not detected	not detected	0.94	3.4	21.5
Trichloroethene	1.5	310	1600	3	820	4400	0.94	1311.9	7043.4
Toluene	1.5	not detected	not detected	3	not detected	not detected	0.94	0.4	1.5
Tetrachloroethene	1.5	9.9	67	3	38	260	0.94	30.1	204.8

EPA Method TO-14: GC/MS Full Scan
Client: CH2M Hill
Site: MW-8-2

Compound	Carbon Molecular Sieve			Tedlar Bags			Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.79	547.3	2714.3	3	690	3400		160	800
Vinyl Chloride	1.79	1443.1	3696.4	3	310	790		not detected	not detected
Freon 11	1.79	622.0	3517.9	3	230	1300		110	630
1,1-Dichloroethene	1.79	15243.0	60535.7	3	26000	100000		9200	37000
Dichloromethane	1.79	not detected	not detected	3	210	720		73	260
Trichlorotrifluoroethane	1.79	10648.2	81607.1	3	16000	120000	1.5	5400	41000
1,1-Dichloroethane	1.79	345.9	1403.6	3	80	320	1.5	43	180
c-1,2-Dichloroethene	1.79	0.9	3.6	3	not detected	not detected	1.5	not detected	not detected
t-1,2-Dichloroethene	1.79	7.6	30.4	3	not detected	not detected	1.5	not detected	not detected
Chloroform	1.79	not detected	not detected	3	not detected	not detected	1.5	not detected	not detected
1,1,1-Trichloroethane	1.79	478.3	2607.1	3	250	1400	1.5	71	390
1,2-Dichloroethane (Ion 62)	1.79	not detected	not detected	3	not detected	not detected	1.5	not detected	not detected
Benzene	1.79	8.4	26.8	3	10	33	1.5	not detected	not detected
Carbon Tetrachloride	1.79	4.2	26.8	3	not detected	not detected	1.5	not detected	not detected
Trichloroethene	1.79	738.4	3964.3	3	1000	5500	1.5	320	1700
Toluene	1.79	113.7	428.6	3	not detected	not detected	1.5	not detected	not detected
Tetrachloroethene	1.79	51.7	351.8	3	42	280	1.5	11	77

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-8-2

Compound	Onsite Pressurized Canisters			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	5	not detected	not detected	0.75	0.0	0.0
Vinyl Chloride	5	not detected	not detected	0.75	0.0	0.0
Freon 11	5	260	1500	0.75	274.3	1551.4
1,1-Dichloroethene	5	27000	110000			
Dichloromethane	5	39	130			
Trichlorotrifluoroethane	5	16000	130000			
1,1-Dichloroethane	5	140	550	0.75	110.8	449.6
c-1,2-Dichloroethene	5	not detected	not detected	0.75	0.0	0.0
t-1,2-Dichloroethene	5	not detected	not detected	0.75	8.6	34.2
Chloroform	5	not detected	not detected	0.75	5.3	25.8
1,1,1-Trichloroethane	5	240	1300	0.75	208.5	1136.5
1,2-Dichloroethane (Ion 62)	5	not detected	not detected	0.75	13.4	54.4
Benzene	5	not detected	not detected	0.75	4.3	13.7
Carbon Tetrachloride	5	not detected	not detected	0.75	2.6	16.4
Trichloroethene	5	1100	6100	0.75	174.9	939.0
Toluene	5	not detected	not detected	0.75	0.7	2.6
Tetrachloroethene	5	32	210	0.75	24.7	168.0

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan

Client: CH2M Hill

Site: MW-8-3

Compound	Activated Carbon Tube		Tedlar Bags		Tedlar Bags (lab duplicate)	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	38.0	188.5	3.75	not detected	not detected
Vinyl Chloride	0.77	543.6	1392.3	3.75	not detected	not detected
Freon 11	0.77	179.5	1015.4	3.75	230	1300
1,1-Dichloroethene	0.77	7999.7	31769.2	3.75	23000	92000
Dichloromethane	0.77	not detected	not detected	3.75	49	170
Trichlorotrifluoroethane	0.77	5691.0	43615.4	3.75	20000	150000
1,1-Dichloroethane	0.77	101.2	410.8	3.75	100	410
c-1,2-Dichloroethene	0.77	0.4	1.5	3.75	not detected	not detected
t-1,2-Dichloroethene	0.77	2.7	10.8	3.75	not detected	not detected
Chloroform	0.77	not detected	not detected	3.75	not detected	not detected
1,1,1-Trichloroethane	0.77	139.9	762.3	3.75	210	1200
1,2-Dichloroethane (ion 62)	0.77	not detected	not detected	3.75	not detected	not detected
Benzene	0.77	6.0	19.2	3.75	not detected	not detected
Carbon Tetrachloride	0.77	0.4	2.3	3.75	not detected	not detected
Trichloroethene	0.77	243.6	1307.7	3.75	740	4000
Toluene	0.77	10.2	38.5	3.75	not detected	not detected
Tetrachloroethene	0.77	26.6	180.8	3.75	17	110

EPA Method TO-14: GC/MS
Client: CH2M Hill
Site: MW-8-3

Compound	Offsite Non-pressurized Canisters			Offsite Pressurized Canisters			Offsite Pressurized Canisters (lab duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	concentration ppbv	concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.875	170	830	3	59	290	3	85	420
Vinyl Chloride	1.875	not detected	not detected	3	81	210	3	100	270
Freon 11	1.875	140	770	3	210	1200	3	310	1800
1,1-Dichloroethene	1.875	11000	43000	3	19000	76000	3	26000	100000
Dichloromethane	1.875	28	98	3	37	130	3	21	73
Trichlorotrifluoroethane	1.875	5500	42000	3	9800	75000	3	13000	99000
1,1-Dichloroethane	1.875	62	250	3	88	360	3	130	510
c-1,2-Dichloroethene	1.875	not detected	not detected	3	not detected	not detected	3	not detected	not detected
t-1,2-Dichloroethene	1.875	not detected	not detected	3	4.8	19	3	not detected	not detected
Chloroform	1.875	not detected	not detected	3	not detected	not detected	3	not detected	not detected
1,1,1-Trichloroethane	1.875	160	870	3	330	1800	3	310	1700
1,2-Dichloroethane (Ion 62)	1.875	not detected	not detected	3	not detected	not detected	3	not detected	not detected
Benzene	1.875	not detected	not detected	3	11	35	3	12	38
Carbon Tetrachloride	1.875	not detected	not detected	3	not detected	not detected	3	not detected	not detected
Trichloroethene	1.875	440	2400	3	970	5200	3	950	5100
Toluene	1.875	not detected	not detected	3	not detected	not detected	3	not detected	not detected
Tetrachloroethene	1.875	18	120	3	46	310	3	43	290

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-8-3

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.58	0.0	0.0
Vinyl Chloride	1.58	0.0	0.0
Freon 11	1.58	249.9	1413.4
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	1.58	129.5	525.4
c-1,2-Dichloroethene	1.58	0.0	0.0
t-1,2-Dichloroethene	1.58	10.4	41.3
Chloroform	1.58	6.5	31.7
1,1,1-Trichloroethane	1.58	238.5	1300.0
1,2-Dichloroethane (Ion 62)	1.58	14.9	60.5
Benzene	1.58	4.9	15.7
Carbon Tetrachloride	1.58	2.4	15.1
Trichloroethene	1.58	363.3	1950.5
Toluene	1.58	0.3	1.1
Tetrachloroethene	1.58	32.7	222.5

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-8-B

Compound	Carbon Molecular Sieve		Tedlar Bags		Offsite Non-pressurized Canisters		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	0.59	1.5	7.7	0.3	not detected	0.75	not detected
Vinyl Chloride	0.59	not detected	not detected	0.3	not detected	0.75	not detected
Freon 11	0.59	0.3	1.8	0.3	not detected	0.75	not detected
1,1-Dichloroethene	0.59	0.4	1.8	0.3	not detected	0.75	not detected
Dichloromethane	0.59	1.9	6.5	0.3	2.3	0.75	4.3
Trichlorotrifluoroethane	0.59	not detected	not detected	0.3	not detected	0.75	not detected
1,1-Dichloroethane	0.59	not detected	not detected	0.3	not detected	0.75	not detected
c-1,2-Dichloroethene	0.59	not detected	not detected	0.3	not detected	0.75	not detected
t-1,2-Dichloroethane	0.59	not detected	not detected	0.3	not detected	0.75	not detected
Chloroform	0.59	not detected	not detected	0.3	not detected	0.75	not detected
1,1,1-Trichloroethane	0.59	not detected	not detected	0.3	not detected	0.75	not detected
1,2-Dichloroethane (Ion 62)	0.59	not detected	not detected	0.3	not detected	0.75	not detected
Benzene	0.59	not detected	not detected	0.3	0.5	0.75	1.6
Carbon Tetrachloride	0.59	not detected	not detected	0.3	not detected	0.75	not detected
Trichloroethene	0.59	not detected	not detected	0.3	not detected	0.75	not detected
Toluene	0.59	1.3	4.7	0.3	0.62	0.75	2.3
Tetrachloroethene	0.59	not detected	not detected	0.3	not detected	0.75	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-8-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.1	0.50
Vinyl Chloride	0.75	0.1	0.26
Freon 11	0.75	0.1	0.57
1,1-Dichloroethene			
Dichloromethane			
Trichlorofluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.1	0.40
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.2	1.09
1,2-Dichloroethane (ion 62)	0.75	0.0	0.00
Benzene	0.75	0.1	0.32
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	1.6	8.59
Toluene	0.75	0.1	0.38
Tetrachloroethene	0.75	0.1	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GCMS Full Scan
 Client: CH2M Hill
 Site: MW-9-1

Compound	Activated Carbon Tube			Tedlar Bags			Tedlar Bags (lab duplicate)		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.77	198.6	984.6	3	not detected	not detected	3	not detected	not detected
Vinyl Chloride	0.77	18.3	46.9	3	not detected	not detected	3	not detected	not detected
Freon 11	0.77	101.5	573.8	3	140	810	3	180	1000
1,1-Dichloroethene	0.77	1811.1	7192.3	3	11000	45000	3	15000	61000
Dichloromethane	0.77	33.2	115.4	3	21	74	3	29	100
Trichlorotrifluoroethane	0.77	2619.7	20076.9	3	9200	71000	3	12000	93000
1,1-Dichloroethane	0.77	1.1	4.6	3	not detected	not detected	3	not detected	not detected
c-1,2-Dichloroethene	0.77	not detected	not detected	3	not detected	not detected	3	not detected	not detected
t-1,2-Dichloroethene	0.77	not detected	not detected	3	not detected	not detected	3	not detected	not detected
Chloroform	0.77	not detected	not detected	3	not detected	not detected	3	not detected	not detected
1,1,1-Trichloroethane	0.77	12.8	70.0	3	46	250	3	42	230
1,2-Dichloroethane (Ion 62)	0.77	not detected	not detected	3	not detected	not detected	3	not detected	not detected
Benzene	0.77	1.4	4.6	3	not detected	not detected	3	not detected	not detected
Carbon Tetrachloride	0.77	not detected	not detected	3	not detected	not detected	3	not detected	not detected
Trichloroethene	0.77	7.6	40.8	3	52	280	3	49	260
Toluene	0.77	2.0	7.7	3	not detected	not detected	3	not detected	not detected
Tetrachloroethene	0.77	1.9	13.1	3	not detected	not detected	3	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-9-1

Compound	Offsite Non-pressurized Canisters			CSL Non-pressurized Canisters			CSL Non-pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	not detected	not detected	0.75	0.0	0.0	0.75	0.0	0.0
Vinyl Chloride	1.5	not detected	not detected	0.75	0.0	0.0	0.75	0.0	0.0
Freon 11	1.5	89	500	0.75	65.3	369.3	0.75	58.7	332.0
1,1-Dichloroethane	1.5	8400	34000	6.94	0.0	0.0			
Dichloromethane	1.5	17	61	6.94	13.1	45.7			
Trichlorotrifluoroethane	1.5	6700	51000	6.94	166.2	1273.5			
1,1-Dichloroethane	1.5	not detected	not detected	0.75	1.3	5.3	0.75	1.2	4.9
c-1,2-Dichloroethane	1.5	not detected	not detected	0.75	0.0	0.0	0.75	0.0	0.0
t-1,2-Dichloroethane	1.5	not detected	not detected	0.75	0.1	0.4	0.75	0.0	0.0
Chloroform	1.5	not detected	not detected	0.75	0.5	2.4	0.75	0.5	2.4
1,1,1-Trichloroethane	1.5	24	130	0.75	19.4	105.7	0.75	14.3	77.9
1,2-Dichloroethane (ion 62)	1.5	not detected	not detected	0.75	1.0	4.1	0.75	0.7	2.8
Benzene	1.5	not detected	not detected	0.75	0.3	1.0	0.75	0.3	1.0
Carbon Tetrachloride	1.5	not detected	not detected	0.75	0.6	3.8	0.75	0.4	2.5
Trichloroethene	1.5	27	150	0.75	34.5	185.2	0.75	26.8	143.9
Toluene	1.5	not detected	not detected	0.75	0.1	0.4	0.75	0.1	0.4
Tetrachloroethene	1.5	not detected	not detected	0.75	1.2	8.2	0.75	0.7	4.8

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-9-2

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	MDL ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	1.67	448.7	2	not detected	1.5	not detected
Vinyl Chloride	1.67	35.1	2	not detected	1.5	not detected
Freon 11	1.67	1155.2	2	80	1.5	66
1,1-Dichloroethene	1.67	2739.6	2	9700	1.5	5400
Dichloromethane	1.67	4.8	2	33	1.5	27
Trichlorotrifluoroethane	1.67	4152.6	2	6000	1.5	3900
1,1-Dichloroethane	1.67	not detected	2	not detected	1.5	not detected
c-1,2-Dichloroethene	1.67	not detected	2	not detected	1.5	not detected
t-1,2-Dichloroethene	1.67	not detected	2	not detected	1.5	not detected
Chloroform	1.67	not detected	2	not detected	1.5	not detected
1,1,1-Trichloroethane	1.67	18.3	2	27	1.5	26
1,2-Dichloroethane (ion 62)	1.67	not detected	2	not detected	1.5	not detected
Benzene	1.67	69.9	2	not detected	1.5	not detected
Carbon Tetrachloride	1.67	not detected	2	not detected	1.5	not detected
Trichloroethene	1.67	19.9	2	45	1.5	31
Toluene	1.67	155.6	2	2.2	1.5	not detected
Tetrachloroethene	1.67	2.4	2	not detected	1.5	not detected

EPA Method TO-14: GC/MS
 Client: CH2M Hill
 Site: MW-9-2

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.95	0.0	0.0
Vinyl Chloride	0.95	0.0	0.0
Freon 11	0.95	38.5	217.7
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.95	0.9	3.7
c-1,2-Dichloroethene	0.95	0.0	0.0
t-1,2-Dichloroethene	0.95	0.1	0.4
Chloroform	0.95	0.3	1.5
1,1,1-Trichloroethane	0.95	14.5	79.0
1,2-Dichloroethane (Ion 62)	0.95	0.8	3.2
Benzene	0.95	0.3	1.0
Carbon Tetrachloride	0.95	0.4	2.5
Trichloroethene	0.95	29.0	155.7
Toluene	0.95	0.1	0.4
Tetrachloroethene	0.95	1.2	8.2

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-9-3

Compound	Activated Carbon Tube		Tedlar Bags			Tedlar Bags (duplicate)		
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	1.47	32.8	167.6	2	170	830	2	not detected
Vinyl Chloride	1.47	not detected	not detected	2	not detected	not detected	2	not detected
Freon 11	1.47	2.1	11.8	2	83	470	2	120
1,1-Dichloroethene	1.47	33.7	133.8	2	15000	58000	2	11000
Dichloromethane	1.47	5.5	19.1	2	not detected	not detected	2	not detected
Trichlorotrifluoroethane	1.47	25.3	194.1	2	8200	63000	2	7100
1,1-Dichloroethane	1.47	not detected	not detected	2	not detected	not detected	2	not detected
c-1,2-Dichloroethene	1.47	not detected	not detected	2	not detected	not detected	2	not detected
t-1,2-Dichloroethene	1.47	not detected	not detected	2	not detected	not detected	2	not detected
Chloroform	1.47	not detected	not detected	2	not detected	not detected	2	not detected
1,1,1-Trichloroethane	1.47	13.2	72.1	2	29	160	2	31
1,2-Dichloroethane (Ion 62)	1.47	not detected	not detected	2	not detected	not detected	2	not detected
Benzene	1.47	50.1	160.3	2	not detected	not detected	2	not detected
Carbon Tetrachloride	1.47	not detected	not detected	2	not detected	not detected	2	not detected
Trichloroethene	1.47	7.7	41.2	2	51	280	2	53
Toluene	1.47	70.6	266.2	2	not detected	not detected	2	not detected
Tetrachloroethene	1.47	not detected	not detected	2	not detected	not detected	2	not detected

EPA Method TO-14: GC/MS
Client: CH2M Hill
Site: MW-9-3

Compound	Offsite Non-pressurized Canisters			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	17	82	1.09	0.1	0.50
Vinyl Chloride	1.5	not detected	not detected	1.09	0.3	0.77
Freon 11	1.5	50	290	1.09	45.0	254.51
1,1-Dichloroethene	1.5	6700	27000			
Dichloromethane	1.5	21	74			
Trichlorotrifluoroethane	1.5	4800	37000			
1,1-Dichloroethane	1.5	not detected	not detected	1.09	1.0	4.06
c-1,2-Dichloroethene	1.5	not detected	not detected	1.09	0.0	0.00
t-1,2-Dichloroethene	1.5	not detected	not detected	1.09	0.0	0.00
Chloroform	1.5	not detected	not detected	1.09	0.4	1.95
1,1,1-Trichloroethane	1.5	24	130	1.09	13.9	75.77
1,2-Dichloroethane (ion 62)	1.5	not detected	not detected	1.09	0.7	2.84
Benzene	1.5	not detected	not detected	1.09	0.3	0.96
Carbon Tetrachloride	1.5	not detected	not detected	1.09	0.4	2.52
Trichloroethene	1.5	25	130	1.09	28.4	152.48
Toluene	1.5	5	19	1.09	0.1	0.38
Tetrachloroethene	1.5	not detected	not detected	1.09	1.3	8.84

