

Montana Department of  
Environmental Quality

**Helena Solvent Site  
Vapor Intrusion Investigation Data Report**

June 2010

*Final*

# Contents

<b>Section 1 Introduction/ Background .....</b>	<b>1-1</b>
1.1 Previous Investigations.....	1-1
1.2 “Worst Case” Investigation.....	1-2
<b>Section 2 Sampling Activities.....</b>	<b>2-1</b>
2.1 SAP Deviations .....	2-1
2.2 Field Activities .....	2-2
<b>Section 3 QA/QC Issues.....</b>	<b>3-1</b>
<b>Section 4 Results .....</b>	<b>4-1</b>
<b>Section 5 References .....</b>	<b>5-1</b>

## Appendices

- Appendix A Results*
- Appendix B Data Validation*
- Appendix C Field Notes*
- Appendix D Questionnaires*
- Appendix E Field Forms*
- Appendix F Field Photos*
- Appendix G Figures*

## List of Figures

- Figure 1 Helena Solvent Site Vapor Intrusion Site Map
- Figure 2 Helena Solvent Site Vapor Intrusion Subslab Sample Locations and PCE/TCE Results

## List of Tables

- Table 2-1 Sample Locations, ID’s, and Quantity. .... 2-1
- Table 2-2 Sample Locations for Buildings with Multiple Samples ..... 2-3
- Table 4-1 Weather Data ..... 4-11

*This page is intentionally left blank.*

# Section 1

## Introduction/ Background

The Helena Solvent Site (HSS) consists of an area in Helena where chlorinated solvents are known to be present in groundwater at various depths. The highest known concentrations of chlorinated solvents in shallow groundwater are generally located in an area within National Avenue to the East, Montana Avenue to the West, Argyle Street to the North, and Boulder Avenue to the South. The compound tetrachloroethylene (PCE) has been as high as 3,050 micrograms per liter (ug/L) in groundwater in June, 2008. This area had one former drycleaner (Danny's Cleaners at 1100 Lyndale Ave.), and has a currently operating drycleaner (Mr. Wise Cleaners at 1118 Helena Ave., Hustad Center). Mr. Wise Cleaners is located immediately up-gradient of Danny's Cleaners. The purpose of this investigation was to determine whether vapor intrusion is occurring as a result of subsurface contamination.

The Montana Department of Environmental Quality (DEQ) determined that a vapor intrusion assessment was needed to determine whether the vapor intrusion pathway is complete for chlorinated solvents at the HSS, and if indoor air concentrations exceed applicable EPA Regional Screening Levels. While the HSS consists of a larger area in Helena, the DEQ's focus was on the area of highest known solvent concentrations in groundwater (shown in Appendix G- Figure 1) based on the currently available data. The groundwater plume at HSS has not yet been fully investigated and characterized.

The area under investigation is a commercial/industrial area, and none of the structures within this area are currently being used as residences. Paired indoor air/subslab samples were collected from structures within and near the known boundaries of the chlorinated solvent groundwater plume shown in Appendix G- Figure 1. Outdoor air samples were also collected for this investigation that were intended as ambient or "background."

The focus of this investigation was described in the February 2010 Sampling and Analysis Plan Helena Solvent Site Vapor Intrusion Investigation Helena, Montana (SAP). The SAP outlines the procedures that were followed to collect indoor air and subslab samples from structures within and near the chlorinated solvent groundwater plume, and also includes a Quality Assurance Project Plan (QAPP).

### 1.1 Previous Investigations

Previous investigations have included groundwater monitoring and the collection of subsurface soil samples. In 2007, the DEQ contracted with CDM to install monitoring wells and collect soil and water samples to collect information regarding two areas of the HSS (CDM, 2007). This investigation identified elevated concentrations of solvents immediately downgradient of Mr. Wise Cleaners. The DEQ later contracted with Tetra Tech, Inc. to conduct groundwater monitoring of HSS wells and of nearby monitoring wells associated with underground storage tank release sites (Tetra Tech, 2008).

The HSS site borehole observations and the analysis of the physical properties of the soil samples indicate that the site is underlain by clay (CDM, 2007). Groundwater in the area of investigation ranges from approximately 8.5 to 15 feet below ground surface. A potentiometric surface map showed that groundwater flow direction at the HSS is toward the north-north east (Tetra Tech, 2008). Groundwater monitoring at the HSS site has consistently shown elevated concentrations of chlorinated solvents.

Groundwater in the area under investigation is predominantly contaminated with chlorinated solvents, including PCE concentrations well above the Circular DEQ-7 Standard of 5 ug/L. In addition, groundwater sampling has also found some low-level detections of petroleum hydrocarbons. All petroleum detections have been well under the appropriate DEQ-7 Standards and Tier 1 Risk-Based Screening Levels. Although vapor intrusion can occur from all sources of subsurface contamination, including groundwater contamination below the relevant standard, the focus of this vapor intrusion investigation was on chlorinated solvents.

## 1.2 “Worst Case” Investigation

This investigation was conducted during the weeks of February 22, 2010 and March 1, 2010 when temperatures were cold and the ground was still frozen. In accordance with various vapor intrusion guidance, including the Interstate Technology Regulatory Council’s (ITRCs) “Vapor Intrusion Pathway: A Practical Guide,” (ITRC, 2007), this vapor intrusion investigation investigated the potential contaminants at their expected highest concentrations, or during the “worst case” scenario. The frozen ground limits the ability of subsurface vapors to migrate up to the atmosphere through the ground, therefore creating a greater potential for vapors to migrate through the warmer ground under structures. In addition, vapors are expected to reach their highest concentrations in the winter months as a result of buildings being less ventilated during the colder months because windows and doors are kept shut in an effort to keep the structure warm.

# Section 2

## Sampling Activities

In the beginning of January, CDM and DEQ performed a walkthrough of buildings around the Helena Solvent Site to identify buildings that would be sampled, given that only a limited number of samples could be collected. After the walkthrough, DEQ identified 14 structures and the number of samples that would be sampled (see Table 2-1 below).

