



RMEC ENVIRONMENTAL, INC.

RMEC PJ08E-1785

August 25, 2010

Morgan Atkinson, PG  
Division of Environmental Response and Remediation  
P.O. Box 144840  
195 North 1950 West  
Salt Lake City, Utah 84114

**SUBJECT: SUMMARY OF INDOOR AIR AND SUB-SLAB SOIL VAPOR  
SAMPLING RESULTS - GUNNISON, UTAH**

Dear Mr. Atkinson:

Per your request RMEC Environmental, Inc. (RMEC) has prepared this letter to update you on the results of the indoor air and sub-slab soil vapor monitoring performed to date in conjunction with the Top Stop petroleum release in Gunnison, Utah.

**Enclosed Materials**

RMEC has developed the attached spread sheets which contain all of the indoor air monitoring and sub-surface soil vapor monitoring data that has been made available to RMEC. Please note that RMEC began collecting indoor air and sub-surface soil vapor samples in January of 2009 and all other air sample data collected before that date were collected by other parties (Wasatch Environmental and/or Remedy, Inc.).

RMEC has also enclosed copies of letters it has written to the residential and business occupants that explain and interpret the sampling results from their respective properties. RMEC was contracted to perform the data interpretation in the spring of 2008 and has attempted to communicate the monitoring results with all of the affected parties. However, it is possible that not all of the data listed in the spreadsheets was communicated to all of the affected parties.

**DATA INTERPRETATION**

**Monitoring History**

As you are aware, RMEC began collecting sub-slab and/or near slab soil vapor samples in April of 2009 in selected residences and businesses as an alternative to collecting indoor air samples in those locations. Some indoor air sampling was also performed in the affected buildings during that time frame, when the sub-slab benzene levels exceeded  $3.9 \mu\text{g}/\text{m}^3$ . A detailed description of the sub-surface sampling methods and materials was submitted to DERR in a Soil Vapor Sampling Proposal dated March 9, 2009. In that sampling proposal, Wind River/RMEC committed to collect periodic sub-surface soil vapor samples for a one-year period, analyze the data, and then reevaluate the need for ongoing sub-surface soil vapor and/or indoor air sampling. This year of data collection was completed in June of 2010 and RMEC is providing the following recommendations for on-going work.

**Guidance Documents**

To determine if the level of soil vapors under a building can potentially result in unsafe levels of vapors inside the building, an attenuation factor is typically applied to the measured soil vapor levels. The factor is intended to account for the reduction in concentration from the subsurface

environment where the vapor samples are collected to the indoor air breathing zone. Research has shown that soil vapor attenuation anywhere from 10 to 10,000 can occur across a slab. In other words, as much as 10% or as little as 0.01% of the soil vapor levels under a building can be expected to permeate through the slab and enter the building. Since the State of Utah has not adopted an attenuation factor for soil vapor intrusion, other guidance documents or sources of information will need to be cited in order to interpret the data collected from the Gunnison residences and businesses.

One document that can serve as a resource in interpreting the Gunnison data is the Oregon Department of Environmental Quality (DEQ) document "*Guidance for Assessing and Remediating Vapor Intrusion in Buildings*" (March 25, 2010). This document states that the Oregon DEQ has selected a default attenuation factor of 200 for residential property. If this attenuation factor were applied to the Utah UST risk-based benzene indoor air concentration of  $0.39 \mu\text{g}/\text{m}^3$  (1E-6 cancer risk), then the acceptable sub-slab benzene level allowed under a home or business would be  $78 \mu\text{g}/\text{m}^3$ .

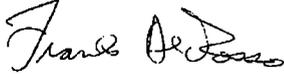
Another document that can serve as a resource in interpreting the Gunnison data is the *Record of Decision (ROD) for the Bountiful/Woods Cross 5<sup>th</sup> South PCE Plume NPL Site* in Bountiful, Utah (September, 2007). Benzene is one of the contaminants of concern (COCs) at this site. In this ROD, the US EPA selected a Risk Based Concentration (RBC) based on a cancer risk factor of 1E-4 assuming a Reasonable Maximum Exposure (RME) through ingestion of contaminated groundwater and inhalation of soil and ground water vapor via the vapor intrusion pathway. Even though the EPA applied a very conservative attenuation factor of 10 to the sub-slab benzene levels, the target risk-based sub-slab benzene level for this site was determined to be  $312 \mu\text{g}/\text{m}^3$ .