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M Hill
 Site: MW-9-B

Compound	Activated Carbon Tube		Tedlar Bags		Offsite Non-pressurized Canisters	
	MDL ug	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.63	20.7	102.5	0.75	not detected	not detected
Vinyl Chloride	0.63	not detected	not detected	0.75	not detected	not detected
Freon 11	0.63	1.9	10.6	0.75	5.1	29
1,1-Dichloroethene	0.63	1.1	4.4	0.75	2.8	11
Dichloromethane	0.63	6.6	23.1	0.75	4.8	17
Trichlorotrifluoroethane	0.63	2.9	22.5	0.75	4.7	26
1,1-Dichloroethane	0.63	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.63	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.63	not detected	not detected	0.75	not detected	not detected
Chloroform	0.63	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.63	0.8	4.4	0.75	4.8	26
1,2-Dichloroethane (Ion 62)	0.63	2.3	not detected	0.75	not detected	not detected
Benzene	0.63	0.0	7.5	0.75	1.2	3.8
Carbon Tetrachloride	0.63	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.63	not detected	not detected	0.75	not detected	not detected
Toluene	0.63	18.6	70.0	0.75	14	51
Tetrachloroethene	0.63	not detected	not detected	0.75	not detected	not detected

EPA Method TO-14: GC/MS

Client: CH2M Hill

Site: MW-9-B

Compound	CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	0.0	0.00
Vinyl Chloride	0.75	0.0	0.00
Freon 11	0.75	0.0	0.00
1,1-Dichloroethene			
Dichloromethane			
Trichlorotrifluoroethane			
1,1-Dichloroethane	0.75	0.0	0.00
c-1,2-Dichloroethene	0.75	0.0	0.00
t-1,2-Dichloroethene	0.75	0.0	0.00
Chloroform	0.75	0.0	0.00
1,1,1-Trichloroethane	0.75	0.0	0.00
1,2-Dichloroethane (ion 62)	0.75	0.0	0.00
Benzene	0.75	0.0	0.00
Carbon Tetrachloride	0.75	0.0	0.00
Trichloroethene	0.75	0.1	0.54
Toluene	0.75	0.0	0.00
Tetrachloroethene	0.75	0.0	0.00

APPENDIX II
CONDENSED VENT RISER DATA

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-13-1

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3	not detected	not detected	1.00	not detected	not detected
Vinyl Chloride	3	not detected	not detected	1.00	not detected	not detected
Freon 11	3	not detected	not detected	1.00	not detected	not detected
1,1-Dichloroethene	3	not detected	not detected	1.00	not detected	not detected
Dichloromethane	3	not detected	not detected	1.00	2.10	7.20
Trichlorotrifluoroethane	3	190	1400	1.00	2.40	18.00
1,1-Dichloroethane	3	not detected	not detected	1.00	not detected	not detected
c-1,2-Dichloroethene	3	not detected	not detected	1.00	not detected	not detected
t-1,2-Dichloroethene	3	not detected	not detected	1.00	not detected	not detected
Chloroform	3	not detected	not detected	1.00	not detected	not detected
1,1,1-Trichloroethane	3	not detected	not detected	1.00	not detected	not detected
1,2-Dichloroethane (ion 62)	3	not detected	not detected	1.00	not detected	not detected
Benzene	3	not detected	not detected	1.00	not detected	1.30
Carbon Tetrachloride	3	not detected	not detected	1.00	not detected	not detected
Trichloroethene	3	not detected	not detected	1.00	not detected	not detected
Toluene	3	not detected	not detected	1.00	not detected	1.80
Tetrachloroethene	3	not detected	not detected	1.00	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M HILL
 Site: VR-13-1

Compound	CSL Non-pressurized Canners (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.50	not detected	not detected
Vinyl Chloride	1.50	not detected	not detected
Freon 11	1.50	not detected	not detected
1,1-Dichloroethene	1.50	not detected	not detected
Dichloromethane	1.50	not detected	not detected
Trichlorotrifluoroethane	1.50	74.0	570.00
1,1-Dichloroethane	1.50	not detected	not detected
c-1,2-Dichloroethene	1.50	not detected	not detected
t-1,2-Dichloroethene	1.50	not detected	not detected
Chloroform	1.50	not detected	not detected
1,1,1-Trichloroethane	1.50	not detected	not detected
1,2-Dichloroethane (ion 62)	1.50	not detected	not detected
Benzene	1.50	not detected	not detected
Carbon Tetrachloride	1.50	not detected	not detected
Trichloroethene	1.50	not detected	not detected
Toluene	1.50	not detected	not detected
Tetrachloroethene	1.50	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-13-2

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	1.50	not detected	not detected
Vinyl Chloride	3.75	not detected	not detected	1.50	not detected	not detected
Freon 11	3.75	not detected	not detected	1.50	not detected	not detected
1,1-Dichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
Dichloromethane	3.75	32	110	1.50	3.0	10.0
Trichlorotrifluoroethane	3.75	130	980	1.50	130.0	980.0
1,1-Dichloroethane	3.75	not detected	not detected	1.50	not detected	not detected
c-1,2-Dichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
t-1,2-Dichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
Chloroform	3.75	not detected	not detected	1.50	not detected	not detected
1,1,1-Trichloroethane	3.75	not detected	not detected	1.50	not detected	not detected
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	1.50	not detected	not detected
Benzene	3.75	not detected	not detected	1.50	not detected	not detected
Carbon Tetrachloride	3.75	not detected	not detected	1.50	not detected	not detected
Trichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
Toluene	3.75	not detected	not detected	1.50	not detected	not detected
Tetrachloroethene	3.75	not detected	not detected	1.50	not detected	not detected

EPA Method TO-14: GC/MS
 Client: CH2M HILL
 Site: VR-13-2

Compound	CSL Non-pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.50	not detected	not detected
Vinyl Chloride	1.50	not detected	not detected
Freon 11	1.50	not detected	not detected
1,1-Dichloroethene	1.50	not detected	not detected
Dichloromethane	1.50	2.2	7.6
Trichlorotrifluoroethane	1.50	120.0	890.0
1,1-Dichloroethane	1.50	not detected	not detected
c-1,2-Dichloroethene	1.50	not detected	not detected
t-1,2-Dichloroethene	1.50	not detected	not detected
Chloroform	1.50	not detected	not detected
1,1,1-Trichloroethane	1.50	not detected	not detected
1,2-Dichloroethane (ion 62)	1.50	not detected	not detected
Benzene	1.50	not detected	not detected
Carbon Tetrachloride	1.50	not detected	not detected
Trichloroethene	1.50	not detected	not detected
Toluene	1.50	not detected	not detected
Tetrachloroethene	1.50	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-13-3

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	1.50	not detected	not detected
Vinyl Chloride	3.75	not detected	not detected	1.50	not detected	not detected
Freon 11	3.75	not detected	not detected	1.50	not detected	not detected
1,1-Dichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
Dichloromethane	3.75	not detected	not detected	1.50	not detected	not detected
Trichlorotrifluoroethane	3.75	190	1400	1.50	77.0	590.0
1,1-Dichloroethane	3.75	not detected	not detected	1.50	not detected	not detected
c-1,2-Dichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
t-1,2-Dichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
Chloroform	3.75	not detected	not detected	1.50	not detected	not detected
1,1,1-Trichloroethane	3.75	not detected	not detected	1.50	not detected	not detected
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	1.50	not detected	not detected
Benzene	3.75	not detected	not detected	1.50	not detected	not detected
Carbon Tetrachloride	3.75	not detected	not detected	1.50	not detected	not detected
Trichloroethene	3.75	not detected	not detected	1.50	not detected	not detected
Toluene	3.75	not detected	not detected	1.50	not detected	not detected
Tetrachloroethene	3.75	not detected	not detected	1.50	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-13-B

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.75	11	39	0.75	2.3	8.1
Trichlorotrifluoroethane	0.75	not detected	not detected	0.75	2.1	16.0
1,1-Dichloroethane	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.75	5.1	28	0.75	not detected	not detected
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
Toluene	0.75	1.8	6.9	0.75	not detected	not detected
Tetrachloroethene	0.75	not detected	not detected	0.75	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-31-1

Compound	Tedlar Bags			Tedlar Bags (duplicate)			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.0	0.00
Freon 11	3.75	32	180	3.75	35	200	0.75	0.1	0.57
1,1-Dichloroethene	3.75	280	1100	3.75	340	1400			
Dichloromethane	3.75	not detected	not detected	3.75	not detected	not detected			
Trichlorotrifluoroethane	3.75	260	2000	3.75	170	1300			
1,1-Dichloroethane	3.75	not detected	not detected	3.75	not detected	not detected	0.75	1.1	4.46
c-1,2-Dichloroethene	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.0	0.00
Chloroform	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.2	0.98
1,1,1-Trichloroethane	3.75	140	760	3.75	150	790	0.75	92.7	505.29
1,2-Dichloroethane (Ion 62)	3.75	not detected	not detected	3.75	not detected	not detected	0.75	4.8	19.48
Benzene	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.4	1.28
Carbon Tetrachloride	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.0	0.00
Trichloroethene	3.75	31	170	3.75	33	180	0.75	26.0	139.59
Toluene	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.3	1.13
Tetrachloroethene	3.75	not detected	not detected	3.75	not detected	not detected	0.75	0.9	6.12

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-31-2

Compound	Tedlar Bags		CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	0.75	0.00
Vinyl Chloride	3.75	not detected	not detected	0.75	0.00
Freon 11	3.75	not detected	not detected	0.75	1.70
1,1-Dichloroethene	3.75	180	720		
Dichloromethane	3.75	not detected	not detected		
Trichlorotrifluoroethane	3.75	130	1000		
1,1-Dichloroethane	3.75	not detected	not detected	0.75	10.55
c-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.00
t-1,2-Dichloroethene	3.75	not detected	not detected	0.75	1.59
Chloroform	3.75	not detected	not detected	0.75	1.95
1,1,1-Trichloroethane	3.75	69	370	0.75	691.71
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	0.75	26.37
Benzene	3.75	not detected	not detected	0.75	1.60
Carbon Tetrachloride	3.75	not detected	not detected	0.75	0.63
Trichloroethene	3.75	16	86	0.75	190.06
Toluene	3.75	not detected	not detected	0.75	0.00
Tetrachloroethene	3.75	not detected	not detected	0.75	4.76

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-31-3

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	0.75	0.0	0.0
Vinyl Chloride	3.75	not detected	not detected	0.75	0.0	0.0
Freon 11	3.75	not detected	not detected	0.75	0.0	0.0
1,1-Dichloroethene	3.75	120	460			
Dichloromethane	3.75	21	74			
Trichlorotrifluoroethane	3.75	140	1100			
1,1-Dichloroethane	3.75	not detected	not detected	0.75	5.2	21.1
c-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.0	0.0
t-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.5	2.0
Chloroform	3.75	not detected	not detected	0.75	0.7	3.4
1,1,1-Trichloroethane	3.75	58	320	0.75	178.0	970.2
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	0.75	9.3	37.7
Benzene	3.75	not detected	not detected	0.75	0.9	2.9
Carbon Tetrachloride	3.75	not detected	not detected	0.75	0.2	1.3
Trichloroethene	3.75	15	81	0.75	52.7	282.9
Toluene	3.75	not detected	not detected	0.75	0.3	1.1
Tetrachloroethene	3.75	not detected	not detected	0.75	1.8	12.2

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-31-B

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	0.75	260	0.75	0.00
Vinyl Chloride	0.75	not detected	0.75	0.00
Freon 11	0.75	not detected	0.75	0.57
1,1-Dichloroethene	0.75	not detected		
Dichloromethane	0.75	6.5		
Trichlorotrifluoroethane	0.75	not detected		
1,1-Dichloroethane	0.75	not detected	0.75	0.00
c-1,2-Dichloroethene	0.75	not detected	0.75	0.00
t-1,2-Dichloroethene	0.75	not detected	0.75	0.00
Chloroform	0.75	not detected	0.75	0.00
1,1,1-Trichloroethane	0.75	not detected	0.75	0.00
1,2-Dichloroethane (ion 62)	0.75	not detected	0.75	0.00
Benzene	0.75	not detected	0.75	0.00
Carbon Tetrachloride	0.75	not detected	0.75	0.00
Trichloroethene	0.75	not detected	0.75	2.68
Toluene	0.75	2.6	0.75	0.38
Tetrachloroethene	0.75	not detected	0.75	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-34-1

Compound	Tedlar Bags			Tedlar Bags (duplicate)			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	3	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	3.75	not detected	not detected	3	not detected	not detected	0.75	0.0	0.00
Freon 11	3.75	not detected	not detected	3	not detected	not detected	0.75	0.9	5.09
1,1-Dichloroethene	3.75	850	3400	3	680	2700			
Dichloromethane	3.75	not detected	not detected	3	not detected	not detected			
Trichlorotrifluoroethane	3.75	390	3000	3	340	2600			
1,1-Dichloroethane	3.75	not detected	not detected	3	not detected	not detected	0.75	3.1	12.58
c-1,2-Dichloroethene	3.75	not detected	not detected	3	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	3.75	not detected	not detected	3	not detected	not detected	0.75	0.0	0.00
Chloroform	3.75	not detected	not detected	3	not detected	not detected	0.75	0.6	2.93
1,1,1-Trichloroethane	3.75	510	2800	3	280	1500	0.75	308.1	1679.40
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	3	not detected	not detected	0.75	17.9	72.63
Benzene	3.75	not detected	not detected	3	not detected	not detected	0.75	0.5	1.60
Carbon Tetrachloride	3.75	not detected	not detected	3	not detected	not detected	0.75	0.0	0.00
Trichloroethene	3.75	94	570	3	63	340	0.75	110.0	590.57
Toluene	3.75	not detected	not detected	3	not detected	not detected	0.75	0.3	1.13
Tetrachloroethene	3.75	not detected	not detected	3	not detected	not detected	0.75	2.6	17.69

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-34-2

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	0.83	0.0	0.0
Vinyl Chloride	3.75	not detected	not detected	0.83	0.0	0.0
Freon 11	3.75	not detected	not detected	0.83	0.2	1.1
1,1-Dichloroethene	3.75	670	2700			
Dichloromethane	3.75	not detected*	1600*			
Trichlorotrifluoroethane	3.75	440*	not detected*			
1,1-Dichloroethane	3.75	not detected	not detected	0.83	1.6	6.5
c-1,2-Dichloroethene	3.75	not detected	not detected	0.83	0.0	0.0
t-1,2-Dichloroethene	3.75	not detected	not detected	0.83	0.4	1.6
Chloroform	3.75	not detected	not detected	0.83	0.3	1.5
1,1,1-Trichloroethane	3.75	570	3100	0.83	217.9	1187.7
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	0.83	13.6	55.2
Benzene	3.75	not detected	not detected	0.83	0.4	1.3
Carbon Tetrachloride	3.75	not detected	not detected	0.83	0.1	0.6
Trichloroethene	3.75	100	550	0.83	87.2	468.2
Toluene	3.75	not detected	not detected	0.83	0.0	0.0
Tetrachloroethene	3.75	not detected	not detected	0.83	2.0	13.6

* data is unresolved but is displayed here as was reported by the lab.

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-34-3

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	1.09	0.00	0.0
Vinyl Chloride	3.75	not detected	not detected	1.09	0.16	0.4
Freon 11	3.75	not detected	not detected	1.09	0.00	0.0
1,1-Dichloroethene	3.75	400	1600	1.09	160.06	635.6
Dichloromethane	3.75	not detected	not detected	1.09	4.29	14.9
Trichlorotrifluoroethane	3.75	250	1900	1.09	123.43	946.0
1,1-Dichloroethane	3.75	not detected	not detected	1.09	1.74	7.1
c-1,2-Dichloroethene	3.75	not detected	not detected	1.09		0.0
t-1,2-Dichloroethene	3.75	not detected	not detected	1.09		0.0
Chloroform	3.75	not detected	not detected	1.09	0.35	1.7
1,1,1-Trichloroethane	3.75	490	2700	1.09	207.23	1129.6
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	1.09	12.20	49.5
Benzene	3.75	not detected	not detected	1.09	0.43	1.4
Carbon Tetrachloride	3.75	not detected	not detected	1.09	0.12	0.8
Trichloroethene	3.75	81	440	1.09	71.49	383.8
Toluene	3.75	not detected	not detected	1.09	0.00	0.0
Tetrachloroethene	3.75	not detected	not detected	1.09	1.16	7.9
1,2-Dichloroethene				1.09	0.63	2.5

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-34-B

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.5	not detected	not detected	0.75	0.00	0.00
Vinyl Chloride	0.5	not detected	not detected	0.75	0.07	0.18
Freon 11	0.5	not detected	not detected	0.75	0.00	0.00
1,1-Dichloroethene	0.5	not detected	not detected	0.75	4.08	16.20
Dichloromethane	0.5	4.5	16	0.75	1.61	5.60
Trichlorotrifluoroethane	0.5	not detected	not detected	0.75	3.14	24.06
1,1-Dichloroethane	0.5	not detected	not detected	0.75	1.14	4.63
c-1,2-Dichloroethene	0.5	not detected	not detected	0.75		
t-1,2-Dichloroethene	0.5	not detected	not detected	0.75		
Chloroform	0.5	not detected	not detected	0.75	0.00	0.00
1,1,1-Trichloroethane	0.5	not detected	not detected	0.75	5.87	32.00
1,2-Dichloroethane (ion 62)	0.5	not detected	not detected	0.75	0.41	1.66
Benzene	0.5	not detected	not detected	0.75	0.00	0.00
Carbon Tetrachloride	0.5	not detected	not detected	0.75	0.00	0.00
Trichloroethene	0.5	not detected	not detected	0.75	1.13	6.07
Toluene	0.5	11	41	0.75	0.00	0.00
Tetrachloroethene	0.5	not detected	not detected	0.75	0.07	0.48
1,2-Dichloroethene	0.5	not detected	not detected	0.75	1.79	7.12