**Table 2-1 Sample IDs, Locations and Quantity**

Location ID	Location Address and Description	Number of samples		
		Indoor Air	Sub-Slab	Ambient Air
1	1424 Dodge Avenue - Pierce Builders	1	1	
2	1000 East Lyndale - ProBuild	2	2	
3	1112/1114 Helena Avenue – H&R Block (Hustad)	2	1	
4	1118 Helena Avenue - Mr. Wise Cleaners (Hustad)	0	1	
5	1116 Helena Avenue – Canine Capital (Hustad)	1	1	
6	1120 Helena Avenue - Bloomers Floral (Hustad)	1	1	
7	1124 Helena Avenue - Vacant Space (Hustad)	1	1	
8	1130 Helena Avenue – Bullman’s Pizza	1	1	
9	1125 Helena Avenue – Antique Shop	2	1	
10	1133 Helena Avenue - Great Harvest	1	1	
11	1400 Montana Avenue – Mergenthaler Transfer and Storage	2	3	
12	1430 North Montana Avenue - Flooring America	2	2	
13	1100 Lyndale Avenue - Loose Caboose Casino	2	1	
14	1119 Helena Avenue – Former Crown Trophy	2	1	
18	Duplicate (Bullman's Pizza)	1	1	
24	Duplicate (Former Crown Trophy)	1	1	
AMB1	Ambient Air			4
<b>Total</b>		<b>22</b>	<b>20</b>	<b>4</b>

### 2.1 SAP Deviations

This vapor intrusion investigation was performed in general accordance with the February 2010 *Sampling and Analysis Plan Helena Solvent Site Vapor Intrusion Investigation Helena, Montana (SAP)*. Deviations from the SAP and any effects on the sampling results are described in this section.

One minor deviation from the SAP was the collection of five ambient air samples rather than the four called for in the SAP. The additional ambient air sample was collected because there were five days of sampling, and the DEQ collects an ambient air sample for each day of air sampling. The SAP had assumed that there would be only four days of sampling.

Another deviation from the SAP was in the list of analytes run by Air Toxics, the analytical laboratory for this investigation. According to Section 2.1 of the SAP, the analytes were to include only PCE, TCE, the breakdown products of PCE and TCE, and chloroform. Air Toxics also analyzed the samples for xylenes, toluene, ethylbenzene, and sec-butylbenzene. Prior to the finalization of the SAP, initial

conversations with Air Toxics included analyzing the samples for xylenes, toluene, ethylbenzene, and sec-butylbenzene. These analytes were removed from the sample analyte list in the final version of the SAP. CDM did communicate to Air Toxics that these analytes were to be removed from the analyte sample list, but Air Toxics went with the original list that they based their quote on which included xylenes, toluene, ethylbenzene, and sec-butylbenzene. The additional analytes do not change the results of the investigation, but they do require additional data interpretation.

## 2.2 Field Activities

Prior to sampling, DEQ mailed out access letters and arranged sampling dates and times with property owners. The dates of vapor intrusion sampling were February 24-25, and March 1-3, 2010. One ambient air sample was collected for each day of sampling. In general, upon entering a building for sampling, DEQ, CDM, and the building owner or representative would identify appropriate locations to drill and collect the subslab sample(s). CDM would start drilling and collecting the subslab and indoor air samples while DEQ would fill out the building questionnaires (see Appendix C) and collect field notes in a log book (see Appendix D). CDM prepared sample field forms and these are in Appendix E.

DEQ mailed copies of the questionnaire to every location to be sampled prior to sampling; however, the form was rarely filled out when DEQ and CDM arrived to conduct the sampling. Therefore, DEQ filled out the questionnaires with assistance from the property owner, lessee, or the representative for the property. For most sample locations, DEQ opted to take photographs of chemicals in the buildings rather than listing them individually in the questionnaire. Because the sampling locations were all commercial structures, many of them had more chemicals than could be listed in the time allotted for sampling, and taking photographs of the chemicals was more feasible.

Photographs taken by DEQ and CDM are provided on a CD in Appendix F along with a photo log. Table 2-2 below summarizes the location of samples within buildings for those structures that required multiple samples.

Upon completion of subslab sampling at each location, each borehole was filled with concrete and smoothed flush to the surface of the slab. Photographs were taken of each patched borehole to document repair of the slab. Upon completion of indoor air sampling, DEQ provided each property owner with a sample receipt.

Ambient air samples were collected in central locations in places where people were likely to be working and within the breathing zone (approximately 3-5 feet above the ground).

The following field measurement equipment was used for the sampling:

1. Helium Leak Detector: Model MGD-2002
2. Helium Regulator: Model 105L
3. Photo Ionization Detector (PID): Model MiniRAE2000 10.6 120V

The PID meter was calibrated each day prior to sampling. The helium leak detector was rented from Pine Environmental Services, Inc. and was calibrated prior to shipping to CDM.

Staff from HydroSolutions Inc. observed the sampling at the Hustad properties (Locations; 3, 4, 5, 6, 7). DEQ staff in addition to Ms. Laura Alvey attended several of the sampling events for training purposes.

CDM filled out Chain of Custody forms and sample labels. CDM also coordinated with and mailed samples to the Air Toxics laboratory.

**Table 2-2 Sample locations for Buildings with Multiple Samples**

Location ID/Building Location	Sample ID	Sample Type and Location
2 - ProBuild 1000 East Lyndale	2-CL-FA1-3210	Indoor air from office in back bay/warehouse area
	2-CL-FA2-3210	Indoor air from middle of sales floor/store
	2-CL-SS1-3210	Subslab sample from back bay/warehouse area
	2-CL-SS2-3210	Subslab sample from utility closet in sales floor/store
3 - H & R Block 1112/1114 Helena Ave	3-CL-FA1-3210	Indoor air from east side of building
	3-CL-FA2-3210	Indoor air from west side of building
11 - Mergenthaler Transfer and Storage 1400 N Montana Ave	11-CL-FA1-22410	Indoor air from office area
	11-CL-FA2-22410	Indoor air from warehouse
	11-CL-SS1-22410	Subslab sample from southwest warehouse bay
	11-CL-SS2-22410	Subslab sample from middle warehouse bay
	11-CL-SS3-22410	Subslab sample from warehouse bay area outside main offices
12 – Flooring America 1430 N Montana Ave	12-CL-FA1-22410	Indoor air from desk in approximate middle of showroom sales floor
	12-CL-FA2-22410	Indoor air from approximate center of warehouse/bay area
	12-CL-SS1-22410	Subslab sample from break room
	12-CL-SS2-22410	Subslab sample from warehouse/bay area

*This page is intentionally left blank.*

## Section 3

### QA/QC Issues

CDM performed a level III data validation on all data. In general, all laboratory QC data met appropriate criteria, and the validation report indicates that all the data is usable without qualification. Specific details can be found in the data validation report in Appendix B. Holding times for all the sample canisters were met (air in canister less than 30 days). Canister vacuum readings before and after sampling were acceptable. The laboratory blanks did not detect any compounds. As stated in the Data Validation memo, “all field duplicate relative percent differences were within appropriate criteria,” and “all sample results validated are usable for project purposes.”

One potential QA/QC issue is that both subslab samples for location 2 were given the same sample ID number (2-CL-SS2-3210) according to the chain of custody. However, by comparing the sample collection times shown on the chain of custody form (as well as canister numbers), the subslab samples were distinguished as samples SS1 and SS2. This issue does not affect the sampling results or their interpretation.