The highest sub-slab benzene level measured in Gunnison was  $35 \mu\text{g}/\text{m}^3$  at 255 South 100 West. As you are aware, as part of the settlement with Wind River Petroleum, this home is slated for demolition. The next highest sub-slab benzene level measured in Gunnison was  $22 \mu\text{g}/\text{m}^3$  at the Body Bam (62 South Main Street). The vast majority of the other sub-slab or near slab soil vapor samples collected in Gunnison had benzene levels less than  $3.9 \mu\text{g}/\text{m}^3$  and many were below the laboratory detection limit of  $1.3 \mu\text{g}/\text{m}^3$ . These data indicate that sub-surface petroleum soil vapor levels are very low and unlikely to result in significant benzene levels in the affected buildings. Also, as can be seen in the spreadsheet, indoor air samples were sometimes collected at the same time as the sub-slab soil vapor samples. Many of the sub-slab benzene levels were less than the simultaneously measured indoor air benzene levels indicating that some source other than a sub-surface petroleum release was responsible for the benzene levels measured in the indoor air of the home.

RMEC has been informed by Wasatch Environmental that less than 70 gallons of petroleum from the Top Stop release is present in the ground water. Most of this gasoline is situated in a narrow plume starting at Main Street and 100 South, running in a southwest direction, and ending at 200 South. Based on this information and the data generated from the sub-surface soil vapor samples collected to date, RMEC believes that the groundwater gasoline plume does not pose a significant threat for vapor intrusion into homes or businesses in Gunnison. Therefore, RMEC is formally petitioning the DERR to stop any further sub-slab or indoor air monitoring. RMEC will be available to perform indoor and/or sub-surface monitoring if credible information becomes available that vapor intrusion from the Top Stop release is threatening any home or business.

Please feel free to call me if you have any questions or need additional information in this matter.

Sincerely,



Frank DeRosso, MSPH, CIH  
*Senior Scientist*  
RMEC ENVIRONMENTAL, INC.

**INDOOR AIR AND  
SUB-SURFACE SOIL VAPOR MONITORING  
STATUS REPORT**

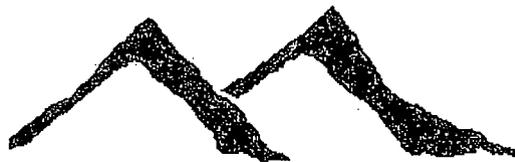
**TOP STOP PETROLEUM RELEASE SITE  
GUNNISON, UTAH**

**Prepared for:**

**Morgan Atkinson, PG  
State of Utah  
Division of Environmental Response and Remediation**

**January 4, 2010**

**Prepared by:**



**RMEC ENVIRONMENTAL, INC.**

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## 1.0 INTRODUCTION/BACKGROUND INFORMATION

RMEC Environmental, Inc. (RMEC) has prepared this indoor air and sub-surface vapor monitoring status report (Status Report) on behalf of Wind River Petroleum/Top Stop Convenience Stores. This Status Report was developed as an element of the overall Corrective Action Plan (CAP) for the petroleum release that occurred at the Top Stop Convenience store in Gunnison, Utah. The development of this Status Report was stipulated by the Utah Division of Environmental Response and Remediation (DERR) in a July 21, 2009 letter to Wind River Petroleum/Top Stop Convenience Stores. The purpose of this Status Report is to detail the results of all indoor air monitoring and sub-slab/near-slab soil vapor monitoring performed to date in Gunnison homes and businesses that were impacted by the Top Stop Petroleum release and to provide recommendations for ongoing monitoring and corrective actions at selected locations.

## 2.0 DESCRIPTION OF MONITORING

### 2.1 Indoor Air Monitoring

Shortly after the petroleum release from the Gunnison Top Stop was discovered, representatives from Wasatch Environmental (Wasatch) began collecting indoor air samples in residences and businesses that were potentially impacted by the release. The homes and businesses that were targeted for the initial sampling effort were chosen based on their proximity to the Top Stop store, the presence of indoor petroleum odors, and from specific requests by home/business owners. Wasatch also conducted soil borings and ground water sampling to determine the extent of the subsurface petroleum plume. Soil Vapor Extraction (SVE) systems were installed at strategic locations in the petroleum plume to help remove sub-surface vapors from the release.

Based on the results of the soil borings and groundwater data, Wasatch identified homes and businesses that were believed to be situated above or could be influenced by the sub-surface petroleum plume. Sub-slab ventilation systems were installed at many of these structures to prevent soil vapors caused by the release from entering the buildings. In a letter titled "Modified Schedule for Residential and Business Indoor Air Analysis" to Wind River Petroleum dated September 15, 2008, Wasatch proposed on-going indoor air monitoring schedule for various Gunnison properties that they believed could be impacted by the petroleum release. This first page of this letter is attached in Appendix A and identified the 16 residential structures and 16 commercial structures listed below for on-going indoor air monitoring:

#### Residential Structures:

- 26 West 100 South Street\*<sup>V</sup>
- 36 West 100 South Street\*<sup>V</sup>
- 29 West 100 South Street\*<sup>V</sup>
- 39 West 100 South Street\*<sup>V</sup>

- 40 West 100 South Street\*
- 49 West 100 South Street\*\*<sup>V</sup>
- 59 West 200 South Street\*\*<sup>V</sup>
- 70 West 300 South Street\*
- 40 West 200 South Street\*
- 60 West 200 South Street\*\*<sup>V</sup>
- 68 West 200 South Street\*\*<sup>V</sup>
- 78 West 200 South Street\*
- 96 West 200 South Street\*\*<sup>V</sup>
- 220 South 100 West Street\*
- 255 South 100 West Street\*\*<sup>V</sup>
- 44 South 100 West Street

Commercial Structures:

- Body Bam - 62 South Main\*
- Casino Star Theater - 78 South Main\*
- Dorius Law Office - 47 South Main\*
- Gunnison Barber Shop - 76 South Main Street
- Gunnison Plumbing and Heating - 20 South Main Street
- Gunnison Telephone - 29 South Main\*
- Gunnison Valley Bank - 10 South Main Street
- Lila Lee's Apparel - 70 South Main Street\*
- His N Hers Inc. - 98 South Main Street\*\*<sup>V</sup>
- Home Town Cafe - 50 South Main Street\*
- Jensen Drug - 77 South Main\*
- Lotsa Motsa Pizza - 54 South Main\*
- Nails and Hair - 65 South Main
- State Farm Insurance - 28 South Main
- White Hills trading Company - 74 South Main

\* Sub-surface soil vapor probes have been installed at these properties

<sup>V</sup> Sub-slab depressurization or soil vapor extraction (SVE) systems have been installed beneath these properties. Vapor intrusion into all of the commercial structures along Main Street is controlled through the SVE systems along the east and west sides of Main Street.

Wasatch personnel collected all of their indoor air samples using 6-liter Summa canisters equipped with flow restrictors that allowed the samples to be collected over an 8-hour period. The canisters were generally placed in living areas of the residences and in occupied areas of the businesses; however, based on individual circumstances, some canisters were placed in crawl spaces or unoccupied basement areas of the building. Most of the indoor air monitoring was performed with the SVE systems and sub-slab ventilation systems operating.

RMEC Environmental, Inc. took over the indoor air monitoring duties in January, 2009. Initially RMEC responded to some specific requests for indoor air sampling in selected businesses and residences. In March of 2009, RMEC began collecting indoor air samples at the businesses and residences identified for on-going indoor air monitoring in the September 15, 2008 Wasatch letter. RMEC did not perform any specific actions to determine if the properties listed in the letter were situated above the groundwater gasoline plume; however, Wasatch performed numerous soil borings and groundwater sampling to identify potentially affected properties and this information was used to compile the list of properties chosen for the monitoring.

RMEC also used 6-liter Summa canisters to collect the air samples; however, the air samples were collected over a 24-hour period instead of an 8-hour period. All indoor air samples were submitted to DataChem Laboratories of Salt Lake City for volatile organic compound (VOC) analysis in accordance with EPA Method TO15.

The results of the all of indoor air monitoring from the discovery of the release through December, 2009 are summarized in Section 3 below and are detailed in the spreadsheets in Appendix C.

## 2.2 Outdoor Air Monitoring

Representatives from Wasatch collected two outdoor air samples in the downtown Gunnison area on September 6, 2007. These air samples were collected using Summa canisters over an 8-hour period. The sample locations are noted below.

- East Main Street (65 South)
- West Main Street (70 South)

Lance Hess from Remedy, Inc. collected additional outdoor samples on December 12 - December 14, 2007. These air samples were also collected using Summa canisters over an 8-hour period. The sample locations are noted below.

- 160 South Main
- 56 North Main
- 44 West Center
- 54 East Center

The results of the outdoor air monitoring are summarized in Section 3 below and are detailed in the spreadsheets in Appendix C.

## 2.3 Sub-Slab and Near-Slab Soil Vapor Monitoring

In order to better delineate the sources of petroleum-related vapors found in the indoor air samples, RMEC installed subsurface vapor probes in selected residential structures and commercial structures. In general, sub-slab soil vapor probes were installed in those buildings where at least a portion of the building had a poured concrete floor, whereas near-slab probes

were installed in those structures that did not have a poured floor. A team consisting of Frank DeRosso from RMEC, Les Pennington from Wasatch, Morgan Atkinson from DERR and Lance Hess from Remedy, Inc. visited each residential and commercial property where the soil vapor probes were proposed and jointly decided on the location of the probe. The soil vapor probes were placed within or adjacent to each selected building at locations that were expected to have the highest concentration of subsurface petroleum vapors caused by the Top Stop release. Convenient access to the probes and minimization of disruption for the property owners were also considered in choosing the probe locations. A total of 15 residential structures and 9 commercial structures were selected for the monitoring.