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-35-1

Compound	Tedlar Bags		CSL Non-pressurized Canisters			CSL Pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	3	not detected	not detected	0.79	0.0	0.00	0.75	0.00
Vinyl Chloride	3	not detected	not detected	0.79	0.0	0.00	0.75	0.00
Freon 11	3	not detected	not detected	0.79	0.0	0.00	0.75	0.00
1,1-Dichloroethene	3	330	1300				0.75	0.00
Dichloromethane	3	not detected	not detected				0.75	0.00
Trichlorotrifluoroethane	3	230	1700				0.75	9.01
1,1-Dichloroethane	3	not detected	not detected	0.79	0.5	2.03	0.75	813.68
c-1,2-Dichloroethene	3	not detected	not detected	0.79	0.0	0.00	0.75	9.66
t-1,2-Dichloroethene	3	not detected	not detected	0.79	0.2	0.80	0.75	
Chloroform	3	not detected	not detected	0.79	0.1	0.49	0.75	
1,1,1-Trichloroethane	3	250	1400	0.79	125.7	685.17	0.75	2.68
1,2-Dichloroethane (ion 62)	3	not detected	not detected	0.79	6.9	28.00	0.75	793.58
Benzene	3	not detected	not detected	0.79	0.2	0.64	0.75	32.99
Carbon Tetrachloride	3	not detected	not detected	0.79	0.1	0.63	0.75	0.93
Trichloroethene	3	63	340	0.79	61.4	329.65	0.75	0.00
Toluene	3	7.1	27	0.79	0.1	0.38	0.75	365.08
Tetrachloroethene	3	not detected	not detected	0.79	1.8	12.25	0.75	0.30
1,2-Dichloroethane	3	not detected	not detected	0.79			0.75	15.31

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-35-2

Compound	Tedlar Bags			CSL Non-pressurized Canisters			CSL Pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	0.94	0.0	0.00	0.75	0.0	0.00
Vinyl Chloride	3.75	not detected	not detected	0.94	0.0	0.00	0.75	0.0	0.00
Freon 11	3.75	not detected	not detected	0.94	0.1	0.57	0.75	0.0	0.00
1,1-Dichloroethene	3.75	240	960						
Dichloromethane	3.75	not detected	not detected						
Trichlorotrifluoroethane	3.75	200	1500						
1,1-Dichloroethane	3.75	not detected	not detected	0.94	1.3	5.27	0.75	0.5	2.03
c-1,2-Dichloroethene	3.75	not detected	not detected	0.94	0.0	0.00	0.75	0.0	0.00
t-1,2-Dichloroethene	3.75	not detected	not detected	0.94	0.4	1.59	0.75	0.1	0.40
Chloroform	3.75	not detected	not detected	0.94	0.3	1.46	0.75	0.3	1.46
1,1,1-Trichloroethane	3.75	320	1700	0.94	141.4	770.75	0.75	133.4	727.14
1,2-Dichloroethane (Ion 62)	3.75	not detected	not detected	0.94	7.6	30.84	0.75	7.6	30.02
Benzene	3.75	not detected	not detected	0.94	0.3	0.96	0.75	0.2	0.64
Carbon Tetrachloride	3.75	not detected	not detected	0.94	0.1	0.63	0.75	0.0	0.00
Trichloroethene	3.75	68	360	0.94	62.7	336.63	0.75	67.8	364.01
Toluene	3.75	not detected	not detected	0.94	0.0	0.00	0.75	0.0	0.00
Tetrachloroethene	3.75	not detected	not detected	0.94	1.2	8.16	0.75	2.1	14.29

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-35-3

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	3.75	not detected	not detected	0.75	0.0	0.00
Freon 11	3.75	not detected	not detected	0.75	0.1	0.57
1,1-Dichloroethene	3.75	350	1400			
Dichloromethane	3.75	not detected	not detected			
Trichlorotrifluoroethane	3.75	240	1800			
1,1-Dichloroethane	3.75	not detected	not detected	0.75	0.9	3.65
c-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.2	0.80
Chloroform	3.75	not detected	not detected	0.75	0.2	0.98
1,1,1-Trichloroethane	3.75	310	1700	0.75	106.2	578.88
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	0.75	5.7	23.13
Benzene	3.75	not detected	not detected	0.75	0.2	0.64
Carbon Tetrachloride	3.75	not detected	not detected	0.75	0.0	0.00
Trichloroethene	3.75	61	330	0.75	44.9	241.06
Toluene	3.75	not detected	not detected	0.75	0.0	0.00
Tetrachloroethene	3.75	not detected	not detected	0.75	1.4	9.52

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan

Client: CH2M HILL

Site: VR-35-B

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	0.75	not detected	0.75	0.00
Vinyl Chloride	0.75	not detected	0.75	0.08
Freon 11	0.75	not detected	0.75	0.00
1,1-Dichloroethene	0.75	not detected	0.75	1.63
Dichloromethane	0.75	20	0.75	6.19
Trichlorotrifluoroethane	0.75	not detected	0.75	3.07
1,1-Dichloroethane	0.75	not detected	0.75	0.20
c-1,2-Dichloroethene	0.75	not detected	0.75	
t-1,2-Dichloroethene	0.75	not detected	0.75	
Chloroform	0.75	not detected	0.75	0.10
1,1,1-Trichloroethane	0.75	8.8	0.75	0.60
1,2-Dichloroethane (ion 62)	0.75	not detected	0.75	0.00
Benzene	0.75	not detected	0.75	0.06
Carbon Tetrachloride	0.75	not detected	0.75	0.00
Trichloroethene	0.75	not detected	0.75	0.86
Toluene	0.75	2.3	0.75	0.30
Tetrachloroethene	0.75	not detected	0.75	0.00
1,2-Dichloroethene	0.75	not detected	0.75	0.08

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-36-1

Compound	Tedlar Bags			CSL Non-pressurized Canisters			CSL Pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	6.94	0.0	0.00	3.75	not detected	not detected
Vinyl Chloride	3.75	not detected	not detected	6.94	0.0	0.00	3.75	not detected	not detected
Freon 11	3.75	not detected	not detected	6.94	2.9	16.40	3.75	not detected	not detected
1,1-Dichloroethene	3.75	140	540				3.75	240	930
Dichloromethane	3.75	not detected	not detected				3.75	not detected	not detected
Trichlorotrifluoroethane	3.75	110	860				3.75	200	1600
1,1-Dichloroethane	3.75	not detected	not detected	6.94	17.2	69.79	3.75	not detected	not detected
c-1,2-Dichloroethene	3.75	not detected	not detected	6.94	0.0	0.00	3.75	not detected	not detected
t-1,2-Dichloroethene	3.75	not detected	not detected	6.94	8.6	34.19	3.75	not detected	not detected
Chloroform	3.75	not detected	not detected	6.94	1.5	7.32	3.75	not detected	not detected
1,1,1-Trichloroethane	3.75	67	360	6.94	252.8	1377.97	3.75	180	960
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	6.94	20.3	82.36	3.75	not detected	not detected
Benzene	3.75	not detected	not detected	6.94	1.1	3.52	3.75	not detected	not detected
Carbon Tetrachloride	3.75	not detected	not detected	6.94	0.0	0.00	3.75	not detected	not detected
Trichloroethene	3.75	21	110	6.94	199.6	1071.62	3.75	20	100
Toluene	3.75	not detected	not detected	6.94	0.0	0.00	3.75	not detected	not detected
Tetrachloroethene	3.75	not detected	not detected	6.94	3.6	24.49	3.75	not detected	not detected

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VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-36-2

Compound	Tedlar Bags			CSL Non-pressurized Canisters			CSL Pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3	not detected	not detected	1.01	0.0	0.00	0.75	0.0	0.00
Vinyl Chloride	3	not detected	not detected	1.01	0.7	1.79	0.75	0.4	1.02
Freon 11	3	not detected	not detected	1.01	0.9	5.09	0.75	0.2	1.13
1,1-Dichloroethene	3	56	220						
Dichloromethane	3	not detected	not detected						
Trichlorotrifluoroethane	3	not detected	not detected						
1,1-Dichloroethane	3	not detected	not detected	1.01	3.6	14.61	0.75	2.7	10.95
c-1,2-Dichloroethene	3	not detected	not detected	1.01	0.0	0.00	0.75	0.0	0.00
t-1,2-Dichloroethene	3	not detected	not detected	1.01	1.7	6.76	0.75	0.0	0.00
Chloroform	3	not detected	not detected	1.01	0.6	2.93	0.75	0.0	0.00
1,1,1-Trichloroethane	3	150	820	1.01	118.0	643.20	0.75	146.7	799.64
1,2-Dichloroethane (ion 62)	3	not detected	not detected	1.01	8.2	33.27	0.75	9.8	39.76
Benzene	3	not detected	not detected	1.01	0.5	1.60	0.75	0.2	0.64
Carbon Tetrachloride	3	not detected	not detected	1.01	0.0	0.00	0.75	0.0	0.00
Trichloroethene	3	41	220	1.01	49.3	264.68	0.75	56.9	305.49
Toluene	3	not detected	not detected	1.01	0.0	0.00	0.75	0.0	0.00
Tetrachloroethene	3	not detected	not detected	1.01	0.9	6.12	0.75	2.3	15.65

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VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-36-3

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	3	not detected	0.68	0.00
Vinyl Chloride	3	not detected	0.68	0.00
Freon 11	3	not detected	0.68	0.00
1,1-Dichloroethene	3	170	0.68	
Dichloromethane	3	not detected	0.68	
Trichlorotrifluoroethane	3	150	0.68	
1,1-Dichloroethane	3	not detected	0.68	10.14
c-1,2-Dichloroethene	3	not detected	0.68	0.00
t-1,2-Dichloroethene	3	not detected	0.68	2.39
Chloroform	3	not detected	0.68	2.44
1,1,1-Trichloroethane	3	120	0.68	850.33
1,2-Dichloroethane (Ion 62)	3	not detected	0.68	42.60
Benzene	3	not detected	0.68	0.96
Carbon Tetrachloride	3	not detected	0.68	0.00
Trichloroethene	3	29	0.68	333.41
Toluene	3	not detected	0.68	0.38
Tetrachloroethene	3	not detected	0.68	11.57

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-36-B

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	0.75	not detected	0.60	not detected
Vinyl Chloride	0.75	not detected	0.60	not detected
Freon 11	0.75	not detected	0.60	not detected
1,1-Dichloroethene	0.75	not detected	0.60	not detected
Dichloromethane	0.75	10	0.60	8.9
Trichlorotrifluoroethane	0.75	not detected	0.60	not detected
1,1-Dichloroethane	0.75	not detected	0.60	not detected
c-1,2-Dichloroethene	0.75	not detected	0.60	not detected
t-1,2-Dichloroethene	0.75	not detected	0.60	not detected
Chloroform	0.75	not detected	0.60	not detected
1,1,1-Trichloroethane	0.75	not detected	0.60	not detected
1,2-Dichloroethane (ion 62)	0.75	not detected	0.60	not detected
Benzene	0.75	not detected	0.60	not detected
Carbon Tetrachloride	0.75	not detected	0.60	not detected
Trichloroethene	0.75	not detected	0.60	not detected
Toluene	0.75	not detected	0.60	not detected
Tetrachloroethene	0.75	not detected	0.60	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-39-1

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	3	not detected	0.75	0.00
Vinyl Chloride	3	not detected	0.75	0.00
Freon 11	3	not detected	0.75	0.57
1,1-Dichloroethene	3	53		
Dichloromethane	3	not detected		
Trichlorotrifluoroethane	3	54		
1,1-Dichloroethane	3	not detected	0.75	1.62
c-1,2-Dichloroethene	3	not detected	0.75	0.00
t-1,2-Dichloroethene	3	not detected	0.75	0.00
Chloroform	3	not detected	0.75	0.49
1,1,1-Trichloroethane	3	85	0.75	203.32
1,2-Dichloroethane (ion 62)	3	not detected	0.75	9.74
Benzene	3	not detected	0.75	0.32
Carbon Tetrachloride	3	not detected	0.75	0.63
Trichloroethene	3	9.7	0.75	61.74
Toluene	3	not detected	0.75	0.00
Tetrachloroethene	3	not detected	0.75	2.72

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-39-2

Compound	Tedlar Bags			GSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	3.75	not detected	not detected	0.75	0.1	0.26
Freon 11	3.75	not detected	not detected	0.75	0.3	1.70
1,1-Dichloroethene	3.75	82	330			
Dichloromethane	3.75	not detected	not detected			
Trichlorotrifluoroethane	3.75	88	680			
1,1-Dichloroethane	3.75	not detected	not detected	0.75	0.7	2.84
c-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	3.75	not detected	not detected	0.75	0.1	0.40
Chloroform	3.75	not detected	not detected	0.75	0.2	0.98
1,1,1-Trichloroethane	3.75	56	300	0.75	30.0	163.52
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	0.75	1.8	7.30
Benzene	3.75	not detected	not detected	0.75	0.1	0.32
Carbon Tetrachloride	3.75	not detected	not detected	0.75	0.0	0.00
Trichloroethene	3.75	not detected	not detected	0.75	10.3	55.30
Toluene	3.75	not detected	not detected	0.75	0.0	0.00
Tetrachloroethene	3.75	not detected	not detected	0.75	0.4	2.72

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-39-3

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	3	not detected	0.75	0.00
Vinyl Chloride	3	not detected	0.75	0.00
Freon 11	3	not detected	0.75	0.00
1,1-Dichloroethene	3	not detected	0.75	62.83
Dichloromethane	3	not detected	0.75	4.18
Trichlorotrifluoroethane	3	18	0.75	197.65
1,1-Dichloroethane	3	not detected	0.75	1.74
c-1,2-Dichloroethene	3	not detected	0.75	
t-1,2-Dichloroethene	3	not detected	0.75	
Chloroform	3	not detected	0.75	0.00
1,1,1-Trichloroethane	3	25	0.75	114.47
1,2-Dichloroethane (Ion 62)	3	not detected	0.75	5.27
Benzene	3	not detected	0.75	0.22
Carbon Tetrachloride	3	not detected	0.75	0.44
Trichloroethene	3	6.7	0.75	42.15
Toluene	3	not detected	0.75	0.00
Tetrachloroethene	3	not detected	0.75	1.29
1,2-Dichloroethene	3	not detected	0.75	0.40

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-39-B

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected	0.75	0.08	0.40
Vinyl Chloride	0.75	not detected	not detected	0.75	0.09	0.23
Freon 11	0.75	19	110	0.75	0.00	0.00
1,1-Dichloroethene	0.75	not detected	not detected	0.75	2.46	9.77
Dichloromethane	0.75	not detected	not detected	0.75	2.17	7.55
Trichlorotrifluoroethane	0.75	not detected	not detected	0.75	1.59	12.19
1,1-Dichloroethane	0.75	not detected	not detected	0.75	0.12	0.49
c-1,2-Dichloroethene	0.75	not detected	not detected	0.75		
t-1,2-Dichloroethene	0.75	not detected	not detected	0.75		
Chloroform	0.75	not detected	not detected	0.75	0.00	0.00
1,1,1-Trichloroethane	0.75	150	810	0.75	0.85	4.63
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected	0.75	0.00	0.00
Benzene	0.75	1.5	4.8	0.75	0.10	0.32
Carbon Tetrachloride	0.75	not detected	not detected	0.75	0.00	0.00
Trichloroethene	0.75	not detected	not detected	0.75	0.66	3.54
Toluene	0.75	30	110	0.75	0.10	0.38
Tetrachloroethene	0.75	not detected	not detected	0.75	0.00	0.00
1,2-Dichloroethene	0.75	not detected	not detected	0.75	0.00	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan

Client: CH2M HILL

Site: VR-42-1

Compound	Tedlar Bags			Tedlar Bags (duplicate)			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Vinyl Chloride	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Freon 11	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
1,1-Dichloroethene	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Dichloromethane	3.75	not detected	not detected	3.75	not detected	not detected	3.75	8.8	31
Trichlorotrifluoroethane	3.75	not detected	not detected	3.75	52	400	3.75	63	480
1,1-Dichloroethane	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
c-1,2-Dichloroethene	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
t-1,2-Dichloroethene	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Chloroform	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
1,1,1-Trichloroethane	3.75	not detected	not detected	3.75	not detected	not detected	3.75	5.1	28
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Benzene	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Carbon Tetrachloride	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Trichloroethene	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected
Toluene	3.75	not detected	not detected	3.75	10	39	3.75	not detected	not detected
Tetrachloroethene	3.75	not detected	not detected	3.75	not detected	not detected	3.75	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-42-2

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	2.50	not detected	not detected
Vinyl Chloride	3.75	not detected	not detected	2.50	not detected	not detected
Freon 11	3.75	not detected	not detected	2.50	not detected	not detected
1,1-Dichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
Dichloromethane	3.75	not detected	not detected	2.50	3.1	11
Trichlorotrifluoroethane	3.75	66	500	2.50	51	390
1,1-Dichloroethane	3.75	not detected	not detected	2.50	not detected	not detected
c-1,2-Dichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
t-1,2-Dichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
Chloroform	3.75	not detected	not detected	2.50	not detected	not detected
1,1,1-Trichloroethane	3.75	not detected	not detected	2.50	3.6	20
1,2-Dichloroethane (Ion 62)	3.75	not detected	not detected	2.50	not detected	not detected
Benzene	3.75	not detected	not detected	2.50	not detected	not detected
Carbon Tetrachloride	3.75	not detected	not detected	2.50	not detected	not detected
Trichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
Toluene	3.75	not detected	not detected	2.50	not detected	not detected
Tetrachloroethene	3.75	not detected	not detected	2.50	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-42-3