According to the laboratory results, sample 2-CL-SS1-3210 at ProBuild contained a helium concentration of 7.1 percent (%). According to the SAP, a concentration of helium in the subslab sample above 10% of that inside the sample shroud indicates a leak in the sampling train and that indoor air has mixed with subslab air. The highest percent helium that would be acceptable for sample 2-CL-SS1 3210 would be 1.8 % (10% of the helium in the shroud, which was about 18%). Therefore, the value of 7.1 % exceeds the criteria for subslab leak detection and indicates ambient air was contained in the subslab sample. The field screening of helium during sample collection for this sample indicated an ambient helium concentration of about 18% within the shroud and a helium concentration within the sampling train of 0.1 % at the start of sampling and 0.15 % after sampling was completed. Therefore, while the pre-sampling leak check did not indicate the presence of a leak, enough helium was present in the summa canister to indicate that a leak occurred. A leak would tend to allow incorporation of ambient air into the subslab air sample, and potentially underestimate the concentration of contaminants in the subslab air sample. The results of sample 2-CL-SS1-3210 are suspect.

The laboratory initially reported helium results for sample numbers 1-CC-FA1-3210 and 3-CC-FA1-3210. The correct sample numbers are 1-CL-SS1-3210 and 3-CL-SS1-3210, respectively. Because all samples were labeled with “CL” (“commercial location”) it was readily apparent that the “CC” identification was incorrect. The laboratory resubmitted the results with the correct sample numbers. This issue does not affect the sampling results or their interpretation.

It is important to note that several of the samples had elevated detection limits due to the presence of high concentrations of target and non-target compounds. In some instances, the detection limits are higher than the applicable screening levels. At two locations (1130 Helena Avenue and 1133 Helena Avenue), Air Toxics indicated that

elevated concentrations of ethanol caused detection limits to be elevated for the target analytes in the indoor air samples. At one location, (1100 Lyndale Avenue), Air Toxics indicated that elevated concentrations of 2-propanol caused detection limits to be elevated in the indoor air sample. While no target analytes were detected in these indoor air samples, the detection limits are higher than the applicable screening levels and it is not possible to determine whether the target analytes are actually present at concentrations that may be of concern. Resampling of indoor air will be needed at these locations.

In some subsurface samples, the presence of high concentrations of PCE caused elevated detection limits of other target compounds, with many “non-detects.” The elevated detection limits were well above indoor air screening levels. Although the DEQ does not directly compare subsurface air contaminant concentrations to indoor air screening levels or utilize a generic attenuation factor, without low enough detection limits, it is not possible to determine whether a complete vapor intrusion pathway is present.

## Section 4

### Results

All laboratory data can be found in Appendix A on the attached compact disc (CD) along with Table A-1 that summarizes the results and compares the results to the applicable screening levels. Table A-1 also summarizes the results of the ambient air samples. Figure 2, in Appendix G, shows the approximate locations of subslab locations and results of these samples.

Provided below is a discussion of PCE, TCE and vinyl chloride results for the individual buildings that were sampled. Following that discussion is a summary of the chloroform and petroleum hydrocarbon results.

#### **Hustad LLC Building (1116, 1118, 1120, 1124 Helena Avenue)**

The Hustad LLC Building is aerially located within a few feet of the highest groundwater PCE concentrations (greater than 50-500 ug/L) at the HSS. One of the businesses in this building, Mr. Wise Cleaners, is a source of PCE and is currently the subject of enforcement actions by the DEQ.

Significant concentrations of PCE were found in the indoor air in the offices located in the Hustad LLC Building, which is the building that houses Mr. Wise Cleaners. The highest PCE concentration was at Canine Capital (3400  $\mu\text{g}/\text{m}^3$ ), while Bloomer's Floral (410  $\mu\text{g}/\text{m}^3$ ) and the vacant Hustad Center office (260  $\mu\text{g}/\text{m}^3$ ) also had elevated PCE concentrations. These concentrations exceed the commercial and residential indoor air Regional Screening Levels of 2.1 and 0.41  $\mu\text{g}/\text{m}^3$ , respectively. Indoor air samples were not collected from Mr. Wise Cleaners because it is an active drycleaner that currently uses PCE in its operations, and indoor air concentrations were expected to be elevated. Elevated subslab concentrations (28,000 - 790,000  $\mu\text{g}/\text{m}^3$ ) were present beneath this building. The highest subslab PCE concentration was found beneath Mr. Wise Cleaners. The elevated concentrations of PCE in the subslab air likely indicate the presence of a source of PCE in the soils, as well as the groundwater, beneath this building.

TCE was detected in the subslab air beneath Mr. Wise and the vacant office at 840 and 51  $\mu\text{g}/\text{m}^3$ , respectively. Vinyl chloride was not detected in any of the subslab air samples, however, the detection limits were elevated due to the presence of high concentrations of PCE and possibly TCE.

It is important to note that the elevated PCE concentrations in this building's indoor air could be coming from intrusion from the subsurface as well as from current operations at Mr. Wise Cleaners. DEQ's Hazardous Waste Program conducted an inspection of Mr. Wise Cleaners in May, 2010 and found several practices that could release PCE into the air (use of wet-to-wet dry cleaning with PCE, open buckets of PCE and PCE-contaminated water, lack of air monitoring, etc). At this time, it is not possible to determine the proportions of PCE that may be coming from beneath the building versus indoor air releases at Mr. Wise Cleaners. However, the presence of

790,000 µg/m<sup>3</sup> PCE in the subslab air underneath Mr. Wise Cleaners indicates strong potential for a complete vapor intrusion pathway.

In several subslab and indoor air samples, the high concentrations of PCE elevated the detection limits of other analytes to values higher than applicable screening levels. This situation makes it impossible to determine whether certain analytes are present in a given sample at a concentration above an applicable screening level.

The ambient air had PCE at 2.6 µg/m<sup>3</sup> on the day this building was sampled. Indoor air concentrations greatly exceed the ambient air concentration, indicating that PCE in ambient air is not a significant contributor to indoor air concentrations in the Hustad LLC building.

Given the high subslab and indoor air PCE concentrations in this building, the DEQ is requiring mitigation of indoor air in all offices in this building. Further, the DEQ is requiring investigation and cleanup of any source area near or under the building, as well as additional investigation and remediation at the HSS.

#### **Mergenthaler Transfer and Storage (1400 North Montana Avenue)**

The Mergenthaler building sits above groundwater contaminated with PCE at concentrations between 5 and 500 µg/L.