A Soil Vapor Monitoring Proposal, which details the properties that were selected for sampling and the sub-slab and near-slab vapor probe installation and sampling methodologies, was submitted to the DERR on March 9, 2009 and is attached (Appendix B) for reference.

To ensure the soil vapor probes were collecting sub-surface soil vapor samples and not short circuiting and/or leaking and collecting ambient air samples, isopropyl alcohol (IPA) pads were placed adjacent to the probe penetration into the slab/ground. The pads were placed adjacent to the probe during the entire sample collection period (typically ~8 minutes for the 1-liter sample volume). The ambient air surrounding the IPA pads were screened with a photo-ionization detector (PID) and IPA concentrations in the immediate vicinity of the probe penetration were found to be 100 ppm – 400 ppm. IPA is a target compound in the T015 analysis. If greater than 1% of the ambient IPA concentration near the probe penetration appeared in the soil vapor sample (i.e. if greater than 1 ppm (1000 ppb) of IPA appeared in the soil vapor sample), the sample train was considered to have leaked and the sample results were rejected.

An initial round of soil vapor samples was collected from all of the probe locations between April 29 and June 22, 2009. A second round of samples was collected from all but two locations again on September 29 – 30, 2009. A third round of soil vapor monitoring was performed on November 18 – 19, 2009. The results of the soil vapor monitoring are summarized in Section 3 below and are detailed in the spreadsheets in Appendix C. The majority of the sub-surface soil vapor monitoring was performed with the SVE systems and sub-slab depressurization systems operating. Three samples were rejected due to elevated levels of IPA in the soil vapor samples, indicating a sample train leak.

### **3.0 FINDINGS/DATA SUMMARY**

The spreadsheets in Appendix C summarize the indoor air monitoring and sub-slab/near-slab vapor monitoring for all of the sampled Gunnison locations. A separate spreadsheet has been developed for each monitored property. Each spreadsheet contains the full suite of chemicals that were analyzed with the EPA TO15 analysis; however, typical petroleum-related compounds (benzene, toluene, ethyl benzene, and xylene) have been highlighted for easier reference.

The site map in Appendix D shows the location of the properties where RMEC collected indoor and/or sub-surface soil vapor samples. RMEC performed indoor air monitoring only at the

properties designated by Wasatch in their September 15 letter to Wind River and made no attempt to correlate the location of the properties with the boundary of the groundwater petroleum plume.

Several of the properties where Wasatch collected indoor air samples during the initial phases of the release were dropped from the on-going monitoring based on soil boring data and groundwater data generated by Wasatch. These properties have not been included on the site map.

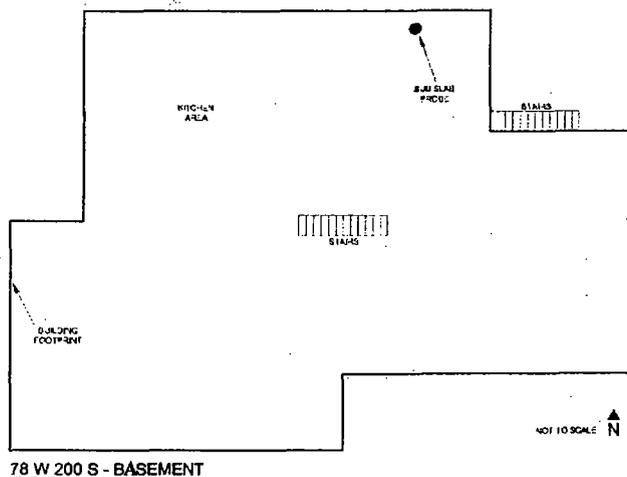
The sub-surface soil vapor locations were chosen in accordance with the criteria specified in Section 2.3 of this report.

In addition, the following sections have been prepared to provide a brief description of the indoor and soil vapor monitoring that was performed at each residential and commercial property.

### 3.1 78 West 200 South

Between 7/9/08 and 4/16/09, five indoor air samples were collected at this residence. The highest benzene level measured at this property was  $12 \mu\text{g}/\text{m}^3$ . This measurement occurred on 3/23/2009.

A sub-slab soil vapor probe was installed along the north wall in the basement apartment on the north side of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 5/5/09 and 9/30/09 were  $1.6 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.