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3.75	not detected	not detected	2.50	not detected	not detected
Vinyl Chloride	3.75	not detected	not detected	2.50	not detected	not detected
Freon 11	3.75	not detected	not detected	2.50	not detected	not detected
1,1-Dichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
Dichloromethane	3.75	not detected	not detected	2.50	not detected	not detected
Trichlorotrifluoroethane	3.75	not detected	not detected	2.50	49	380
1,1-Dichloroethane	3.75	not detected	not detected	2.50	not detected	not detected
c-1,2-Dichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
t-1,2-Dichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
Chloroform	3.75	not detected	not detected	2.50	not detected	not detected
1,1,1-Trichloroethane	3.75	not detected	not detected	2.50	6.5	35
1,2-Dichloroethane (ion 62)	3.75	not detected	not detected	2.50	not detected	not detected
Benzene	3.75	not detected	not detected	2.50	not detected	not detected
Carbon Tetrachloride	3.75	not detected	not detected	2.50	not detected	not detected
Trichloroethene	3.75	not detected	not detected	2.50	not detected	not detected
Toluene	3.75	not detected	not detected	2.50	not detected	not detected
Tetrachloroethene	3.75	not detected	not detected	2.50	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-42-B

Compound	Tedar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.75	not detected	not detected	0.75	not detected	not detected
Vinyl Chloride	0.75	not detected	not detected	0.75	not detected	not detected
Freon 11	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
Dichloromethane	0.75	8.3	29	0.75	1.5	5.2
Trichlorotrifluoroethane	0.75	not detected	not detected	0.75	not detected	not detected
1,1-Dichloroethane	0.75	not detected	not detected	0.75	not detected	not detected
c-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
t-1,2-Dichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
Chloroform	0.75	not detected	not detected	0.75	not detected	not detected
1,1,1-Trichloroethane	0.75	not detected	not detected	0.75	not detected	not detected
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected	0.75	not detected	not detected
Benzene	0.75	not detected	not detected	0.75	not detected	not detected
Carbon Tetrachloride	0.75	not detected	not detected	0.75	not detected	not detected
Trichloroethene	0.75	not detected	not detected	0.75	not detected	not detected
Toluene	0.75	7.8	30	0.75	not detected	not detected
Tetrachloroethene	0.75	not detected	not detected	0.75	not detected	not detected

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan

Client: CH2M HILL

Site: VR-43-1

Compound	Tedlar Bags		CSL Non-pressurized Canisters			CSL Non-pressurized Canisters (duplicate)		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ug/m3
Freon 12	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
Vinyl Chloride	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
Freon 11	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
1,1-Dichloroethene	1.88	not detected	not detected	0.94	0.29	1.15		
Dichloromethane	1.88	not detected	not detected	0.94	2.20	7.65		
Trichlorotrifluoroethane	1.88	not detected	not detected	0.94	7.49	57.40		
1,1-Dichloroethane	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
c-1,2-Dichloroethene	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
t-1,2-Dichloroethene	1.88	not detected	not detected	0.94	0.1	0.40	0.94	0.40
Chloroform	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
1,1,1-Trichloroethane	1.88	not detected	not detected	0.94	0.20	1.50	0.94	1.64
1,2-Dichloroethane (ion 62)	1.88	not detected	not detected	0.94	0.20	0.21	0.94	0.00
Benzene	1.88	not detected	not detected	0.94	0.17	0.14	0.94	0.00
Carbon Tetrachloride	1.88	not detected	not detected	0.94	0.00	0.00	0.94	0.00
Trichloroethene	1.88	not detected	not detected	0.94	0.57	7.61	0.94	9.13
Toluene	1.88	not detected	not detected	0.94	0.11	0.58	0.94	0.75
Tetrachloroethene	1.88	not detected	not detected	0.94	0.00	0.51	0.94	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-43-2

Compound	Tedlar Bags			Tedlar Bags (duplicate)			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.00	0.00
Vinyl Chloride	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.00	0.00
Freon 11	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.00	0.00
1,1-Dichloroethene	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.20	0.79
Dichloromethane	2.14	not detected	not detected	2.5	not detected	not detected	0.75	1.55	5.39
Trichlorotrifluoroethane	2.14	not detected	not detected	2.5	20	150	0.75	8.90	68.21
1,1-Dichloroethane	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.07	0.28
c-1,2-Dichloroethene	2.14	not detected	not detected	2.5	not detected	not detected	0.75		
t-1,2-Dichloroethene	2.14	not detected	not detected	2.5	not detected	not detected	0.75		
Chloroform	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.03	0.15
1,1,1-Trichloroethane	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.29	1.58
1,2-Dichloroethane (ion 62)	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.00	0.00
Benzene	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.00	0.00
Carbon Tetrachloride	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.05	0.32
Trichloroethene	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.47	2.52
Toluene	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.09	0.34
Tetrachloroethene	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.04	0.27
1,2-Dichloroethene	2.14	not detected	not detected	2.5	not detected	not detected	0.75	0.14	0.56

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-43-3

Compound	Tedlar Bags			GSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	2.5	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	2.5	not detected	not detected	0.75	0.3	0.77
Freon 11	2.5	not detected	not detected	0.75	0.1	0.57
1,1-Dichloroethene	2.5	not detected	not detected			
Dichloromethane	2.5	not detected	not detected			
Trichlorotrifluoroethane	2.5	not detected	not detected			
1,1-Dichloroethane	2.5	not detected	not detected	0.75	0.2	0.81
c-1,2-Dichloroethene	2.5	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	2.5	not detected	not detected	0.75	0.0	0.00
Chloroform	2.5	not detected	not detected	0.75	0.0	0.00
1,1,1-Trichloroethane	2.5	not detected	not detected	0.75	0.4	2.18
1,2-Dichloroethane (Ion 62)	2.5	not detected	not detected	0.75	0.0	0.00
Benzene	2.5	not detected	not detected	0.75	0.2	0.64
Carbon Tetrachloride	2.5	not detected	not detected	0.75	0.1	0.63
Trichloroethene	2.5	not detected	not detected	0.75	1.0	5.37
Toluene	2.5	not detected	not detected	0.75	0.2	0.75
Tetrachloroethene	2.5	not detected	not detected	0.75	0.1	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-43-B

Compound	Tedlar Bags		GSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	Concentration ug/m3	Concentration ug/m3
Freon 12	0.75	2.9	14	0.00
Vinyl Chloride	0.75	not detected	not detected	0.17
Freon 11	0.75	210	1200	0.17
1,1-Dichloroethene	0.75	not detected	not detected	3.97
Dichloromethane	0.75	25	87	6.37
Trichlorotrifluoroethane	0.75	not detected	not detected	27.51
1,1-Dichloroethane	0.75	not detected	not detected	0.00
c-1,2-Dichloroethene	0.75	not detected	not detected	
t-1,2-Dichloroethene	0.75	not detected	not detected	
Chloroform	0.75	not detected	not detected	0.15
1,1,1-Trichloroethane	0.75	19	100	0.00
1,2-Dichloroethane (ion 62)	0.75	not detected	not detected	0.00
Benzene	0.75	2.1	6.6	0.19
Carbon Tetrachloride	0.75	2.5	16	0.00
Trichloroethene	0.75	not detected	not detected	1.99
Toluene	0.75	57	220	0.00
Tetrachloroethene	0.75	not detected	not detected	0.00
1,2-Dichloroethene	0.75			0.23

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-44-1

Compound	Tedlar Bags			Tedlar Bags (duplicate)			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.0	0.00
Vinyl Chloride	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.0	0.00
Freon 11	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.1	0.57
1,1-Dichloroethene	1.5	not detected	not detected	1.875	not detected	not detected			
Dichloromethane	1.5	not detected	not detected	1.875	not detected	not detected			
Trichlorotrifluoroethane	1.5	4.5	35	1.875	not detected	not detected			
1,1-Dichloroethane	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.5	2.03
c-1,2-Dichloroethene	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.0	0.00
t-1,2-Dichloroethene	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.2	0.80
Chloroform	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.1	0.49
1,1,1-Trichloroethane	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.2	1.09
1,2-Dichloroethane (Ion 62)	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.2	0.81
Benzene	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.1	0.32
Carbon Tetrachloride	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.0	0.00
Trichloroethene	1.5	not detected	not detected	1.875	not detected	not detected	0.79	3.0	16.11
Toluene	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.0	0.00
Tetrachloroethene	1.5	not detected	not detected	1.875	not detected	not detected	0.79	0.1	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-44-2

Compound	Tedlar Bags			GSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	not detected	not detected	0.75	0.00	0.00
Vinyl Chloride	1.5	not detected	not detected	0.75	0.00	0.00
Freon 11	1.5	not detected	not detected	0.75	0.00	0.00
1,1-Dichloroethene	1.5	not detected	not detected	0.75	1.02	4.05
Dichloromethane	1.5	not detected	not detected	0.75	0.50	1.74
Trichlorotrifluoroethane	1.5	not detected	not detected	0.75	6.95	53.26
1,1-Dichloroethane	1.5	not detected	not detected	0.75	0.51	2.07
c-1,2-Dichloroethene	1.5	not detected	not detected	0.75		
t-1,2-Dichloroethene	1.5	not detected	not detected	0.75		
Chloroform	1.5	not detected	not detected	0.75	0.08	0.39
1,1,1-Trichloroethane	1.5	not detected	not detected	0.75	0.28	1.53
1,2-Dichloroethane (Ion 62)	1.5	not detected	not detected	0.75	0.07	0.28
Benzene	1.5	not detected	not detected	0.75	0.00	0.00
Carbon Tetrachloride	1.5	not detected	not detected	0.75	0.08	0.50
Trichloroethene	1.5	not detected	not detected	0.75	0.70	3.76
Toluene	1.5	not detected	not detected	0.75	0.02	0.08
Tetrachloroethene	1.5	not detected	not detected	0.75	0.00	0.00
1,2-Dichloroethene	1.5	not detected	not detected	0.75	0.00	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-44-3

Compound	Tedlar Bags		CSL Non-pressurized Canisters	
	MDL ppbv	Concentration ppbv	MDL ppbv	Concentration ug/m3
Freon 12	1.5	not detected	0.75	0.0
Vinyl Chloride	1.5	not detected	0.75	0.0
Freon 11	1.5	not detected	0.75	1.13
1,1-Dichloroethene	1.5	not detected		
Dichloromethane	1.5	not detected		
Trichlorotrifluoroethane	1.5	not detected		
1,1-Dichloroethane	1.5	not detected	0.75	2.43
c-1,2-Dichloroethene	1.5	not detected	0.75	0.0
t-1,2-Dichloroethene	1.5	not detected	0.75	1.59
Chloroform	1.5	not detected	0.75	0.0
1,1,1-Trichloroethane	1.5	not detected	0.75	2.18
1,2-Dichloroethane (Ion 62)	1.5	not detected	0.75	0.0
Benzene	1.5	not detected	0.75	0.32
Carbon Tetrachloride	1.5	not detected	0.75	0.0
Trichloroethene	1.5	not detected	0.75	21.48
Toluene	1.5	not detected	0.75	0.75
Tetrachloroethene	1.5	not detected	0.75	0.68

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-44-B

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	1.5	not detected	not detected	0.75	0.06	0.30
Vinyl Chloride	1.5	not detected	not detected	0.75	0.00	0.00
Freon 11	1.5	58	330	0.75	0.10	0.57
1,1-Dichloroethene	1.5	not detected	not detected	0.75	2.12	8.42
Dichloromethane	1.5	8.4	29	0.75	1.63	5.67
Trichlorotrifluoroethane	1.5	not detected	not detected	0.75	90.76	695.58
1,1-Dichloroethane	1.5	not detected	not detected	0.75	0.00	0.00
c-1,2-Dichloroethene	1.5	not detected	not detected	0.75		
t-1,2-Dichloroethene	1.5	not detected	not detected	0.75		
Chloroform	1.5	not detected	not detected	0.75	0.00	0.00
1,1,1-Trichloroethane	1.5	10	55	0.75	0.00	0.00
1,2-Dichloroethane (ion 62)	1.5	not detected	not detected	0.75	0.00	0.00
Benzene	1.5	not detected	not detected	0.75	0.04	0.13
Carbon Tetrachloride	1.5	not detected	not detected	0.75	0.00	0.00
Trichloroethene	1.5	not detected	not detected	0.75	0.49	2.63
Toluene	1.5	4.5	17	0.75	0.00	0.00
Tetrachloroethene	1.5	not detected	not detected	0.75	0.00	0.00
1,2-Dichloroethene	1.5	not detected	not detected	0.75	0.00	0.00

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-61-1

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	3	not detected	not detected	0.75	0.0	0.00
Freon 11	3	not detected	not detected	0.75	0.5	2.83
1,1-Dichloroethene	3	1000	4100			
Dichloromethane	3	not detected	not detected			
Trichlorotrifluoroethane	3	690	5300			
1,1-Dichloroethane	3	720	2900	0.75	243.4	987.57
c-1,2-Dichloroethene	3	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	3	150	580	0.75	444.3	1766.27
Chloroform	3	not detected	not detected	0.75	1.1	5.36
1,1,1-Trichloroethane	3	1300	7000	0.75	103.1	561.98
1,2-Dichloroethane (ion 62)	3	not detected	not detected	0.75	7.0	28.40
Benzene	3	not detected	not detected	0.75	0.7	2.24
Carbon Tetrachloride	3	not detected	not detected	0.75	0.2	1.26
Trichloroethene	3	160	860	0.75	184.2	988.94
Toluene	3	not detected	not detected	0.75	0.0	0.00
Tetrachloroethene	3	30	210	0.75	34.2	232.67

EPA Method TO-14: GC/MS
 Client: CH2M HILL
 Site: VR-61-1

Compound	CSL Non-pressurized Canisters (duplicate)	
	MDL ppbv	Concentration ppbv
Freon 12	1.50	not detected
Vinyl Chloride	1.50	not detected
Freon 11	1.50	3.3
1,1-Dichloroethene	1.50	870
Dichloromethane	1.50	not detected
Trichlorotrifluoroethane	1.50	450
1,1-Dichloroethane	1.50	550
c-1,2-Dichloroethene	1.50	8.7
t-1,2-Dichloroethene	1.50	530
Chloroform	1.50	not detected
1,1,1-Trichloroethane	1.50	360
1,2-Dichloroethane (ion 62)	1.50	not detected
Benzene	1.50	not detected
Carbon Tetrachloride	1.50	not detected
Trichloroethene	1.50	34
Toluene	1.50	not detected
Tetrachloroethene	1.50	6.1

Concentration ug/m3	
not detected	not detected
not detected	19
3400	3400
not detected	not detected
3400	3400
2200	2200
34	34
2100	2100
not detected	not detected
2000	2000
not detected	not detected
not detected	not detected
not detected	not detected
180	180
not detected	not detected
42	42

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-61-2

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3	not detected	not detected	0.75	0.0	0.00
Vinyl Chloride	3	not detected	not detected	0.75	0.0	0.00
Freon 11	3	not detected	not detected	0.75	1.2	6.79
1,1-Dichloroethene	3	1300	5100	0.75		
Dichloromethane	3	not detected	not detected	0.75		
Trichlorotrifluoroethane	3	780	6000	0.75		
1,1-Dichloroethane	3	690	2800	0.75	218.6	886.94
c-1,2-Dichloroethene	3	not detected	not detected	0.75	0.0	0.00
t-1,2-Dichloroethene	3	140	560	0.75	422.9	1681.20
Chloroform	3	not detected	not detected	0.75	1.2	5.85
1,1,1-Trichloroethane	3	1300	7100	0.75	39.7	216.40
1,2-Dichloroethane (ion 62)	3	not detected	not detected	0.75	13.5	54.77
Benzene	3	not detected	not detected	0.75	1.0	3.20
Carbon Tetrachloride	3	not detected	not detected	0.75	0.3	1.89
Trichloroethene	3	190	1000	0.75	215.4	1156.45
Toluene	3	not detected	not detected	0.75	0.1	0.38
Tetrachloroethene	3	28	190	0.75	22.7	154.43

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan

Client: CH2M HILL

Site: VR-61-3

Compound	Tedlar Bags			CSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	3	not detected	not detected	1.50	not detected	not detected
Vinyl Chloride	3	not detected	not detected	1.50	not detected	not detected
Freon 11	3	not detected	not detected	1.50	not detected	not detected
1,1-Dichloroethene	3	960	3800	1.50	870	3500
Dichloromethane	3	not detected	not detected	1.50	2.2	7.6
Trichlorotrifluoroethane	3	630	4900	1.50	not detected	not detected
1,1-Dichloroethane	3	390	1600	1.50	400	1600
c-1,2-Dichloroethene	3	not detected	not detected	1.50	8.7	35
t-1,2-Dichloroethene	3	130	500	1.50	370	1500
Chloroform	3	not detected	not detected	1.50	not detected	not detected
1,1,1-Trichloroethane	3	1800	9800	1.50	360	1900
1,2-Dichloroethane (Ion 62)	3	not detected	not detected	1.50	not detected	not detected
Benzene	3	not detected	not detected	1.50	not detected	not detected
Carbon Tetrachloride	3	not detected	not detected	1.50	not detected	not detected
Trichloroethene	3	210	1100	1.50	32	170
Toluene	3	not detected	not detected	1.50	not detected	not detected
Tetrachloroethene	3	32	220	1.50	4.7	32

VOLATILE ORGANIC COMPOUND ANALYSIS REPORT

EPA Method TO-14: GC/MS Full Scan
 Client: CH2M HILL
 Site: VR-61-B

Compound	Tedlar Bags			GSL Non-pressurized Canisters		
	MDL ppbv	Concentration ppbv	Concentration ug/m3	MDL ppbv	Concentration ppbv	Concentration ug/m3
Freon 12	0.5	not detected	not detected	0.75	0.00	0.00
Vinyl Chloride	0.5	not detected	not detected	0.75	0.00	0.00
Freon 11	0.5	not detected	not detected	0.75	0.00	0.00
1,1-Dichloroethene	0.5	not detected	not detected	0.75	0.68	2.70
Dichloromethane	0.5	3.7	13	0.75	1.44	5.01
Trichlorotrifluoroethane	0.5	not detected	not detected	0.75	0.48	3.68
1,1-Dichloroethane	0.5	not detected	not detected	0.75	0.04	0.16
c-1,2-Dichloroethene	0.5	not detected	not detected	0.75		
t-1,2-Dichloroethene	0.5	not detected	not detected	0.75		
Chloroform	0.5	not detected	not detected	0.75	0.00	0.00
1,1,1-Trichloroethane	0.5	not detected	not detected	0.75	0.06	0.33
1,2-Dichloroethane (Ion 62)	0.5	not detected	not detected	0.75	0.00	0.00
Benzene	0.5	not detected	not detected	0.75	0.00	0.00
Carbon Tetrachloride	0.5	not detected	not detected	0.75	0.00	0.00
Trichloroethene	0.5	not detected	not detected	0.75	0.44	2.36
Toluene	0.5	not detected	not detected	0.75	0.06	0.23
Tetrachloroethene	0.5	not detected	not detected	0.75	0.00	0.00
1,2-Dichloroethene	0.5	not detected	not detected	0.75	0.00	0.00