Elevated subslab results for PCE were found under the Mergenthaler slab in all three subslab samples (120,000, 250,000, and 350,000 µg/m<sup>3</sup>). Indoor air PCE in the Mergenthaler office was 68 µg/m<sup>3</sup>, and in the warehouse was 32 µg/m<sup>3</sup>, which are both higher than the industrial and residential indoor air screening levels of 2.1 and 0.41 µg/m<sup>3</sup>, respectively. The DEQ is requiring mitigation of indoor air in Mergenthaler's, and will require investigation and cleanup of PCE in the subsurface in this area.

Outside air had PCE at 3.2 µg/m<sup>3</sup> on the day this building was sampled. Indoor air concentrations greatly exceed the ambient air concentration, indicating that PCE in ambient air is not a significant contributor to indoor air concentrations in the Hustad LLC building. While a number of chemicals and cleaning supplies are stored in the Mergenthaler office and warehouse, none of these were obvious PCE-containing substances, and no PCE-containing substances were listed on the building questionnaires. A review of the lines of evidence and the very high concentrations of PCE in the subslab air indicate that PCE in Mergenthaler's indoor air is a result of vapor intrusion.

#### **Bullman's Woodfired Pizza (1130 Helena Avenue)**

The Bullman's pizza building is located immediately to the northwest of the Hustad LLC building. Bullman's is aerially located above the highest groundwater PCE concentrations (greater than 50-500 µg/L) at the HSS. During visits to the Bullman's, no obvious sources of PCE or other chlorinated solvents were noted, and no PCE-containing substances were listed on the building questionnaires. Chemicals in the

building were primarily detergent-based cleaners. On the day this building was sampled, PCE was detected in the outdoor air at 1.7  $\mu\text{g}/\text{m}^3$ .

According to Air Toxics (CITE), elevated concentrations of ethanol in the indoor air in Bullman's Pizza caused elevated detection limits for several target analytes. Therefore, it is not possible to determine if PCE, TCE, and vinyl chloride are present in Bullman's indoor air above screening levels. However, based on the low concentrations of TCE ( $<0.19 \mu\text{g}/\text{m}^3$ ) and vinyl chloride ( $<0.046 \mu\text{g}/\text{m}^3$ ) in the subslab air, vapor intrusion of these two compounds would not be anticipated. PCE was detected in the subslab air at  $84 \mu\text{g}/\text{m}^3$ , which could be a vapor intrusion threat to indoor air. The DEQ is requiring resampling of Bullman's indoor air to more accurately determine concentrations of PCE and determine whether vapor intrusion is occurring.

#### **Great Harvest Bakery (1133 Helena Avenue)**

Great Harvest is aerielly located above groundwater that has between  $<0.5$  to  $5 \mu\text{g}/\text{L}$  PCE. This building is located southeast of the Hustad LLC building, and is cross-gradient of the known PCE source area and groundwater plume. During visits to the Great Harvest, no obvious sources of PCE or other chlorinated solvents were noted, and no PCE-containing substances were listed on the questionnaires. Chemicals in the building were primarily detergent-based cleaners. On the day this building was sampled, PCE was detected in the outdoor air at  $0.57 \mu\text{g}/\text{m}^3$ .

According to Air Toxics (Air Toxics, personal communication 2010), elevated concentrations of ethanol in the indoor air in Great Harvest caused elevated detection limits for PCE, TCE, and vinyl chloride. Therefore, it is not possible to determine whether these compounds are present in the indoor air above screening levels. However, based on the low concentrations of TCE ( $<0.19 \mu\text{g}/\text{m}^3$ ) and vinyl chloride ( $0.1 \mu\text{g}/\text{m}^3$ ) in the subslab air, vapor intrusion of these compounds would not be anticipated. PCE was detected in the subslab air at  $3.6 \mu\text{g}/\text{m}^3$ , which could be a vapor intrusion threat to indoor air. The DEQ is requiring resampling of Great Harvest's indoor air to more accurately determine concentrations of PCE and determine whether vapor intrusion is occurring.

#### **Loose Caboose Casino (1100 Lyndale Avenue, formerly Danny's Cleaners)**

The Casino is aerielly located above groundwater that has between  $50$  to  $500 \mu\text{g}/\text{L}$  PCE. This building is located northeast of the Hustad LLC building, and is directly down-gradient of the known PCE source area. It is important to note that this building used to be a dry cleaning establishment, and that PCE has been found in the soil taken from boreholes on the north side of this building. During visits to the Casino, no obvious sources of PCE or other chlorinated solvents were noted, and no PCE-containing substances were listed on the questionnaires. Chemicals in the building were primarily detergent-based cleaners. On the day this building was sampled, PCE was detected in the outdoor air at  $3.2 \mu\text{g}/\text{m}^3$ .

According to Air Toxics (Air Toxics, personal communication 2010), elevated concentrations of 2-propanol (isopropyl alcohol or rubbing alcohol) in the indoor air

in the Casino caused elevated detection limits for several target analytes. According to the manager of the Casino, rubbing alcohol is used daily to sanitize the gaming machines. Because of the elevated detection limits, it is not possible to determine if PCE, TCE, and vinyl chloride are present in the Casino's indoor air above screening levels. However, based on the low concentrations of TCE ( $<0.75 \mu\text{g}/\text{m}^3$ ) and vinyl chloride ( $<0.18 \mu\text{g}/\text{m}^3$ ) in the subslab air, vapor intrusion of these two compounds would not be anticipated. PCE was detected in the subslab air at  $320 \mu\text{g}/\text{m}^3$ , which could be a vapor intrusion threat to indoor air. The DEQ is requiring resampling of the Casino's indoor air to more accurately determine concentrations of PCE and determine whether vapor intrusion is occurring.

#### **Mueller Architect Office (1119 Helena Avenue, formerly Crown Trophy)**

This office is located above groundwater that may contain PCE at concentrations ranging from  $<0.5$  to  $5 \text{ ug}/\text{L}$ . It is located southeast of the Hustad LLC building, and cross gradient of the known PCE source. During visits to this office, no obvious sources of PCE or other chlorinated solvents were noted, and no PCE-containing substances were listed on the questionnaires. On the day this building was sampled, PCE was detected in the outdoor air at  $0.57 \mu\text{g}/\text{m}^3$ .

PCE was detected in the basement air ( $2.7 \mu\text{g}/\text{m}^3$ ) and the main floor air ( $2.4 \mu\text{g}/\text{m}^3$ ) at concentrations just over the industrial screening level of  $2.1 \mu\text{g}/\text{m}^3$ . Subslab air had  $3.5 \mu\text{g}/\text{m}^3$ . Neither vinyl chloride nor TCE was detected in the subslab air, and the detection limits were less than residential screening levels. Resampling may be needed at this location to verify sampling results.