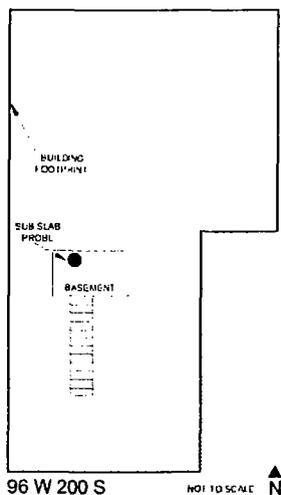


### 3.2 96 West 200 South

A sub-slab ventilation system has been installed in this home. Between 11/16/07 and 11/19/09, twelve indoor air samples were collected at this residence. The highest benzene level measured

in the home was  $8.1 \mu\text{g}/\text{m}^3$ . This measurement occurred on 12/14/07. All benzene measurements in the past year (since 9/5/2008) have been less than or equal to  $1.5 \mu\text{g}/\text{m}^3$ .

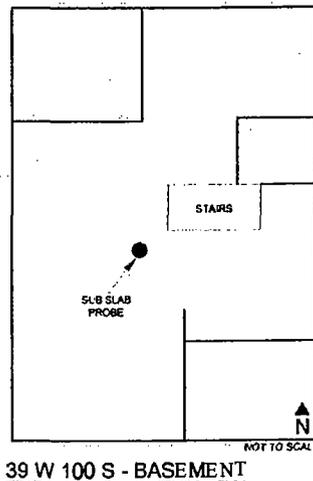
A sub-slab soil vapor probe was installed in the basement furnace room on the north side of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 5/4/09, 9/30/09 and 11/18/09 were  $4.5 \mu\text{g}/\text{m}^3$ ,  $<1.3 \mu\text{g}/\text{m}^3$ , and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.3 39 West 100 South

A sub-slab ventilation system has been installed in this home. It is currently unoccupied. Between 12/5/07 and 3/23/09, six indoor air samples were collected at this residence. The highest benzene level measured in the home was  $27 \mu\text{g}/\text{m}^3$ . This measurement occurred on 12/5/07. All subsequent indoor benzene measurements have been less than or equal to  $2.0 \mu\text{g}/\text{m}^3$ .

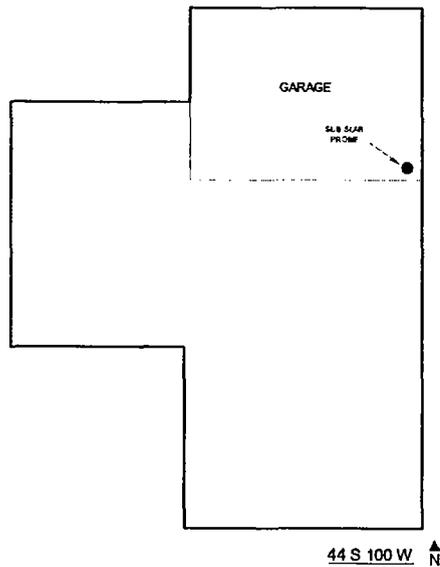
A sub-slab soil vapor probe was installed in the center of the basement area of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 5/4/09 and 9/30/09 were  $1.6 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.4 44 South 100 West

One indoor sample was collected at this residence by Wasatch Environmental (Wasatch) personnel on 8/7/08. The benzene level in the sample was  $81 \mu\text{g}/\text{m}^3$ . Based on information contained in a September 15, 2008 Wasatch letter to DERR, the elevated benzene level measured in the indoor air sample on this date was reportedly due to a gasoline spill in the garage of the residence. Subsequent to this sampling event, numerous borings were performed at the property by Wasatch and it was determined that this property is not situated above the groundwater gasoline plume. Therefore, this property was dropped from the on-going indoor air monitoring and was not included in the subsurface monitoring plan.

Based on a request from the DERR, an additional indoor sample was collected by RMEC from this property on September 30, 2009. The benzene level in this indoor air sample was found to be  $25 \mu\text{g}/\text{m}^3$ . To further investigate the situation, RMEC installed a sub-slab soil vapor probe under the east side of the garage on this property and collected a sub-slab soil vapor sample on November 19, 2009. The diagram below shows the general location of the probe. The benzene level in this soil vapor sample was  $11 \mu\text{g}/\text{m}^3$ . A small amount of isopropyl alcohol (IPA), a leak test agent used by RMEC to verify the soil vapor probe collected sub-surface rather than indoor air, was found in the soil vapor sample. This indicated that some indoor air from the garage may have leaked into the soil vapor probe.



Based on the location of this property relative to the groundwater plume, RMEC does not plan additional monitoring at this property.

### 3.5 117 West 200 South

Based on a request from the DERR, indoor air samples were collected from this property on September 29 and November 18, 2009. The September 29 sample was collected from the kitchen on the main floor and the November 18 sample was collected from the northeast basement bedroom. The benzene levels in these indoor air samples were  $1.0 \mu\text{g}/\text{m}^3$  and  $1.5 \mu\text{g}/\text{m}^3$ , respectively.