APPENDIX III
RELATIVE PERCENT DIFFERENCES—MEDIA

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-1-2

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Non-pressurized Canister (ppbv)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	35.68	47	28	24	22	22	24.8	12
Vinyl Chloride	7.51	NA	not detected	0	not detected	not detected	0.3	0
Freon 11	115.61	-128	300	-55	530	530	107.4	-133
1,1-Dichloroethene	445.50	-150	1800	-53	3100	3100	990.0	-103
Dichloromethane	3.54	-158	16	-61	30	30	114.5	117
Trichlorotrifluoroethane	371.37	-195	21000	-32	29000	29000	4100.0	-150
1,1-Dichloroethane	not detected	0	not detected	0	not detected	not detected	0.2	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	not detected	0.1	0
Chloroform	not detected	0	not detected	0	not detected	not detected	0.2	0
1,1,1-Trichloroethane	0.69	-151	3.5	-33	4.9	4.9	3.5	-33
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	not detected	0.2	0
Benzene	not detected	0	not detected	0	not detected	not detected	0.1	0
Carbon Tetrachloride	0.65	-192	23	-33	32	32	15.7	-68
Trichloroethene	0.91	-189	19	-48	31	31	21.4	-37
Toluene	2.86	100	1.1	15	0.95	0.95	0.1	NA
Tetrachloroethene	not detected	NA	not detected	NA	0.85	0.85	0.3	NA
TOTAL RPD		-1014		-277				-396

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-1-3

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	1.18	-158	12	18	10	40.1	120
Vinyl Chloride	not detected	0	not detected	0	not detected	0.1	0
Freon 11	206.28	-49	460	30	340	289.3	-16
1,1-Dichloroethene	755.42	-117	2600	-11	2900	2565.8	-12
Dichloromethane	3.59	-174	41	-24	52	106.0	68
Trichlorotrifluoroethane	826.38	-189	25000	-11	28000	1332.6	-182
1,1-Dichloroethane	not detected	0	1.4	NA	not detected	0.2	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.2	0
Chloroform	not detected	0	not detected	0	not detected	0.2	0
1,1,1-Trichloroethane	3.82	-14	4.7	7	4.4	3.3	-29
1,2-Dichloroethane (Ion 62)	not detected	0	not detected	0	not detected	0.2	0
Benzene	0.76	NA	not detected	0	not detected	0.1	0
Carbon Tetrachloride	11.09	-92	28	-7	30	21.8	-32
Trichloroethene	10.71	-86	25	-8	27	20.1	-29
Toluene	6.63	NA	1.3	NA	not detected	0.1	0
Tetrachloroethene	0.21	NA	not detected	0	not detected	0.3	0
TOTAL RPD		-879		-6			-111

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-1-4

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	1.40	-155	not detected	NA	11	0.00	NA
Vinyl Chloride	not detected	0	not detected	0	not detected	0.07	0
Freon 11	1.17	-199	290	-49	480	280.75	-52
1,1-Dichloroethene	1.43	-200	25000	164	2500		
Dichloromethane	16.14	-87	73	56	41		
Trichlorotrifluoroethane	5.62	-200	520	-192	25965		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.13	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.00	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.10	0
Chloroform	not detected	0	not detected	0	not detected	0.10	0
1,1,1-Trichloroethane	0.49	-163	2.5	-65	4.9	2.07	-81
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.07	0
Benzene	0.31	NA	not detected	0	not detected	0.13	0
Carbon Tetrachloride	not detected	NA	17	-67	34	14.17	-82
Trichloroethene	not detected	NA	14	-76	31	19.77	-44
Toluene	7.96	NA	4.5	NA	not detected	0.30	0
Tetrachloroethene	not detected	0	not detected	0	not detected	0.20	0
TOTAL RPD		-1004		-229			-260

* - Offsite canisters are considered to be the true value for the relative percent calculations.

COMPARISON OF SOIL VAPOR SAMPLING MEDIA RELATIVE PERCENT*

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-2-1

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Pressurized Canister (ppbv)	CSL Pressurized Canister (ppbv)	RPD (%)
Freon 12	not detected	0	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	not detected	NA	18	-47	29	26.9	-8
1,1-Dichloroethene	not detected	NA	300	105	93		
Dichloromethane	not detected	0	not detected	0	not detected		
Trichlorotrifluoroethane	not detected	NA	12000	133	2400		
1,1-Dichloroethane	34.51	NA	not detected	0	not detected	0.0	0
c-1,2-Dichloroethene	16.14	NA	not detected	0	not detected		
t-1,2-Dichloroethene	24.11	177	1.9	24	1.5		
Chloroform	not detected	0	not detected	0	not detected	0.4	0
1,1,1-Trichloroethane	not detected	0	not detected	0	not detected	0.1	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	not detected	NA	not detected	NA	2.8	1.9	-38
Carbon Tetrachloride	0.26	-196	42	40	28	26.0	-7
Trichloroethene	6.98	-167	110	34	78	83.8	7
Toluene	3.09	-67	0.77	-156	6.2	1.2	-135
Tetrachloroethene	not detected	0	not detected	0	not detected	0.1	0
TOTAL RPD		-254		134			-181

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-2-2

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Pressurized Canister (ppbv)	CSL Pressurized Canister (ppbv)	RPD (%)
Freon 12	28.4	40	not detected	NA	19	0.0	NA
Vinyl Chloride	not detected	0	not detected	0	not detected	0.1	0
Freon 11	125.1	129	12	-77	27	34.7	25
1,1-Dichloroethene	39.3	-95	300	93	110	162.08	38
Dichloromethane	14.1	NA	not detected	0	not detected	16.26	NA
Trichlorotrifluoroethane	938.6	-91	12000	131	2500	6561.91	90
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.2	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected		
t-1,2-Dichloroethene	not detected	NA	2.5	87	0.98		
Chloroform	not detected	0	not detected	0	not detected	0.8	NA
1,1,1-Trichloroethane	1.3	NA	1.1	NA	not detected	0.1	0
1,2-Dichloroethane (Ion 62)	not detected	0	not detected	0	not detected	0.1	0
Benzene	1.6	-56	not detected	NA	2.9	0.4	NA
Carbon Tetrachloride	not detected	NA	51	91	19	54.9	97
Trichloroethene	1.7	-188	130	81	55	166.5	101
Toluene	5.5	-28	1.8	-121	7.3	0.2	NA
Tetrachloroethene	not detected	0	not detected	0	not detected	0.2	0
TOTAL RPD		-288		286			751

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-2-3

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Pressurized Canister (ppbv)	CSL Pressurized Canister (ppbv)	RPD (%)
Freon 12	1.4	NA	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	1.2	-190	7.9	-145	49.5	38.5	-25
1,1-Dichloroethene	1.7	-197	210	-11	235		0
Dichloromethane	9.2	NA	not detected	0	not detected		0
Trichlorotrifluoroethane	262.0	-193	8400	-50	14000		0
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.0	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected		0
t-1,2-Dichloroethene	not detected	NA	2.5	-23	3.15		0
Chloroform	not detected	0	0.86	NA	not detected	0.5	0
1,1,1-Trichloroethane	not detected	0	1	NA	not detected	0.1	0
1,2-Dichloroethane (Ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	not detected	0	1.1	NA	not detected	2.3	NA
Carbon Tetrachloride	not detected	NA	32	-81	75.5	28.2	-91
Trichloroethene	not detected	NA	not detected	NA	205	90.8	-77
Toluene	not detected	0	1.4	NA	not detected	1.6	NA
Tetrachloroethene	not detected	0	not detected	0	not detected	0.1	0
TOTAL RPD		-580		-310			-193

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-3-1

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	35.0	NA	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	4.3	NA	not detected	0	not detected	0.3	0
1,1-Dichloroethene	0.0	0	not detected	0	not detected		
Dichloromethane	10.0	-167	90	-20	110		
Trichlorotrifluoroethane	1620.5	65	4500	138	830		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.0	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
Chloroform	not detected	0	not detected	0	not detected	0.1	0
1,1,1-Trichloroethane	0.3	NA	not detected	0	not detected	0.1	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.1	0
Benzene	0.9	NA	not detected	0	not detected	0.0	0
Carbon Tetrachloride	2.4	-74	9	55	5.1	4.8	-6
Trichloroethene	4.4	-73	8.5	-11	9.5	7.9	-18
Toluene	10.0	NA	not detected	0	not detected	0.0	0
Tetrachloroethene	0.0	NA	not detected	NA	2	0.1	NA
TOTAL RPD		-249		162			-24

* - Offsite canisters are considered to be the true value for the relative percent calculations.

COMPARISON OF SOIL VAPOR SAMPLING MEDIA RELATIVE PERCENT*

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-3-2

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	31.2	NA	not detected	0	not detected	0.00	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.00	0
Freon 11	6.4	NA	not detected	0	not detected	0.50	0
1,1-Dichloroethene	not detected	0	not detected	0	not detected	4.33	NA
Dichloromethane	not detected	NA	not detected	NA	88	20.51	-124
Trichlorotrifluoroethane	2351.7	112	2500	116	660	1037.21	44
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.20	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
Chloroform	not detected	0	not detected	0	not detected	0.20	0
1,1,1-Trichloroethane	0.7	NA	not detected	0	not detected	0.00	0
1,2-Dichloroethane (Ion 62)	not detected	0	not detected	0	not detected	0.19	0
Benzene	not detected	0	not detected	0	not detected	0.00	0
Carbon Tetrachloride	2.2	-51	7.4	67	3.7	5.80	44
Trichloroethene	5.2	-72	11	0	11	7.80	-34
Toluene	1.0	NA	not detected	0	not detected	0.00	0
Tetrachloroethene	not detected	0	not detected	0	not detected	0.00	0
TOTAL RPD		-11		183			-70

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan

Client: CH2M HILL

Site: MW-3-3

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Non-pressurized Canister (ppbv)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	87.0	NA	not detected	0	not detected	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	not detected	0.3	0
Freon 11	9.1	NA	not detected	0	not detected	not detected	0.1	0
1,1-Dichloroethene	1.3	NA	not detected	0	not detected	not detected		
Dichloromethane	3.2	-191	not detected	NA	140	not detected		
Trichlorotrifluoroethane	3023.9	127	2150	105	670			
1,1-Dichloroethane	not detected	0	not detected	0	not detected	not detected	0.0	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	not detected	0.0	0
Chloroform	not detected	0	not detected	0	not detected	not detected	0.0	0
1,1,1-Trichloroethane	1.1	NA	not detected	0	not detected	not detected	0.1	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	not detected	0.1	0
Benzene	0.8	NA	not detected	0	not detected	not detected	0.1	0
Carbon Tetrachloride	not detected	NA	7.65	36	5.3		2.8	-62
Trichloroethene	1.4	-148	11.5	20	9.4		4.4	-72
Toluene	76.3	NA	not detected	0	not detected	not detected	0.1	0
Tetrachloroethene	not detected	-212	not detected	0	not detected	not detected	0.1	0
TOTAL RPD				161				-134

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-4-1

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	10.0	NA	not detected	0	not detected	0.0	0
Vinyl Chloride	2.1	NA	not detected	0	not detected	0.0	0
Freon 11	2.5	NA	not detected	0	not detected	2.7	0
1,1-Dichloroethene	28.0	NA	48	NA	not detected		
Dichloromethane	3.1	NA	4.9	NA	not detected		
Trichlorotrifluoroethane	135.1	NA	280	NA	not detected		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	2.6	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	4.5	NA	27	NA	not detected	122.8	0
Chloroform	not detected	0	not detected	0	not detected	1.6	0
1,1,1-Trichloroethane	not detected	0	1.7	NA	not detected	1.7	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.3	0
Benzene	0.7	NA	not detected	0	not detected	0.4	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.0	0
Trichloroethene	35.9	140	510	195	6.3	106.0	NA
Toluene	1.7	NA	1.4	NA	not detected	0.3	0
Tetrachloroethene	0.3	NA	1.7	NA	not detected	0.9	0
TOTAL RPD		140		195			0

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-4-2

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Teflar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	5.4	NA	11	NA	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	1.5	NA	not detected	0	not detected	1.4	NA
1,1-Dichloroethene	13.2	-160	97	-21	120		
Dichloromethane	3.1	NA	3.6	NA	not detected		
Trichlorotrifluoroethane	74.0	-138	320	-22	400		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	2.0	NA
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	4.3	-164	29	-39	43	101.9	81
Chloroform	not detected	0	not detected	0	not detected	1.3	NA
1,1,1-Trichloroethane	not detected	0	7	NA	not detected	1.4	NA
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.4	0
Benzene	0.9	NA	1.8	NA	not detected	0.4	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.1	0
Trichloroethene	24.1	-187	500	-36	720	0.0	NA
Toluene	1.4	NA	3.2	NA	not detected	0.4	0
Tetrachloroethene	not detected	0	not detected	0	not detected	1.1	NA
TOTAL RPD		-649		-118			81

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-4-3

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	10.0	NA	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	2.5	NA	not detected	0	not detected	2.4	NA
1,1-Dichloroethene	27.3	-19	36	9	33		
Dichloromethane	2.0	NA	3.3	NA	not detected		
Trichlorotrifluoroethane	132.8	-45	120	-55	210		
1,1-Dichloroethane	0.9	NA	not detected	0	not detected	3.0	NA
c-1,2-Dichloroethene	0.1	NA	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	7.0	-120	9.3	-100	28	236.7	158
Chloroform	0.5	NA	not detected	0	not detected	1.8	NA
1,1,1-Trichloroethane	0.4	NA	2.2	NA	not detected	2.5	NA
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	0.9	NA	1.2	NA	not detected	0.7	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.1	0
Trichloroethene	4.4	-197	190	-93	520	126.4	-122
Toluene	15.6	NA	2	NA	not detected	0.3	0
Tetrachloroethene	0.4	NA	not detected	0	not detected	0.9	NA
TOTAL RPD		-381		-239			36

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-5-1

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	not detected	0	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	not detected	0	not detected	0	not detected	1.0	NA
1,1-Dichloroethene	not detected	0	10.7	NA	not detected		
Dichloromethane	not detected	NA	8.65	-24	11		
Trichlorotrifluoroethane	not detected	0	91.5	NA	not detected		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.4	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	4.65	NA	not detected	29.3	NA
Chloroform	not detected	0	not detected	0	not detected	0.3	0
1,1,1-Trichloroethane	not detected	0	18	NA	not detected	0.2	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	0.6	NA	0.93	NA	not detected	0.5	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.1	0
Trichloroethene	4.7	NA	38	NA	not detected	64.8	NA
Toluene	1.7	NA	1.5	NA	not detected	0.4	0
Tetrachloroethene	0.3	NA	not detected	0	not detected	0.2	0
TOTAL RPD		0		-24			0

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-5-2

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	1.4	NA	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.1	0
Freon 11	not detected	0	not detected	0	not detected	0.5	0
1,1-Dichloroethene	not detected	0	11	NA	not detected		
Dichloromethane	not detected	0	not detected	0	not detected		
Trichlorotrifluoroethane	not detected	0	160	NA	not detected		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.6	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	11	NA	not detected	46.1	NA
Chloroform	not detected	0	not detected	0	not detected	0.4	0
1,1,1-Trichloroethane	not detected	0	not detected	0	not detected	0.2	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	not detected	0	not detected	0	not detected	0.4	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.1	0
Trichloroethene	not detected	0	86	NA	not detected	103.5	NA
Toluene	not detected	0	not detected	0	not detected	0.3	0
Tetrachloroethene	not detected	0	not detected	0	not detected	0.2	0
TOTAL RPD		0		0			0

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-5-3

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	not detected	0	not detected	0	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	5.9	NA	not detected	0	not detected	1.4	NA
1,1-Dichloroethene	24.1	NA	18	NA	not detected	33.94	NA
Dichloromethane	5.1	NA	3.2	NA	not detected	21.10	NA
Trichlorotrifluoroethane	318.0	NA	280	NA	not detected	333.64	NA
1,1-Dichloroethane	1.5	NA	not detected	0	not detected	0.7	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	5.8	NA	15	NA	not detected	49.9	NA
Chloroform	not detected	0	not detected	0	not detected	0.5	0
1,1,1-Trichloroethane	not detected	0	not detected	0	not detected	0.1	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	0.3	NA	not detected	0	not detected	0.3	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.0	0
Trichloroethene	not detected	0	110	NA	not detected	115.9	NA
Toluene	2.2	NA	not detected	0	not detected	0.3	0
Tetrachloroethene	0.6	NA	not detected	0	not detected	0.3	0
TOTAL RPD		0		0			0

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14 GC/MS Full Scan
Client: CH2M HILL
Site: MW-6-1

Compound	Activated Carbon Tubes (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	66.9	NA	16	NA	not detected	0.0	0
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	2.1	NA	not detected	0	not detected	3.3	NA
1,1-Dichloroethene	12.3	-190	not detected	NA	490		
Dichloromethane	4.5	-53	16	69	7.8		
Trichlorotrifluoroethane	80.2	-138	740	51	440		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.2	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	1.9	NA	not detected	3.9	NA
Chloroform	not detected	0	not detected	0	not detected	0.1	0
1,1,1-Trichloroethane	11.6	NA	not detected	0	not detected	0.2	0
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.1	0
Benzene	2.1	NA	not detected	0	not detected	0.1	0
Carbon Tetrachloride	1.5	NA	not detected	0	not detected	0.0	0
Trichloroethene	23.3	15	44	75	20	56.5	95
Toluene	48.2	NA	4.3	NA	not detected	0.2	0
Tetrachloroethene	5.6	NA	not detected	0	not detected	0.2	0
TOTAL RPD		-366		195			95