#### **ProBuild (1000 East Lyndale Avenue)**

The ProBuild building is located north of the Hustad LLC building. It is located aerially above groundwater containing PCE at concentrations ranging from  $<0.5$  to  $500 \text{ ug}/\text{L}$ . ProBuild is a building supply store with an attached warehouse that stores lumber and other products. The sales floor has a large number of chemicals, some of which may contain chlorinated solvents. On the day ProBuild was sampled, outdoor air had  $1.6 \mu\text{g}/\text{m}^3$  PCE.

PCE was detected in the indoor air in the warehouse office ( $0.77 \mu\text{g}/\text{m}^3$ ) and the sales floor ( $2.4 \mu\text{g}/\text{m}^3$ ) at ProBuild. The warehouse air PCE exceeds the residential screening level of  $0.41 \mu\text{g}/\text{m}^3$  and the sales floor air just exceeds the industrial screening level of  $2.1 \mu\text{g}/\text{m}^3$ . PCE was detected in the subslab air at  $1.3$  and  $5.4 \mu\text{g}/\text{m}^3$  under the warehouse and sales floor, respectively. Neither vinyl chloride nor TCE was detected in the subslab air, and the detection limits were less than residential screening levels.

A complicating factor at ProBuild is that the warehouse subslab sample appears to have had a leak as indicated by the presence of helium at  $7.1 \%$  in the sample. This issue was described previously in Section 3. Resampling will be needed at this location to verify sampling results.

### **Flooring America (1430 North Montana Avenue)**

The Flooring America building is located aerially over the northern portion of the HSS PCE plume. Under this building, PCE concentrations may be between <0.5 to 50 ug/L. The building houses a flooring sales floor and a warehouse that stores flooring and chemicals used to install and remove flooring. Some of these chemicals may be chlorinated solvents. On the day this building was sampled, outdoor air had 1.7 µg/m<sup>3</sup> PCE.

PCE was detected in the indoor air in the warehouse (2.6 µg/m<sup>3</sup>) and the sales floor (1.0 µg/m<sup>3</sup>) at Flooring America. The sales floor air PCE result exceeds the residential screening level of 0.41 µg/m<sup>3</sup> and the warehouse air result just exceeds the industrial screening level of 2.1 µg/m<sup>3</sup>. PCE was detected in the subslab air at 240 and 6400 µg/m<sup>3</sup> under the warehouse and break room floors, respectively. Vinyl chloride was not detected in the subslab air, although the detection limit for the break room floor air was elevated due to the high concentration of PCE in the sample. TCE was detected in both indoor air samples at concentrations less than the residential screening level. TCE was detected in the warehouse subslab air sample at 3.3 µg/m<sup>3</sup>. The detection limit for TCE in the warehouse subslab air sample was greater than the residential screening level (1.2 µg/m<sup>3</sup>) but less than the industrial screening level (6.4 µg/m<sup>3</sup>). Resampling of this location may be needed to verify sampling results.

### **Pierce Builders (1424 Dodge Avenue)**

The Pierce building is located north of the Hustad LLC building. It is located aerially above groundwater containing PCE at concentrations ranging from <0.5 to 5 ug/L. This building houses offices and attached shop that stores lumber, construction materials, gasoline-powered equipment, paints, and other chemicals used during building. On the day the Pierce building was sampled, outdoor air had 1.6 µg/m<sup>3</sup> PCE.

PCE was detected in indoor air at 0.86 µg/m<sup>3</sup>, which is just over the residential screening level of 0.41 µg/m<sup>3</sup> but less than the industrial screening level of 2.1 µg/m<sup>3</sup>. Subslab air had 0.99 µg/m<sup>3</sup>. Neither vinyl chloride nor TCE were detected in the subslab air, and the detection limits were less than residential screening levels. TCE was detected in the indoor air sample at 0.24 µg/m<sup>3</sup>, which does not exceed the residential screening level. Resampling may be needed at this location to verify sampling results.

### **H&R Block (1114 Helena Avenue)**

H&R Block is located immediately to the northwest of the Hustad LLC building. Groundwater beneath this building has PCE concentrations ranging from <0.5 to 50 ug/L. On the day the H&R Block was sampled, outdoor air had 1.6 µg/m<sup>3</sup> PCE.

PCE was detected in the west office air (2.5 µg/m<sup>3</sup>) and the east office air (2.6 µg/m<sup>3</sup>) at concentrations just over the industrial screening level of 2.1 µg/m<sup>3</sup>. Subslab air had 12 µg/m<sup>3</sup>. Neither vinyl chloride nor TCE was detected in the subslab air, and the detection limits were less than residential screening levels. Resampling may be needed at this location to verify sampling results.

### **Missouri River Chronicles Antique Store (1125 Helena Avenue)**

The antique store is a historic home with a basement and two floors above. It is located above groundwater that may contain PCE at concentrations ranging from <0.5 to 5 ug/L. It is located southeast of the Hustad LLC building, and cross gradient of the known PCE source. During visits to the antique store, no obvious sources of PCE or other chlorinated solvents were noted and no PCE-containing substances were listed on the questionnaires. However, a variety of chemicals were kept in the basement and first floor. On the day this building was sampled, PCE was detected in the outdoor air at 0.57 µg/m<sup>3</sup>.

PCE was detected in the basement air (3.4 µg/m<sup>3</sup>) and the main level air (6.4 µg/m<sup>3</sup>) at concentrations over the industrial screening level of 2.1 µg/m<sup>3</sup>. Subslab air had PCE at 1.1 µg/m<sup>3</sup>. Because the subslab air PCE was less than the indoor air PCE concentrations, and the main level air was higher than the basement air, it is likely that an indoor air source is causing the PCE concentrations in indoor air. Neither vinyl chloride nor TCE was detected in the subslab air, and the detection limits were less than residential screening levels. Vinyl chloride was detected below the residential screening level in the main level air but not in the basement air, which suggests an indoor source of vinyl chloride. Resampling may be needed at this location to verify sampling results.

### **Other Analytes**

Chloroform was detected in the indoor air above EPA's residential Regional Screening Levels in all structures except for Flooring America, the Loose Caboose Casino, Great Harvest, and Bullman's Pizza. In the four buildings where chloroform was not detected in the indoor air, the method detection limits were elevated to values greater than the residential or both of the screening levels. Therefore, it is not possible to determine whether chloroform is present in the indoor air in these four buildings at concentrations exceeding screening levels. Chloroform in indoor air may be coming from the use of chlorinated water in the building and/or from vapors from leaking drinking water and sewer lines underground. Chloroform is not a breakdown product of PCE or TCE degradation.