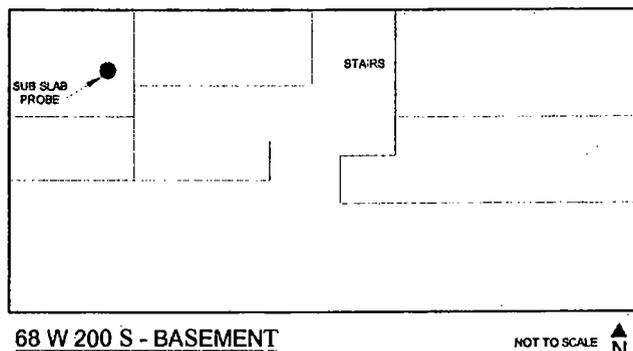
Based on the monitoring history and location of this property relative to the groundwater plume, RMEC recommends no further monitoring for this property.

### 3.6 68 West 200 South

A sub-slab ventilation system has been installed in this home. Between 11/9/07 and 3/26/09, seven indoor air samples were collected at this residence. The highest benzene level measured in the home was  $4.1 \mu\text{g}/\text{m}^3$ . This measurement occurred on 11/9/07. All subsequent benzene measurements have been less than or equal to  $1.6 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the "coal room" in the northwest corner of the basement of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 5/28/09 and on 9/30/09 were both  $<1.3$

$\mu\text{g}/\text{m}^3$ . Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.

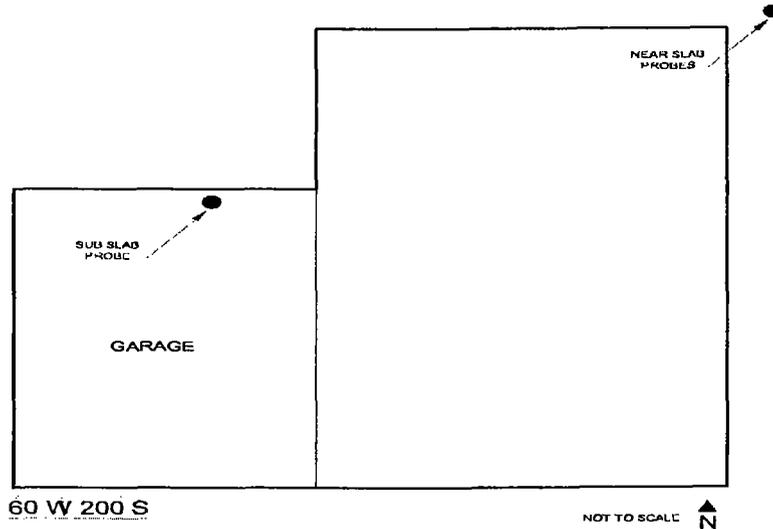


### 3.7 60 West 200 South

A sub-slab ventilation system has been installed in this home. Between 11/14/07 and 3/23/09, ten indoor air samples were collected at this residence. The highest benzene level measured in the home was  $47 \mu\text{g}/\text{m}^3$ . This measurement occurred on 11/19/08.

Two near-slab soil vapor probes were nested in a single boring within 10 feet of the northeast corner of the home. One probe was installed at a depth of 92 inches and the other was installed at a depth of 54 inches. The diagram below shows the general location of the probes. Two near slab soil vapor samples have been collected. The near-slab benzene levels measured at the deeper probe on 5/28/09 and 9/30/09 were both  $<1.3 \mu\text{g}/\text{m}^3$ .

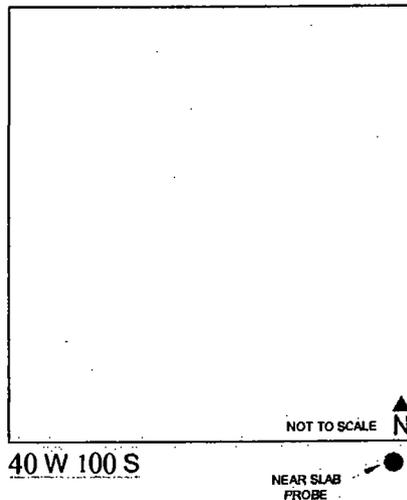
A sub-slab soil vapor probe was installed along the north wall of the garage on November 18, 2009. The location of this probe is also shown on the diagram below. The soil vapor sample collected from this location showed a benzene concentration of  $4.8 \mu\text{g}/\text{m}^3$ . Another soil vapor sample was collected from the garage probe in December 2009, however the data was not available at the time of this report.