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-6-2

Compound	Activated Carbon Tube (ppbv)	Carbon Molecular Sieve (ppbv)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	184.8	55.9	7	120	14	0	NA
Vinyl Chloride	not detected	not detected	not detected	NA	not detected	0.0	NA
Freon 11	17.4	2.6	not detected	NA	not detected	0.8	NA
1,1-Dichloroethene	17.2	3.1	not detected	NA	not detected	NA	NA
Dichloromethane	33.5	30.5	21	NA	not detected	NA	NA
Trichlorotrifluoroethane	565.6	43.5	690	-145	270	NA	NA
1,1-Dichloroethane	not detected	not detected	not detected	NA	not detected	0.2	NA
c-1,2-Dichloroethene	not detected	1.8	not detected	NA	not detected	0.0	NA
t-1,2-Dichloroethene	2.5	3.4	1.9	NA	not detected	4.3	NA
Chloroform	not detected	3.8	not detected	NA	not detected	0.2	NA
1,1,1-Trichloroethane	2.1	4.4	11	NA	not detected	0.0	NA
1,2-Dichloroethane (ion 62)	not detected	not detected	not detected	NA	not detected	0.0	NA
Benzene	not detected	2.0	not detected	NA	not detected	0.1	NA
Carbon Tetrachloride	not detected	not detected	not detected	NA	not detected	0.0	NA
Trichloroethene	27.9	12.6	61	-79	29	59.3	69
Toluene	30.9	18.5	37	NA	not detected	0.2	NA
Tetrachloroethene	not detected	1.8	not detected	NA	not detected	0.2	NA
TOTAL RPD				-103			92

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-6-3

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	166.4	174	9.3	174	12	0.0	NA
Vinyl Chloride	not detected	0	not detected	0	not detected	0.0	0
Freon 11	11.3	0	not detected	0	not detected	3.0	NA
1,1-Dichloroethene	11.4	0	not detected	0	not detected		0
Dichloromethane	10.5	0	11	0	not detected		0
Trichlorotrifluoroethane	682.1	-136	630	45	240		NA
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.3	0
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	1.1	0	2.1	0	not detected	3.8	NA
Chloroform	not detected	0	not detected	0	not detected	0.3	0
1,1,1-Trichloroethane	2.9	0	not detected	0	not detected	0.2	0
1,2-Dichloroethane (Ion 62)	not detected	0	not detected	0	not detected	0.0	0
Benzene	2.1	0	not detected	0	not detected	0.2	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.0	0
Trichloroethene	14.8	139	65	139	25	46.2	60
Toluene	16.3	0	4.6	0	not detected	0.0	0
Tetrachloroethene	0.7	0	not detected	0	not detected	0.3	0
TOTAL RPD		177		359			60

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-7-1

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	139	-67	250	-11	280	0.0	NA
Vinyl Chloride	1104	-70	2300	0	2300	0.0	NA
Freon 11	58	-70	110	-9	120	875.5	152
1,1-Dichloroethene	4301	-159	57000	40	38000	NA	NA
Dichloromethane	not detected	NA	150	0	150	NA	NA
Trichlorotrifluoroethane	3195	-126	29000	70	14000	NA	NA
1,1-Dichloroethane	659	-88	3500	69	1700	16470.6	163
c-1,2-Dichloroethene	1	NA	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	68	-139	610	46	380	8457.4	183
Chloroform	not detected	NA	37	60	20	99.8	133
1,1,1-Trichloroethane	88	-31	170	34	120	606.3	134
1,2-Dichloroethane (Ion 62)	175	-69	480	29	360	1278.1	112
Benzene	29	-109	140	35	98	512.7	136
Carbon Tetrachloride	not detected	0	not detected	0	not detected	3.8	NA
Trichloroethene	1091	-144	9200	31	6700	6367.0	-5
Toluene	25	NA	not detected	0	not detected	11.2	NA
Tetrachloroethene	44	-105	180	25	140	255.6	58
TOTAL RPD		-977		420			1066

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-7-2

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	not detected	NA	180	-36	260	0.00	NA
Vinyl Chloride	1866	-40	180	-176	2800	-1.31	NA
Freon 11	34	-149	166	-32	230	0.00	NA
1,1-Dichloroethene	5347	-168	45000	-32	62000	0.00	NA
Dichloromethane	not detected	NA	87.5	-74	190	385.11	68
Trichlorotrifluoroethane	2354	-167	19500	-29	26000	7997.68	-106
1,1-Dichloroethane	756	-113	1950	-32	2700	16365.78	143
c-1,2-Dichloroethene	2	NA	9.9	NA	not detected		0
t-1,2-Dichloroethene	106	-109	285	-23	360		NA
Chloroform	not detected	NA	22.5	-25	29	75.07	89
1,1,1-Trichloroethane	53	-90	86	-48	140	330.03	81
1,2-Dichloroethane (Ion 62)	not detected	NA	210.5	-71	440	712.52	47
Benzene	17	-150	55	-74	120	341.75	96
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.00	0
Trichloroethene	611	-170	4150	-59	7600	3742.58	-68
Toluene	0.6	NA	4.6	NA	not detected	0.00	0
Tetrachloroethene	0.03	-200	78	-74	170	85.67	-66
TOTAL RPD		-1356		-785			284

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-7-3

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	not detected	0	54	NA	not detected	0.0	0
Vinyl Chloride	1408	-44	1200	-59	2200	0.0	NA
Freon 11	79	-67	150	-6	160	617.2	118
1,1-Dichloroethene	2758	-172	54000	40	36000		
Dichloromethane	not detected	NA	91	-19	110		
Trichlorotrifluoroethane	3912	-129	27000	40	18000		
1,1-Dichloroethane	1014	-74	3100	34	2200	8113.4	115
c-1,2-Dichloroethene	not detected	NA	not detected	NA	8.2	0.0	NA
t-1,2-Dichloroethene	146	-100	610	32	440	5343.0	170
Chloroform	not detected	NA	37	35	26	48.7	61
1,1,1-Trichloroethane	155	10	170	19	140	290.8	70
1,2-Dichloroethane (Ion 62)	not detected	NA	450	17	380	606.9	46
Benzene	37	-91	140	33	100	236.2	81
Carbon Tetrachloride	not detected	NA	not detected	NA	18	0.0	NA
Trichloroethene	1558	-84	8900	80	3800	22048.7	141
Toluene	11	NA	9.8	NA	not detected	5.1	NA
Tetrachloroethene	57	-96	180	12	160	88.4	-58
TOTAL RPD		-846		259			743

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-8-1

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bag (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	Offsite Pressurized Canister (ppbv)	RPD (%)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	1.1	NA	not detected	0	not detected	280	NA	0.0	0
Vinyl Chloride	314	159	51	34	36	160	127	0.0	NA
Freon 11	130	59	280	119	71	210	99	413.5	141
1,1-Dichloroethene	4057	-67	20000	85	8100	21000	89		
Dichloromethane	not detected	NA	26	31	19	not detected	NA		
Trichlorotrifluoroethane	3443	-37	13000	89	5000	10000	67		
1,1-Dichloroethane	43	8	140	111	40	90	77	180.3	127
c-1,2-Dichloroethene	0.3	NA	not detected	0	not detected	not detected	0	0.0	0
t-1,2-Dichloroethene	1.4	NA	5.1	NA	not detected	not detected	0	13.6	NA
Chloroform	not detected	0	6	NA	not detected	not detected	0	8.1	NA
1,1,1-Trichloroethane	80	17	320	130	68	240	112	301.9	126
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	not detected	0	18.3	NA
Benzene	3.9	NA	9.2	NA	not detected	not detected	0	6.1	NA
Carbon Tetrachloride	not detected	0	5.9	NA	not detected	not detected	0	3.4	NA
Trichloroethene	153	-68	750	83	310	820	90	1311.9	124
Toluene	15	NA	not detected	0	not detected	not detected	0	0.4	0
Tetrachloroethene	17	53	34	110	9.9	38	117	30.1	101
TOTAL RPD		123		792			777		620

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan

Client: CH2M HILL

Site: MW-8-2

Compound	Carbon Molecular Sieve (ppbv)	RPD (%)	Tedlar Bag (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	Offsite Pressurized Canister (ppbv)	RPD (%)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	547	110	690	125	160	not detected	NA	0.0	NA
Vinyl Chloride	1443	NA	310	NA	not detected	not detected	0	0.0	0
Freon 11	622	140	230	71	110	not detected	NA	274.3	86
1,1-Dichloroethene	15243	49	26000	95	9200	260	-189		
Dichloromethane	0	NA	210	97	73	27000	199		
Trichlorotrifluoroethane	10648	65	16000	99	5400	39	-197		
1,1-Dichloroethane	346	156	80	60	43	16000	199	110.8	88
c-1,2-Dichloroethene	1	NA	not detected	0	not detected	140	NA	0.0	0
t-1,2-Dichloroethene	8	NA	not detected	0	not detected	not detected	0	8.6	NA
Chloroform	0	0	not detected	0	not detected	not detected	0	5.3	NA
1,1,1-Trichloroethane	478	148	250	112	71	not detected	NA	208.5	98
1,2-Dichloroethane (Ion 62)	0	0	not detected	0	not detected	240	NA	13.4	NA
Benzene	8	NA	10	NA	not detected	not detected	0	4.3	NA
Carbon Tetrachloride	4	NA	not detected	0	not detected	not detected	0	2.6	NA
Trichloroethene	738	79	1000	103	320	not detected	NA	174.9	-59
Toluene	114	NA	not detected	0	not detected	1100	NA	0.7	0
Tetrachloroethene	52	130	42	117	11	not detected	NA	24.7	77
TOTAL RPD		877		878			12		290

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-8-3

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bag (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	Offsite Pressurized Canister (ppbv)	RPD (%)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	38	-127	not detected	NA	170	85	-67	0.0	NA
Vinyl Chloride	544	NA	not detected	0	not detected	100	NA	0.0	0
Freon 11	180	25	150	7	140	310	76	249.9	56
1,1-Dichloroethene	8000	-32	25000	78	11000	26000	81		
Dichloromethane	not detected	NA	47	51	28	21	-29		
Trichlorotrifluoroethane	5691	3	17000	102	5500	13000	81		
1,1-Dichloroethane	101	48	96	43	62	130	71	129.5	70
c-1,2-Dichloroethene	0.4	NA	not detected	0	not detected	not detected	0	0.0	0
t-1,2-Dichloroethene	2.7	NA	not detected	0	not detected	not detected	0	10.4	NA
Chloroform	not detected	0	not detected	0	not detected	not detected	0	6.5	NA
1,1,1-Trichloroethane	140	-13	220	32	160	310	64	238.5	39
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	not detected	0	14.9	NA
Benzene	6.0	NA	not detected	0	not detected	12	NA	4.9	NA
Carbon Tetrachloride	0.4	NA	not detected	0	not detected	not detected	0	2.4	NA
Trichloroethene	244	-57	740	51	440	950	73	363.3	-19
Toluene	10	NA	not detected	0	not detected	not detected	0	0.3	0
Tetrachloroethene	27	38	23	24	18	43	82	32.7	58
TOTAL RPD		-115		387			432		205

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-9-1

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bag (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Frecn 12	199	NA	not detected	0	not detected	0.00	0
Vinyl Chloride	18	NA	not detected	0	not detected	0.00	0
Freon 11	101	13	180	68	89	62.00	-36
1,1-Dichloroethene	1811	-129	15000	56	8400		
Dichloromethane	33	64	29	52	17	13.13	-26
Trichlorotrifluoroethane	2620	-88	12000	57	6700	166.17	-190
1,1-Dichloroethane	1	NA	not detected	0	not detected	1.25	NA
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.00	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.05	0
Chloroform	not detected	0	not detected	0	not detected	0.50	0
1,1,1-Trichloroethane	13	-61	42	55	24	16.85	-35
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.85	NA
Benzene	1	NA	not detected	0	not detected	0.30	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.50	0
Trichloroethene	8	-112	49	58	27	30.65	13
Toluene	2	NA	not detected	0	not detected	0.10	0
Tetrachloroethene	2	NA	not detected	0	not detected	0.95	NA
TOTAL RPD		-312		345			-274

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-9-2

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bags (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	C-SL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	449	NA	not detected	0	not detected	0.0	0
Vinyl Chloride	35	NA	not detected	0	not detected	0.0	0
Freon 11	1155	178	80	19	66	38.5	-53
1,1-Dichloroethene	2740	-65	9700	57	5400		
Dichloromethane	5	-140	33	20	27		
Trichlorotrifluoroethane	4153	6	6000	42	3900		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	0.9	NA
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.1	0
Chloroform	not detected	0	not detected	0	not detected	0.3	0
1,1,1-Trichloroethane	18	-35	27	4	26	14.5	-57
1,2-Dichloroethane (Ion 62)	not detected	0	not detected	0	not detected	0.8	NA
Benzene	70	NA	not detected	0	not detected	0.3	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.4	0
Trichloroethene	20	-44	45	37	31	29.0	-7
Toluene	156	NA	2.2	NA	not detected	0.1	0
Tetrachloroethene	2	NA	not detected	0	not detected	1.2	NA
TOTAL RPD		-99		179			-116

* - Offsite canisters are considered to be the true value for the relative percent calculations.

**COMPARISON OF SOIL VAPOR SAMPLING MEDIA
RELATIVE PERCENT***

EPA Method TO-14: GC/MS Full Scan
Client: CH2M HILL
Site: MW-9-3

Compound	Activated Carbon Tube (ppbv)	RPD (%)	Tedlar Bag (ppbv)	RPD (%)	Offsite Non-pressurized Canister (ppbv)	CSL Non-pressurized Canister (ppbv)	RPD (%)
Freon 12	34	66	170	164	17	0.1	NA
Vinyl Chloride	not detected	0	not detected	0	not detected	0.3	0
Freon 11	2	-184	101.5	68	50	45.0	-11
1,1-Dichloroethene	34	-198	13000	64	6700		
Dichloromethane	5	-117	not detected	NA	21		
Trichlorotrifluoroethane	25	-198	7650	46	4800		
1,1-Dichloroethane	not detected	0	not detected	0	not detected	1.0	NA
c-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
t-1,2-Dichloroethene	not detected	0	not detected	0	not detected	0.0	0
Chloroform	not detected	0	not detected	0	not detected	0.4	0
1,1,1-Trichloroethane	13	-58	30	22	24	13.9	-53
1,2-Dichloroethane (ion 62)	not detected	0	not detected	0	not detected	0.7	0
Benzene	50	NA	not detected	0	not detected	0.3	0
Carbon Tetrachloride	not detected	0	not detected	0	not detected	0.4	0
Trichloroethene	8	-106	52	70	25	28.4	13
Toluene	71	174	not detected	NA	5	0.1	NA
Tetrachloroethene	not detected	0	not detected	0	not detected	1.3	NA
TOTAL RPD		-621		434			-51

* - Offsite canisters are considered to be the true value for the relative percent calculations.

APPENDIX IV
SAMPLING STANDARD OPERATING
PROCEDURES

CANISTER SAMPLING PROCEDURE

Recommended Sampling Procedure - Canister sample collection of soil gas from wells/risers

1. Principle and Applicability

1.1 Principle: To withdraw a sample of soil gas from an existing soil gas monitoring well or riser, a sampling manifold of clean teflon tubing and clean tubing fittings is constructed. The manifold is connected to flow measurement equipment and to an evacuated Summa passivated canister in which the sample is collected.

1.2 Applicability: The method is applicable for sampling gases for analysis to very low detection levels. The method may be used to withdraw grab samples or samples integrated over a short period of time. Alternative flow control equipment should be considered if very uniform sampling rates or long (greater than 20 minutes) integration periods are desired.

2. Reference Method

2.1 Apparatus - A schematic of the sampling equipment is shown in Figure 1. Specifications for the recommended apparatus are provided below. Alternative equipment may provide satisfactory performance and should be evaluated on a case-by-case basis.

2.1.1 Sample line and fittings. Sample line and connections used between the well head and sample container connection must be constructed of ultra-clean materials. The reactivity of sample gas with materials of construction and permeability of materials to sample gases must be considered. These concerns may be addressed with the use of new teflon tubing for sample line and new stainless steel valves and connections.

2.1.2 Vacuum gauge (optional for grab samples)
A vacuum gauge with range scale from 30 inches mercury vacuum to zero is necessary to integrate sample collection. A gauge guard constructed of ultra-clean materials may be desirable to limit any possible contamination of the gauge with sample gases.

2.1.3 Well purging Pump
A gas sampling pump is necessary to purge the well to steady-state concentrations. Figure 1 shows a configuration with the

pump in place between the well head and the sample collection port. This arrangement requires that the pump be constructed of clean materials (stainless or teflon parts wetted with gas, oil free) as the sample contacts the pump prior to the sample container. The pump should be of sufficient size to deliver 10 scfh while pumping against a slight vacuum. An alternate arrangement with the pump between the water trap and the flow meter is acceptable (shown in Figure 2).

2.1.4 Flow Meter

A flow meter with a scale range up to 10 scfh (maximum pump output) is necessary. The flow meter may be a rotameter with limited calibration because it is used only to evaluate gross withdrawal rates.

2.1.5 Condensate Trap

A condensate trap is necessary to protect the flow meter from contamination. Any materials of construction that will produce a gas-tight sampling system are acceptable. The trap is arranged with a inlet line reaching to within an inch or two of the bottom of the reservoir and an outlet line at a greater distance from the bottom. This can be accomplished with a 250 ml erhlenmeyer flask and a two hole stopper. The reservoir is placed in an ice water bath which helps to condense any liquids in the sample stream.

2.1.6 Leak detection fluid

A supply of leak detection fluid is necessary. Snoop or other bubbling agents are acceptable if it is determined that no target analytes are present in the fluid.

2.2 Procedure

2.2.1

Set up the sampling train as shown in Figure 1. Connect a cylinder of UHP nitrogen (or air) to the exhaust end of the train with the well head and sample container connections capped (sample port needle valve open). Regulate the UHP gas to 5-10 psig. Remove the cap from the well head connector and allow the UHP gas to vent to ambient for a few minutes. Recap the well head connection and repeat this purging on the sample container connection. Recap the sample connector and allow the system pressure to stabilize 5-10 psig. Apply the leak detection fluid to all connections and tighten if bubbles form. Rinse all leak detection fluid from the connections with UHP water.