Several petroleum hydrocarbon compounds were included in the laboratory analysis. These compounds were ethyl benzene, xylenes, and toluene. Xylenes and toluene were detected in a few samples, but not at levels exceeding residential screening levels. Ethyl benzene was detected in the indoor air at concentrations exceeding screening levels in several locations (Pierce, Pro Builders, H&R Block, the antique shop, and Flooring America), but because in each location the indoor air concentrations were higher than the subslab concentrations, it is likely that indoor air sources are causing the elevated ethylbenzene concentrations in these buildings. In a few locations (Canine Capitol, Bullman's Pizza, Great Harvest, and Loose Caboose Casino), the method detection limits for ethyl benzene were elevated above the applicable screening levels. Only Bloomer's Floral, the vacant Hustad LLC office, and the Mueller Office had indoor air ethyl benzene concentrations less than the residential screening level.

### **Outdoor "Ambient" Air Results**

One ambient air sample was collected for each day of indoor air sampling. The objective of collecting ambient air samples is to document the concentrations of contaminants in the outdoor air, for comparison to indoor air sample results, and to determine the potential contribution of outdoor sources.

PCE was detected in all of the ambient air samples at concentrations ranging from 0.57 to 3.2  $\mu\text{g}/\text{m}^3$ . While no screening levels exist for PCE in ambient air, it is worth noting that these PCE concentrations all exceeded residential indoor air screening levels, and two of the five samples exceeded industrial indoor air screening levels. It is possible that PCE in outdoor air could be contributing to PCE in the indoor air in several of the buildings that were sampled. However, at least one indoor air sample in each of the following structures was lower than the ambient air levels of PCE on the day the sample was collected: ProBuild, Pierce Builders, and Flooring America. It is not known where the PCE in the ambient air is originating. Known PCE sources that could be contributing to PCE in ambient air include the HSS groundwater PCE plume and PCE inside Mr. Wise Cleaners. The wind tended to come from the southwest during the sampling event (see the discussion of weather data, below), therefore the ambient air samples may have been located downwind of Mr. Wise Cleaners rather than upwind or crosswind (see Appendix G- Figure 1).

TCE, vinyl chloride, and chloroform were not detected in the ambient air samples. Ethylbenzene, xylenes, and toluene were detected in all ambient air samples, which was not unexpected given the location of the samples in a commercial/industrial area with vehicle traffic nearby. In general, the concentrations of petroleum constituents in ambient air were less than those found in indoor air samples.

### **Weather Data**

Generally the average temperature for the days of sampling ranged between 27.4 and 34 degrees Fahrenheit. Average wind speeds ranged from 2.2 mph to 3.0 mph from the SW. Weather information during sampling was collected from the Helena West Side weather station at [www.underground.com](http://www.underground.com).

Results of weather data including average wind speed, wind direction, average temperature and barometric pressure for each day of sampling can be seen below in Table 4-1.

**Table 4-1 Weather Data**

Date	Avg. Wind Speed (mph)	Avg. Temperature (°F)	Barometric Pressure (inches)	
			High	Low
February 24, 2010	2.9 from the SW	27.4	30.21	29.67
February 25, 2010	3.0 from the SW	27.9	30.21	29.67
March 1, 2010	2.0 from the SSW	34	30.14	29.93
March 2, 2010	3.0 from the SSW	34	30.14	29.75
March 3, 2010	2.2 from the SSW	31.2	30.14	29.69

## Section 5

# References

Air Toxics 2010. Email from Karen Lopez of Air Toxics Laboratory to Laura Alvey of the Montana Department of Environmental Quality. June 5, 2010.

CDM. 2007. Monitoring Well Installation and Field Sampling Activities Final Summary Report 1118 Helena Ave., 1427 Helena Ave, and 1432 Gallatin Ave. Helena, Montana. June.

CDM. 2010, Sampling and Analysis Plan Helena Solvent Site Vapor Intrusion Investigation Helena, Montana. February.

CDM. 2010. Memorandum to Montana Department of Environmental Quality. Subject: Helena Solvent Site Data Validation. April.

DTSC 2003. Advisory-Active Soil Gas Investigations. California Department of Toxic Substances Control and State Water Resources Control board. January.

DTSC. 2004 (Revised in February 2005). Guidance for the Evaluation and Mitigation for Subsurface and Vapor Intrusion to Indoor Air (Interim Final). Department of Toxics Substances Control and California Regional Water Control Board. December.

ITRC 2007. Vapor Intrusion Pathway: A Practical Guide. Interstate Technology and Regulatory Council. January.

Tetra Tech. 2008. Semiannual Groundwater Monitoring Program Helena Solvent Site, Helena Montana. October.

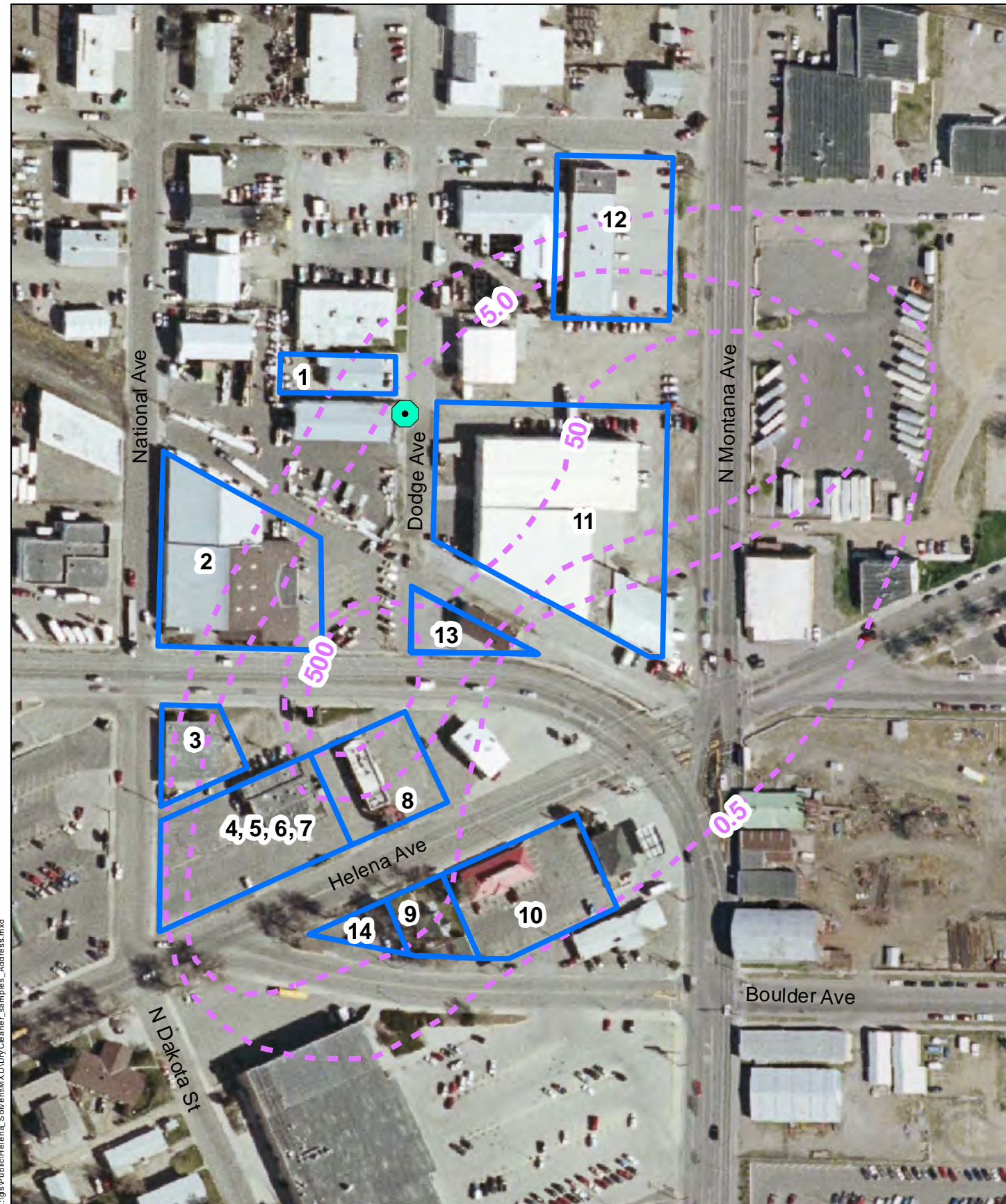
USEPA 1995. Environmental Response Team (ERT). Standard Operating Procedure (SOP) #1704: Summa Canister Sampling. United States Environmental Protection Agency Environmental Response Team. July.