### 3.8 40 West 100 South

Between 11/14/07 and 3/23/09, five indoor air samples were collected at this residence. The highest benzene level measured in the home was  $2.8 \mu\text{g}/\text{m}^3$ . This measurement occurred on 7/9/08. All subsequent indoor benzene measurements were less than or equal to  $1.4 \mu\text{g}/\text{m}^3$ .

Two near-slab soil vapor probes were nested in a single boring within 10 feet of the southeast corner of the home. One probe was installed at a depth of 98 inches and the other was installed at a depth of 60 inches. The diagram below shows the general location of the probes. Two near slab soil vapor samples have been collected. The near-slab benzene levels measured at the deeper probe on 5/28/09 and on 9/30/09 were  $2.6 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.9 89 West Center Street

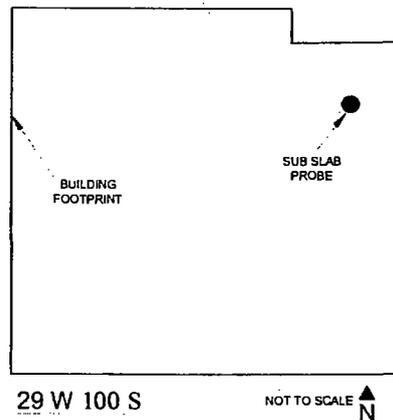
Between 11/19/07 and 4/25/08, four indoor air samples were collected at this residence. The benzene levels in the samples on the four sample dates were 130, 17, 20 and 12  $\mu\text{g}/\text{m}^3$ , respectively. The elevated benzene levels at this property were reportedly due to a furnace drawing air from an attached garage that stored recreational vehicles. Wasatch performed three soil borings at the property and did not find any evidence of petroleum vapors in the borings. Eventually, it was determined that this property was not situated above the groundwater gasoline plume and, therefore, it was not included in the on-going indoor air and subsurface monitoring in Gunnison.

Based on the monitoring history and location of this property relative to the groundwater plume, RMEC recommends no further monitoring for this property.

### 3.10 29 West 100 South

A sub-slab ventilation system has been installed in this home. Between 10/26/07 and 3/26/09, seven indoor air samples were collected at this residence. The highest benzene level measured in the home was 20  $\mu\text{g}/\text{m}^3$ . This measurement occurred on 10/26/08. The most recent indoor air sample collected on 3/26/09 showed a benzene level of 0.59  $\mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the northeast corner of the basement of the residence. The diagram below shows the general location of the probe. Sub-slab soil vapor samples were collected at the residence on 4/29/09 and 11/19/09. The benzene level measured in each of the soil vapor samples was  $<1.3 \mu\text{g}/\text{m}^3$ . Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report. This home is currently vacant.



### 3.11 40 West 200 South

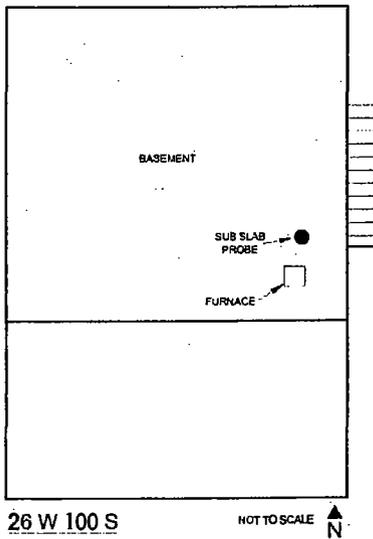
Between 7/9/08 and 3/23/09, four indoor air samples were collected at this residence. The highest benzene level measured in the home was  $1.6 \mu\text{g}/\text{m}^3$ . This measurement occurred on 9/4/08. RMEC attempted to install a near-slab soil vapor probe at this property, but encountered sub-surface rocks and was not able to complete the probe installation.

Based on the indoor monitoring history and the difficulty in installing a near surface soil vapor probe, RMEC recommends no further monitoring for this property.

### 3.12 26 West 100 South

A sub-slab ventilation system has been installed in this home. Between 11/16/07 and 3/23/09, eight indoor air samples were collected at this residence. The highest benzene level measured in the home was  $25 \mu\text{g}/\text{m}^3$ . This measurement occurred on 11/16/07. All indoor benzene measurements in the past year (since 9/4/2008) have been less than or equal to  $1.7 \mu\text{g}/\text{m}^3$ .