2.2.2 Field blank collection

Uncap the sample container connection and ensure that a constant flow of UHP gas is exhausting through the line. Connect a clean evacuated canister on the sample container connection and open its integral valve to withdraw a field blank sample. Close the in-line needle valve and the canister valve.

2.2.3 Well stabilization

Disconnect the UHP gas from the exhaust line of the sampling manifold. Remove the cap from the well head connector and connect the train to the well head. Start the pump and allow it to run for sufficient time for the well to reach a stable concentration (20-40 CF for monitoring wells). Open the sample container line and allow sample gas to vent through this line. Connect a clean sample container to the sample container connection. Close the needle valve completely.

2.2.4a Grab Sampling

Grab sample(s) may be withdrawn by first completely opening the needle valve in the sample line, then the canister valve, waiting for pressure equalization and then closing both valves. The canister is then disconnected and capped and sent to a laboratory for analysis.

2.2.4b Integrated sampling

Samples may be taken from the well over an extended time by first attaching the canister to the sample container connector with both the canister and needle valves closed. The canister valve is then opened completely (registers 29 - 30 inches mercury vacuum on the vacuum gauge). The needle valve is then opened a very small amount to allow sample gas to flow slowly into the canister. The change in deflection on the vacuum gauge is used to evaluate the speed at which the canister fills. Once the gauge reads zero pressure the needle valve is opened completely for a few seconds and then both valves are closed and the canister is removed, capped, and sent to the laboratory for analysis. The length of time over which this integration can be conducted depends on the size of canister but 20 minutes is a long period for for 850 ml canisters unless more sophisticated flow controlling equipment is used.

3.0 Quality control

3.1 Sample contamination

Sample contamination by the sampling manifold is reduced through the use of high purity purge and leak check gases. Rinsing of the leak detection fluid with UHP water minimizes contamination from this source. The condition of the sampling train is evaluated using the field blank and appropriate quality control criteria.

3.2 Sample train leaks

Leaks are prevented by pressurizing the system and using a bubbling agent to detect leaks. Any leaks discovered are repaired prior to sampling.

3.3 Canister integrity

The integrity of the sample canister is evaluated by checking its pressure prior to connecting it to the sample manifold. A vacuum gauge is connected directly to the canister and the canister valve opened. A pressure reading is recorded and then the canister valve closed. The reading should be 29-30 inches mercury. A vacuum less than 29 inches mercury indicates that the canister seal has breached and that the canister is contaminated. This requires that the canister not be used.

3.4 Calibration

Two instruments are included in this sampling arrangement: the vacuum gauge and the flow meter. The uses for the information produced by these instruments are general and as such do not require formal calibration practices.

4.0 Alternate methods for pressure-filled canister sampling

Canisters may be filled with sample gas to a pressure above atmospheric using an auxiliary pump in the system. The apparatus required is the same as is shown in Figure 1 or 2 except for the line from the sample "tee" to the canister which is shown in Figure 3. All steps described for leak checking and field blanks of subatmospheric canisters are followed for these samples, except that the inline pump is used to bring the canisters to an elevated pressure. The following describes the procedure.

4.1 Apparatus

The apparatus necessary for pressure-filled sampling differs only slightly from that used in sub-atmospheric canister sampling. Specifications for the apparatus that differs are given below.

4.1.1 Auxiliary pump

The in-line pump used to pressurize samples must be of ultra-clean design (stainless or teflon diaphragm) and capable of pressurizing the sample container to around 30 psig.

4.1.2 Pressure/vacuum gauge

A compound gauge (capable of reading both pressure and vacuum) is necessary. The scale ranges should be from 30 inches mercury vacuum to 30 psi positive pressure.

4.2 Procedure

4.2.1 Grab samples

Pressure filled grab samples are taken after following the steps outlined for purging subatmospheric canister systems. Then start the auxiliary pump with the needle valve open (pumping to ambient). Then connect the canister to the sample container connection (canister valve closed). Open the canister valve and pump sample into the canister until pressure stabilizes. Close the canister valve and then the sample-line needle valve. Turn off the pump and disconnect and cap the canister to prepare it for shipment to the laboratory.

4.2.2 Integrated samples

A sample can be taken over a short period of time using the following procedures: The auxiliary pump is started and the sample line needle valve opened to flush sample gas through the line. Then attach the canister with its valve closed and close the needle valve. Open the canister valve completely and then the needle valve very slightly. The rate of filling is regulated by the needle valve and indicated by the change in needle deflection on the pressure/vacuum gauge. Allow the canister to fill until there is no more change in pressure and then close the canister valve. Close the needle valve and shut off the pump. Disconnect the canister (valve closed) and cap it for shipment to the lab.

The advantages of subatmospheric canister sampling are as follows:

- . No ultra-clean canister pressurizing pump is necessary
- . No power source for a pressurizing pump is necessary
- . When configured as in Figure 2, there is no pump to contaminate the sample upstream of the sample container

The advantages of pressurized canister sampling are as follows:

- . More sample is collected
- . Some species may be more stable at higher pressures
- . Integration periods can be extended

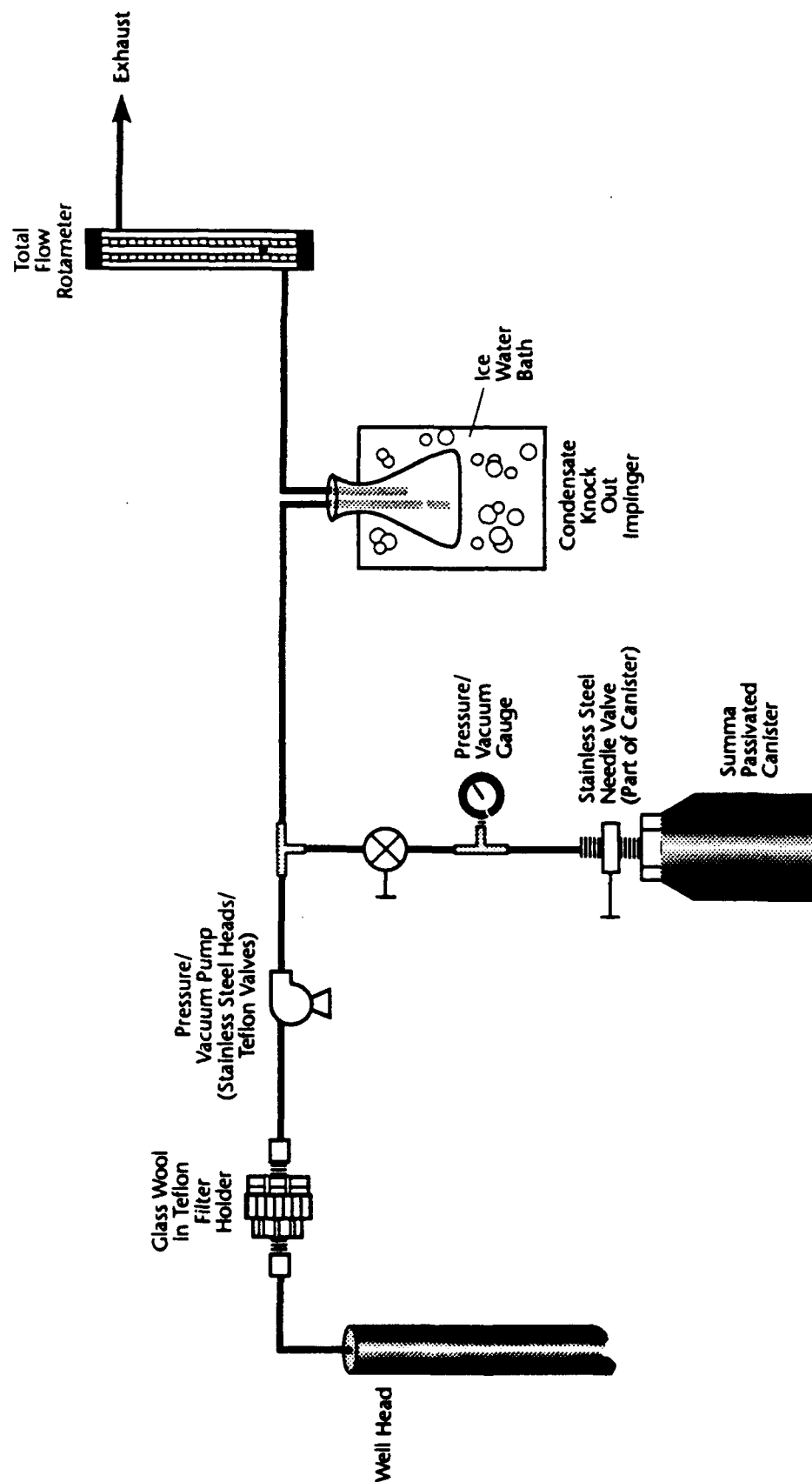


Figure 1

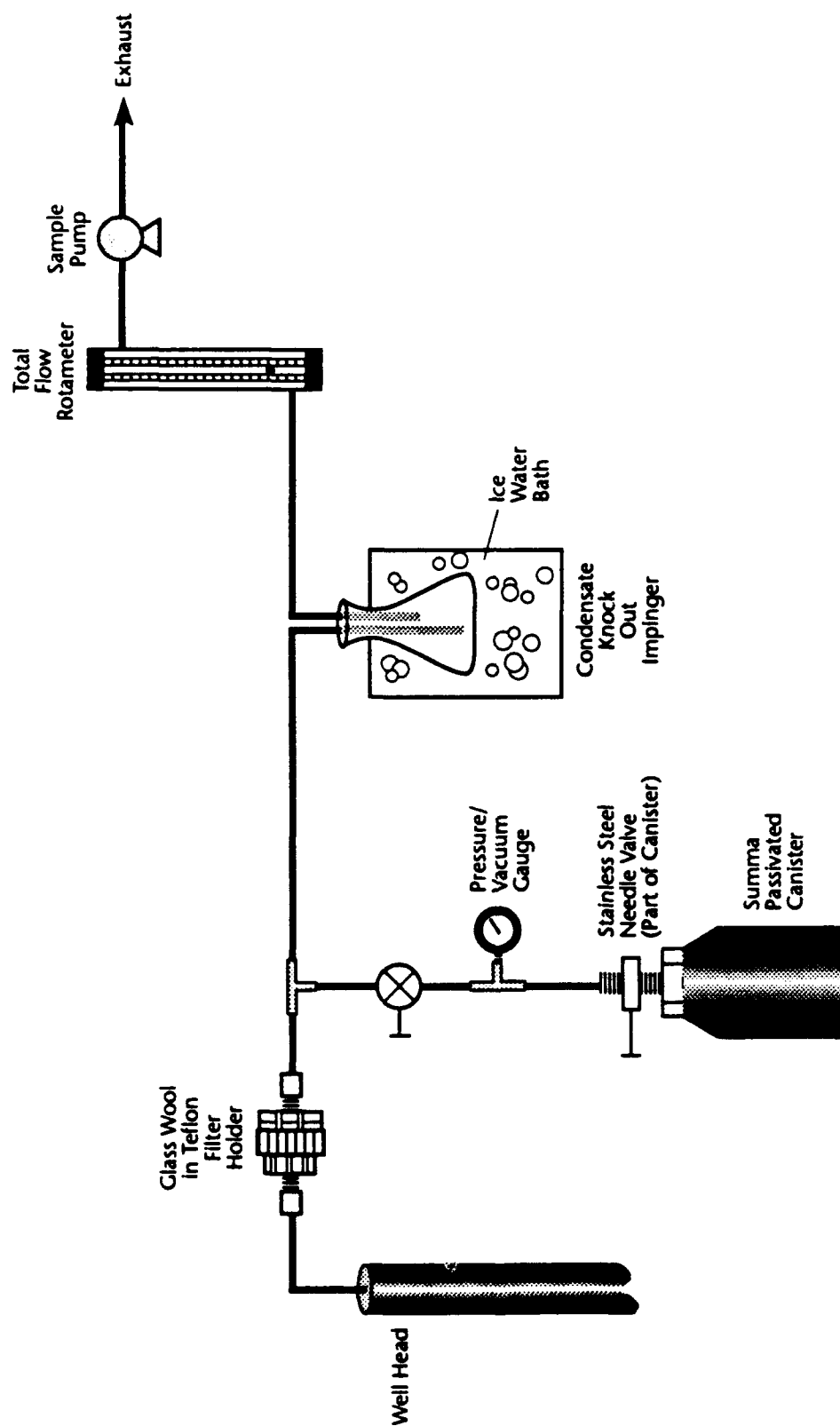


Figure 2

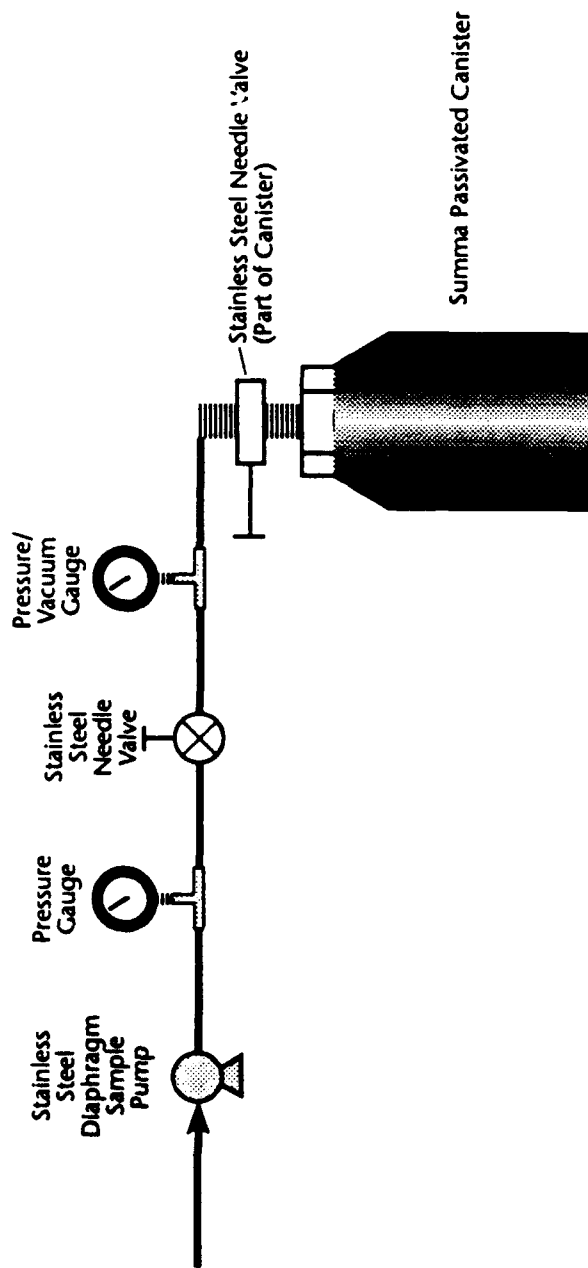


Figure 3

SOLID SORBENT SAMPLING PROCEDURE

Recommended Sampling Procedure - Solid sorbent sample collection from soil gas wells

1. Principle and Applicability

1.1 Principle: To withdraw a sample of soil gas from an existing soil gas monitoring well or riser, a sampling manifold of clean teflon tubing and clean tubing fittings is constructed. The manifold is connected to flow measurement equipment and to an pair of solid sorbent tubes connected in series.

1.2 Applicability: The method is applicable for collecting samples of gases for analysis to very low detection levels. The method is used to withdraw samples integrated over a short period of time.

2. Reference Method

2.1 Apparatus - A schematic of the sampling equipment is shown in Figure 1. Specifications for the recommended apparatus are provided below. Alternative equipment may provide satisfactory performance and should be evaluated on a case-by-case basis.

2.1.1 Sample line and fittings. Sample line and connections used between the well head and sample container connection must be constructed of ultra-clean materials. The reactivity of sample gas with materials of construction and permeability of materials to sample gases must be considered. These concerns may be addressed with the use of new teflon tubing for sample line and new stainless steel valves and connections.

2.1.2 Sampling Pump

A pump is necessary to draw sample gas through the solid sorbent tubes. The pump is placed on the outlet side of the tubes in series and so, is not an ultra-clean device. The pump must be capable of delivering the desired sample flow rate (100-200 cc/minute) while pumping against a slight vacuum. Personnel sampling pumps (in low-flow configuration) are suitable for this purpose.

2.1.3 Purge Pump

A gas pump is necessary to purge the well to steady-state concentrations. Figure 1 shows a configuration with the pump in

place between the condensate trap and the exhaust line flow meter. This arrangement allows the pump to be constructed of any desired materials as the sample does not contact the pump prior to the solid sorbent tubes. The pump should be of sufficient size to deliver 10 scfh while pumping against a slight vacuum.

2.1.4 Flow Meter/exhaust line

A flow meter with a scale range up to 10 scfh (maximum pump output) is necessary. The flow meter may be a rotameter with limited calibration because it is used only to evaluate gross withdrawal rates.

2.1.5 Flow meter/sample line

Collection of an accurately known volume of sample is critical to the accuracy of the results. It is recommended that a mass flow controller be used to measure sample flows rather than critical orifices or needle valves.

2.1.6 Condensate Trap

A condensate trap is necessary to protect the flow meter in the exhaust line from contamination. Any materials of construction that will produce a gas-tight sampling system are acceptable. The trap is arranged with an inlet line reaching to within an inch or two of the bottom of the reservoir and an outlet line at a greater distance from the bottom. This can be accomplished with a 250 ml erhlenmeyer flask and a two hole stopper. This reservoir is placed in an ice bath which helps to condense any liquids in the sample stream.

2.1.6 Leak detection fluid

A supply of leak detection fluid is necessary. Snoop or other bubbling agents are acceptable if it is determined that no target analytes are present in the mixture.