USEPA. 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion guidance). EPA/530/D-02/004. United States Environmental Protection Agency. November.

*This page is intentionally left blank.*




# Appendix G

## Figures



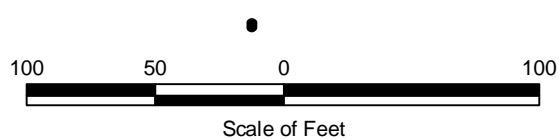
**Figure 1**  
**Helena Solvent Site**  
**Vapor Intrusion**  
**Site Map**

Location ID	Location Description	Location Address
1	Pierce Builders	1424 Dodge Ave
2	Pro Build	1000 East Lyndale
3	H&R Block (Hustad)	1112/1114 Helena Ave
4	Mr. Wise Cleaners (Hustad)	1118 Helena Ave
5	Canine Capital (Hustad)	1116 Helena Ave
6	Bloomers Floral (Hustad)	1120 Helena Ave
7	Vacant Space (Hustad)	1124 Helena Ave
8	Bullman's Pizza	1130 Helena Ave
9	Antique Shop	1125 Helena Ave
10	Great Harvest	1133 Helena Ave
11	Mergenthaler Transfer and Storage	1400 Montana Ave
12	Flooring America	1430 North Montana Ave
13	Loose Caboose Casino	1100 Lyndale Ave
14	Mueller Architect Office	1119 Helena Ave
AMB1	Ambient Air	

-  Ambient Air Sample Location
-  Approximate Boundary of the PCE Plume
-  Sampled Property



**Figure 2**  
**Helena Solvent Site**  
**Vapor Intrusion**  
**Subslab Sample Locations**  
**and PCE/TCE Results**



# Appendix A

## Results

Table A-1. 2010 Helena Solvent Site Vapor Intrusion Results

Location ID	Business Name	Address	Sample ID*	Sample Date	Helium	PCE	TCE	Vinyl Chloride	trans-1,2-DCE	1,1,2,2-TCA	cis-1,2-DCE	Ethyl Benzene	m,p-Xylene	o-Xylene	Toluene	Chloroform
						RSL(res)=0.41 RSL(ind)=2.1	RSL(res)=1.2 RSL(ind)=6.1	RSL(res)=0.16 RSL(ind)=2.8	RSL(res)=63 RSL(ind)=260	RSL(res)=0.042 RSL(ind)=0.21	RSL(res)=NA RSL(ind)=NA	RSL(res)=0.97 RSL(ind)=4.9	RSL(res)=100 RSL(ind)=440	RSL(res)=730 RSL(ind)=3100	RSL(res)=5200 RSL(ind)=22000	RSL(res)=0.11 RSL(ind)=0.53
						Result (%)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)	Result (µg/m³)
1	Pierce Builders	1424 Dodge Avenue	1-CL-FA1-3210	03/02/2010	0.63	0.86	0.24	<0.049	<0.76	<0.26	<0.15	5.3	20	5.8	47	0.52
			1-CL-SS1-3210	03/02/2010	NA	0.99	<0.53	<0.12	<1.9	<0.67	<0.39	4.4	17	5.7	360	4.9
2	Pro-Builders	1000 East Lyndale	2-CL-FA1-3210	03/02/2010	NA	0.77	<0.27	<0.064	<1	<0.34	<0.2	11	41	15	70	<0.24
			2-CL-IA2-3210	03/02/2010	NA	2.4	<0.54	<0.13	<2	<0.69	<0.4	9.5	33	9.8	350	<0.49
			2-CL-SS2-3210 (SS1)	3/2/2010	7.1	1.3	<0.17	<0.04	<0.61	<0.21	<0.12	2.7	8.1	2.8	34	0.9
3	H&R Block	1112 Helena Avenue	2-CL-SS2-3210	03/02/2010	<0.098	5.4	<0.21	<0.05	<0.78	<0.27	<0.16	0.64	1.9	1	5.1	4
			3-CL-FA1-3210	03/02/2010	0.18	2.6	<0.21	<0.05	<0.78	<0.27	<0.16	1.2	3.1	1.1	7.8	0.54
			3-CL-FA2-3210	03/02/2010	NA	2.5	<0.2	<0.048	<0.74	<0.26	<0.15	1.4	3.9	1.4	9.9	0.54
4	Mr. Wise	1118 Helena Avenue	3-CL-SS1-3210	03/02/2010	NA	12	<0.19	<0.045	<0.69	<0.24	<0.14	0.31	0.73	0.33	1.4	2.2
			4-CL-SS1-3310	03/03/2010	<0.098	790000	840	<310	<480	<840	<480	<530	<530	<530	<460	<600
5	Canine Capital	1116 Helena Avenue	5-CL-FA1-3310	03/03/2010	NA	3400	<15	<7	<11	<19	<11	<12	<12	<12	<10	<13
			5-CL-SS1-3310	03/03/2010	1.3	100000	<170	<81	<130	<220	<130	<140	<140	<140	<120	<160
6	Bloomers Floral	1120 Helena Avenue	6-CL-FA1-3310	03/03/2010	NA	410	<0.56	<0.13	<2	<0.71	<0.41	0.81	2.1	0.78	20	1.6
			6-CL-SS1-3310	03/03/2010	0.38	22000	<50	<24	<37	<64	<37	<40	<41	<35	<46	
7	Vacant Space	1124 Helena Avenue	7-CL-FA1-3310	03/03/2010	NA	260	<0.34	<0.081	<1.3	<0.44	<0.25	0.68	1.9	0.71	9.1	0.35
			7-CL-SS1-3310	03/03/2010	<0.09	28000	51	<23	<35	<61	<35	<39	<39	<34	<44	
8	Bullmans Pizza	1130 Helena Avenue	18-CL-FA1-22510	02/25/2010	NA	<25	<20	<9.6	<15	<26	<15	<16	<16	<16	<14	<18
			8-CL-FA1-22510	02/25/2010	NA	<56	<44	<21	<33	<57	<33	<36	<36	<36	<31	<40
			18-CL-SS1-22510	02/25/2010	<0.09	84	<0.19	<0.046	<0.71	<0.24	<0.14	<0.16	<0.31	<0.16	0.15	<0.17
9	Antique Shop	1125 Helena Avenue	8-CL-SS1-22510	02/25/2010	<0.082	82	<0.18	<0.042	<0.65	<0.22	<0.13	<0.14	<0.28	<0.14	0.33	<0.16
			9-CL-FA1-3110	03/01/2010	NA	6.4	<0.23	0.07	<0.85	<0.29	<0.17	4.4	13	4	85	0.21
			9-CL-BA1-3110	03/01/2010	NA	3.4	<0.19	<0.046	<0.71	<0.24	<0.14	1.2	4.3	1.4	42	<0.17
10	Great Harvest	1133 Helena Avenue	9-CL-SS1-3110	03/01/2010	0.83	1.1	<0.18	<0.044	<0.68	<0.23	<0.14	<0.15	<0.3	<0.15	0.51	18
			10-CL-FA1-3110	03/01/2010	NA	<27	<22	<10	<16	<28	<16	<17	<17	<17	<15	<20
11	Mergenthaler Transfer & Storage	1400 Montana Avenue	10-CL-SS1-3110	03/01/2010	<0.088	3.6	<0.19	0.1	<0.69	<0.24	<0.14	0.17	0.52	0.32	0.84	0.74
			11-CL-FA1-022410	02/24/2010	NA	68	0.61	<0.053	<0.82	<0.28	<0.16	1.4	4.9	1.5	9.2	0.28
12	Flooring America	1430 North Montana Avenue	11-CL-FA2-022410	02/24/2010	NA	32	0.4	<0.045	<0.69	<0.24	<0.14	1.3	4.6	1.4	9.6	<0.17
			11-CL-SS1-22410	02/24/2010	0.22	250000	710	<220	<350	<600	<350	<380	<380	<380	<330	<430
			11-CL-SS2-22410	02/24/2010	0.32	350000	1000	<370	<580	<1000	<580	<630	<630	<630	<550	<710
			11-CL-SS3-22410	02/24/2010	<0.09	120000	<190	<92	<140	<240	<140	<160	<160	<160	<130	<170
13	Loose Caboose	1100 Lyndale Avenue	12-CL-FA1-22510	02/25/2010	NA	1	0.49	<0.043	<0.67	<0.23	<0.13	1.2	3.9	1.3	22	<0.16
			12-CL-FA2-22510	02/25/2010	NA	2.6	0.33	0.067	<0.65	<0.22	<0.13	1.6	5.7	2.4	22	<0.16
			12-CL-SS1-22510	02/25/2010	<0.12	6300	<14	<6.4	<10	<17	<10	<11	<11	<11	<9.5	<12
			12-CL-SS2-22510	02/25/2010	<0.084	240	3.3	<0.086	<1.3	<0.46	<0.27	1.2	3	1.6	4.7	2.4
14	Mueller Office	1119 Helena Avenue	13-CL-FA1-22410	02/24/2010	NA	<70	<55	<26	<41	<71	<41	<45	<45	<45	<39	<50
			13-CL-BA1-22410	02/24/2010	NA	<52	<41	<19	<30	<52	<30	<33	<33	<29	<37	
			13-CL-SS1-22410	02/24/2010	<0.088	320	<0.75	<0.18	<2.8	<0.96	<0.56	0.75	4.3	2.5	3.2	5.4
14	Mueller Office	1119 Helena Avenue	14-CL-IA1-3110	03/01/2010	NA	2.4	<0.17	<0.04	<0.61	<0.21	<0.12	0.56	1.8	0.57	4.1	0.29
			14-CL-BA1-3110	03/01/2010	NA	2.6	0.87	<0.041	<0.64	<0.22	<0.13	0.46	1.4	0.53	3.9	0.22
			24-CL-BA1-3110	03/01/2010	NA	2.7	<0.2	<0.048	<0.74	<0.26	<0.15	0.49	1.5	0.54	4.3	<0.18
			14-CL-SS1-3110	03/01/2010	<0.086	3.5	<0.18	<0.044	<0.68	<0.23	<0.14	0.18	0.51	0.31	4.1	62
			24-CL-SS1-3110	03/01/2010	<0.082	3.2	<0.18	<0.042	<0.65	<0.22	<0.13	<0.14	0.43	0.23	2.9	55
Ambient Air			AMB1-22410	2/24/2010	NA	3.2	<0.18	<0.043	<0.67	<0.23	<0.13	0.19	0.58	0.2	1.6	<0.16
			AMB1-22510	2/25/2010	NA	1.7	<0.19	<0.045	<0.69	<0.24	<0.14	0.42	1.4	0.5	2.5	<0.17
			AMB1-3110	3/1/2010	NA	0.57	<0.16	<0.039	<0.60	<0.21	<0.12	0.48	1.5	0.64	3.5	<0.15
			AMB1-3210	3/2/2010	NA	1.6	<0.18	<0.043	<0.67	<0.23	<0.13	0.84	2.7	1	5	<0.16
			AMB1-3310	3/3/2010	NA	2.6	<0.17	<0.041	<0.64	<0.22	<0.13	0.57	1.8	0.6	3.3	<0.16

Notes:

NA = Not Applicable

### Compound detected in indoor air sample above commercial/industrial screening level, or detection limit exceeded these screening levels

### Compound detected in indoor air sample above residential screening level, or the detection limit exceeded residential screening levels

PCE= Tetrachloroethene

TCE= Trichloroethene

DCE= Dichloroethene

TCA= Tetrachloroethane

RSL(res) = EPA Regional Screening Level for residential indoor air

RSL(ind) = EPA Regional Screening Level for industrial indoor air

\*SS=sub-slab air, FA=main level indoor air, BA= basement indoor air, IA=indoor air

µg/m³ = micrograms per cubic meter