2.2 Procedure

2.2.1

Set up the sampling train as shown in Figure 1. Connect a cylinder of UHP nitrogen (or air) to the exhaust end of the train with the well head and sample container connections capped (sample port needle valve open). Regulate the UHP gas to 5-10 psig. Remove the cap from the well head connector and allow the UHP gas to vent to ambient for a few minutes. Recap the well head connection and repeat this purging through the sample container connection. Recap the sample connector and

allow the system pressure to stabilize 5-10 psig. Apply the leak detection fluid to all connections and tighten if bubbles form. Rinse all leak detection fluid from the connections with UHP water once leaks have been eliminated.

2.2.2 Field blank collection

Uncap the sample container connection and ensure that a constant flow of UHP gas is exhausting through the line. Connect a clean solid sorbent tube on the sample connection and start the sample pump to withdraw a field blank sample. Close the in line needle valves.

2.2.3 Well stabilization

Disconnect the UHP gas from the exhaust line of the sampling manifold. Remove the cap from the well head connector and connect the train to the well head. Start the pump and allow it to run for sufficient time for the well to reach a stable concentration (20-40 CF for monitoring wells). Open the sample container line and pump sample gas through this line. Close the sample line valve and immediately connect a set of clean solid sorbent tubes to the sample connection.

2.2.4 Integrated sampling

Samples may be taken from the well over an extended period of time, limited by flow rate and breakthrough volume of the sorbent. Turn off the purge pump and close the exhaust line valve. Ensure that the solid sorbent tubes are oriented vertically. Open the sample line valve and initialize the mass flow controller totalizer. Start the sample pump and withdraw the desired quantity of sample gas. Close the sample line valve and turn off the sample pump. The solid sorbent tubes must be handled in a manner appropriate for the analytical results desired, but should be immediately sealed for shipment.

3.0 Quality control

3.1 Sample contamination

Sample contamination by the sampling manifold is reduced through the use of high purity purge and leak check gases. Rinsing of the leak detection fluid with UHP water minimizes contamination from this source. The condition of the sampling train is evaluated using the field blank and appropriate quality control criteria.

3.2 Sample train leaks

Leaks are prevented by pressurizing the system and using a bubbling agent to detect leaks.

Any leaks discovered are repaired prior to sampling.

3.3 Solid sorbent handling

Care should be taken to handle solid sorbent tubes as little as possible (using gloves for glass tubes). The tubes should be sealed after sampling and packed in a container with clean charcoal. The container should be maintained at reduced temperature prior to analysis (< 20 degrees C).

3.4 Calibration

Two instruments are included in this sampling arrangement: the two flow metering devices. The use for the information produced by the meter in the exhaust line is general and as such does not require formal calibration practices. The sample flow measurement is critical to the accuracy of the results. A calibrated mass flow controller with totalizer is recommended for low flow rates.

4.0 Alternate methods

4.1 Flow measurement

Sample flow can be measured using metering devices other than mass flow controllers. A critical orifice may be inserted in the sample line in place of the mass flow controller. This requires calibration with the solid sorbent tubes in place. The critical orifice (or, less desirable, a needle valve) and pump are first calibrated with a soap bubble meter or wet test meter or Mini-Buck automated bubble meter. The solid sorbent is then attached and the gas sampled. The critical orifice and sample pump are recalibrated after sampling to ensure constant flows during the sampling period. The pump and critical orifice are then reset to the flow rate of the sampling period. The tubes, recovered after analysis, are inserted into the calibration setup and the calibration is repeated with sample gas. The effect of this exercise is to establish a constant flow through the pump and orifice alone, and to then determine the actual sampling flow using the sample tubes after analysis when they are no longer required to be maintained free of contamination.

Advantages to sampling with solid sorbent tubes are as follows:

- . Sorbents are inexpensive
- . Some analytes are collected most efficiently on sorbents

Disadvantages are as follows:

- . Analyte breakthrough is a problem requiring some samples to be collected with tubes in series and/or differential flow arrangements in parallel

- . Field flow measurement is critical
- . All quality control samples (duplicates, blanks, and etc.) must be collected in the field as only a single analysis of sample is possible (destructive analysis)
- . Breakthrough series-tubes double the analysis cost
- . Differential flow arrangements require multiple analyses and increase analytical and media cost accordingly
- . Some analytes are not collected well on sorbents

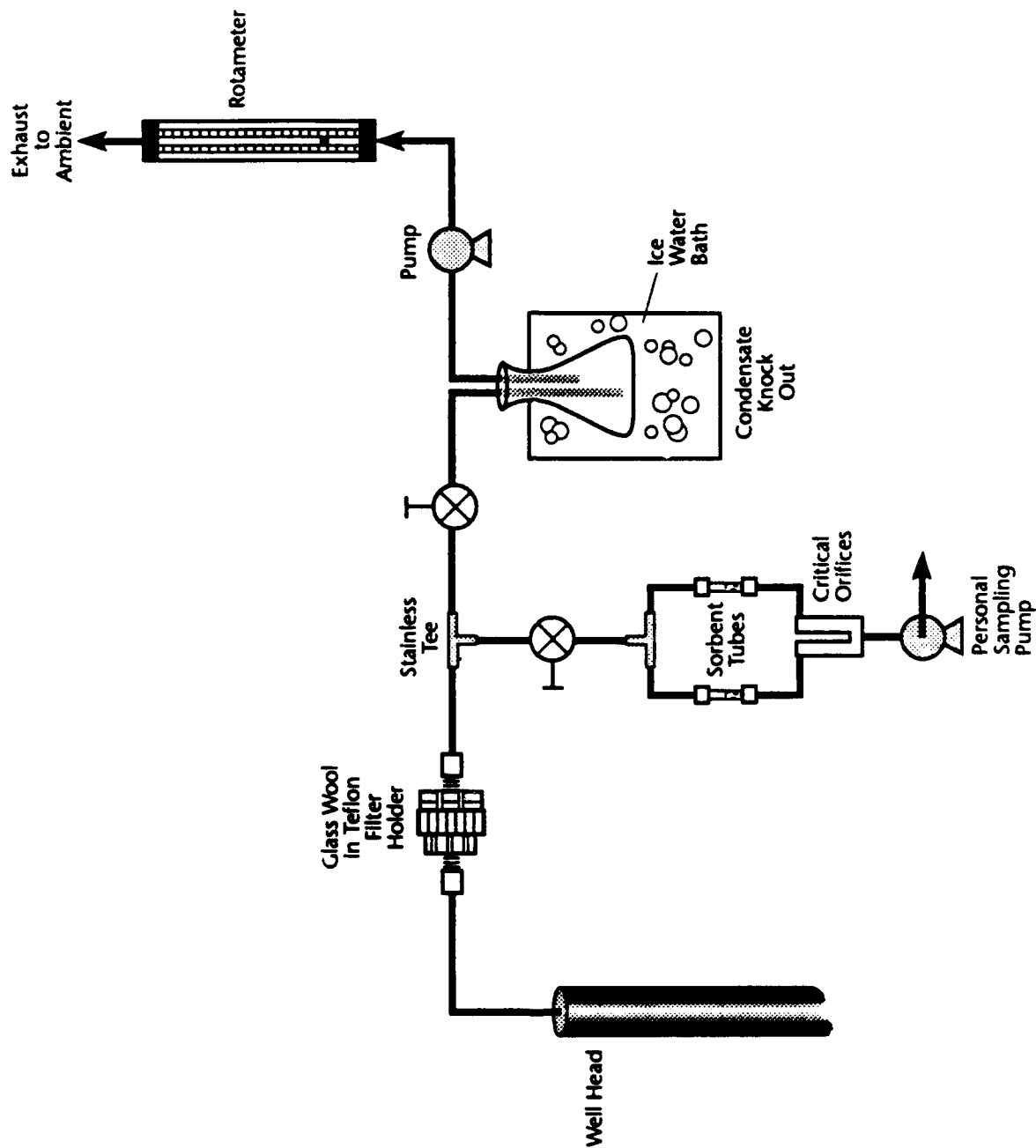


Figure 1

TEDLAR BAG SAMPLING PROCEDURE

Recommended Sampling Procedure - Tedlar Bag sample collection of soil gas from vent risers or soil gas wells

1. Principle and Applicability

1.1 Principle: To withdraw a sample of soil gas from an existing soil gas monitoring well or riser, a sampling manifold of clean teflon tubing and clean tubing fittings is constructed. The manifold is connected to a tedlar bag inside an air tight container.

1.2 Applicability: The method is applicable to the collection of samples of gases for analysis to very low detection levels. The method is used to withdraw samples integrated over a short period of time.

2. Reference Method

2.1 Apparatus - A schematic of the sampling equipment is shown in Figure 1. Specifications for the recommended apparatus are provided below. Alternative equipment may provide satisfactory performance and should be evaluated on a case-by-case basis.

2.1.1 Sample line and fittings. Sample line and connections used between the well head and sample container connection must be constructed of ultra-clean, inert materials. The reactivity of sample gas with materials of construction and permeability of materials to sample gases must be considered. These concerns may be addressed with the use of new teflon tubing for sample line and new stainless steel valves and connections.

2.1.2 Sampling Pump

A pump is necessary to draw sample gas into the sample bag. The pump is placed on the outlet side of the container in which the bag is placed and so, is not an ultra-clean device. The pump must be capable of delivering the desired sample flow rate (100-200 cc/minute) while pumping against a slight vacuum. Personnel sampling pumps (in low-flow configuration) are suitable for this purpose.

2.1.3 Purge Pump

A gas pump is necessary to purge the well to steady-state concentrations. Figure 1 shows a configuration with the pump in place between the condensate trap and the

exhaust line flow meter. This arrangement allows the pump to be constructed of any desired materials as the sample does not contact the pump prior to the sample container. The pump should be of sufficient size to deliver 10 scfh while pumping against a slight vacuum.

2.1.4 Flow Meter/exhaust line

A flow meter with a scale range up to 10 scfh (maximum pump output) is necessary. The flow meter may be a rotameter with limited calibration because it is used only to evaluate gross withdrawal rates.

2.1.5 Sample Bags

Sample bags shall be made of Tedlar film.

2.1.6 Rigid container for filling sample bags by application of vacuum

An air tight container is necessary in this application. Cardboard cartons and duct tape have been used but a 5 gallon plastic bucket is more durable and can be arranged with an air tight plexiglas window to inspect the bag during filling. The container must be opaque except for the small inspection window. The container shall be equipped with fittings to mate with the sample bag, sample line and vacuum line. The recommended fittings are quick connects, some with ball checks which prevent flow when disconnected, and some without as shown in Figure 1.

2.1.7 Condensate Trap

A condensate trap is necessary to protect the flow meter in the exhaust line from contamination. Any materials of construction that will produce a gas-tight sampling system are acceptable. The trap is arranged with a inlet line reaching to within an inch or two of the bottom of the reservoir and an outlet line at a greater distance from the bottom. This can be accomplished with a 250 ml erhlenmeyer flask and a two hole stopper. This reservoir is placed in an ice bath which helps to condense any liquids in the sample stream.

2.1.8 Leak detection fluid

A supply of leak detection fluid is necessary. Snoop or other bubbling agents are acceptable if it is determined that no target analytes are present in the mixture.

2.2 Procedure

2.2.1

Set up the sampling train as shown in Figure 1. Connect a cylinder of UHP nitrogen (or air) to the exhaust end of the train with the well head and sample container connections capped (sample line needle valve open). Regulate the UHP gas to 5-10 psig. Remove the cap from the well head connector and allow the UHP gas to vent to ambient for a few minutes. Recap the well head connection and repeat this purging through the sample container connection. Recap the sample connector and allow the system pressure to stabilize 5-10 psig. Apply the leak detection fluid to all connections and tighten if bubbles form. Rinse all leak detection fluid from the connections with UHP water once leaks have been eliminated.

2.2.2 Flushing Sample Bags

To ensure that sample bags have not become contaminated prior to sampling, they should be purged with UHP gas. Each bag is connected directly to the UHP gas cylinder, filled, then disconnected and forced to empty. This should be repeated three times.

2.2.3 Field blank collection

Uncap the sample container connection and ensure that a constant flow of UHP gas is exhausting through the line. Connect a clean, purged sample bag to the sample connection under the bucket lid and open the needle valve to allow N₂ to fill the bag. Close the in line needle valve.

2.2.3 Well stabilization

Disconnect the UHP gas from the exhaust line of the sampling manifold. Remove the cap from the well head connector and connect the train to the well head. Start the pump and allow it to run for sufficient time for the well to reach a stable concentration (10-20 CF for monitoring wells). Open the sample container line and pump sample gas through this line. Close the sample line valve and immediately connect the sample bag to the inlet line under the bucket lid, close the bucket, and attach the vacuum line to the outlet line on the bucket lid.

2.2.4 Integrated sampling

Samples may be taken from the well over an extended period of time, limited by flow rate and volume of the sample bag. Turn off the purge pump and close the exhaust line valve. Open the sample line valve and start the sample pump. Sampling rates can be preset by

calibrating the sampling pump to withdraw the desired volume over the desired period. Once the desired volume is contained in the sample bag, close the sample line valve and turn off the sample pump. The sample bags must be handled in a manner appropriate for the analytical results desired, but should be immediately valved closed for shipment. Sample bags should be kept in a cool environment and must not be exposed to sunlight.

3.0 Quality control

3.1 Sample contamination

Sample contamination by the sampling manifold is reduced through the use of high purity purge and leak check gases. Rinsing of the leak detection fluid with UHP water minimizes contamination from this source. The condition of the sampling train is evaluated using the field blank and appropriate quality control criteria.

3.2 Sample train leaks

Leaks are prevented by pressurizing the system and using a bubbling agent to detect leaks. Any leaks discovered are repaired prior to sampling.

3.3 Sample bag handling

Care should be taken to prevent exposure of the bags to high temperatures or sunlight. The bag valves should be closed after sampling and the bags may be packed in a container with clean charcoal. The container should be maintained at reduced temperature prior to analysis (< 20 degrees C). The container with bags ready for shipment should not be exposed to any elevated concentrations of target analytes as these may permeate the bag.

3.4 Calibration

One instrument is included in this sampling arrangement: the flow metering device. The use for the information produced by the meter in the exhaust line is general and as such does not require formal calibration.

Advantages to sampling with tedlar bags are as follows:

- . Bags are inexpensive
- . Large sample volumes can be collected

Disadvantages to tedlar bag sampling are as follows

- . Bags are difficult to completely purge of preexisting contamination
- . Some species may migrate through bags
- . Bags must be kept out of sunlight

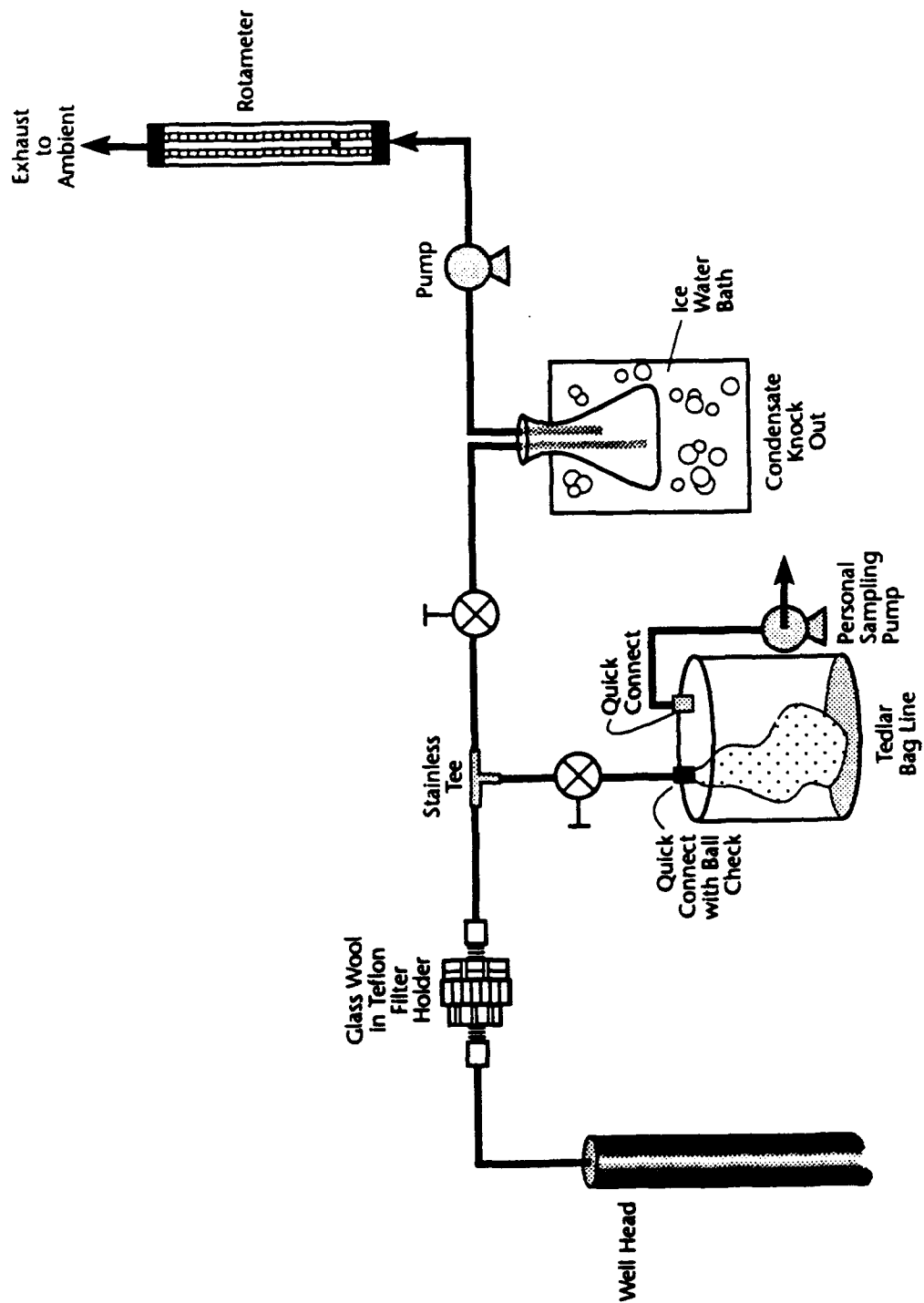


Figure 1