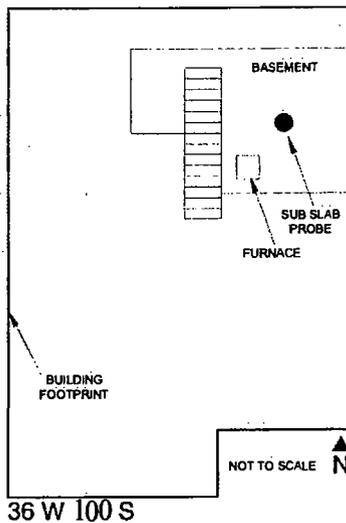
A sub-slab soil vapor probe was installed in the center of the basement area along the east side of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 4/29/09 and on 9/30/09 were  $2.4 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.13 36 West 100 South

A sub-slab ventilation system has been installed in this home. Between 11/16/07 and 11/18/09, nine indoor air samples were collected at this residence. The highest benzene level measured in the home was  $8.8 \mu\text{g}/\text{m}^3$ . This measurement occurred on 11/16/07. The indoor benzene levels measured in the home in the past year (since 9/4/2008) were all less than or equal to  $1.2 \mu\text{g}/\text{m}^3$ .

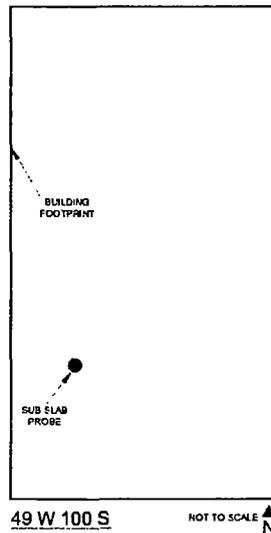
A sub-slab soil vapor probe was installed in the center of the basement area along the north side of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 4/29/09 and on 9/30/09 were  $17 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.14 49 West 100 South

A sub-slab ventilation system has been installed in this home. Between 1/7/08 and 3/23/09, five indoor air samples were collected at this residence. The highest benzene level measured in the home was  $1.7 \mu\text{g}/\text{m}^3$ . This measurement occurred on 9/4/08. The most recent indoor measurement on 3/23/09 showed a benzene level of  $0.7 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the southwest portion of the basement area of the residence. The diagram below shows the general location of the probe. Sub-slab benzene levels measured at the residence on 6/9/09 and 11/18/09 were  $2.8 \mu\text{g}/\text{m}^3$  and  $< 1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.15 43 West Center Street

One indoor air sample was collected at this property on 12/5/07. The benzene level measured in this sample was  $1.4 \mu\text{g}/\text{m}^3$ . Subsequent to this sampling event, it was determined that this property is not situated above the groundwater gasoline plume and, therefore, it was not included in the on-going indoor air and subsurface monitoring in Gunnison.

Based on the monitoring history and location of this property relative to the groundwater plume, RMEC recommends no further monitoring for this property.

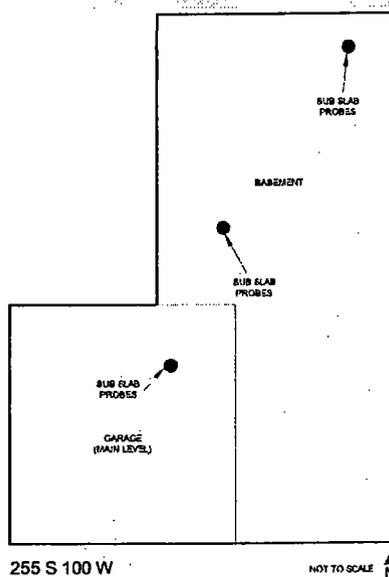
### 3.16 255 South 100 West

Between 11/7/07 and 9/30/09, 22 indoor air samples were collected at this residence. The highest benzene level measured in the home was  $48 \mu\text{g}/\text{m}^3$ . This measurement occurred on

6/22/09. The most recent indoor air sampling was performed on 11/18/09. Two indoor samples were collected on this date and the benzene level in each sample was  $0.9 \mu\text{g}/\text{m}^3$ .

Three sub-slab soil vapor probes were installed in this home. One was installed in the northeast portion of the basement, another was installed in the pantry area under the stairs in the basement and the final was installed in the northeast portion of the garage. The diagram below shows the general location of the probes.

Eleven sub-slab soil vapor samples were collected between 5/1/09 and 6/22/09. The highest sub-slab benzene level was  $35 \mu\text{g}/\text{m}^3$  and this measurement also occurred on 6/22/09. Two of the sub-slab samples collected on 5/26/09 were rejected due to sample train leaks. In July of 2009, Wasatch Environmental performed additional remedial actions at the home, including the installation of a soil vapor extraction system under the garage. Additional sub-slab soil vapor monitoring was performed in this home on September 29 and November 19, 2009. A soil vapor sample was collected from the probe in the northeast corner of the basement and from the probe in the pantry under the stairs on each of the dates. The garage probe was not sampled but a grab sample of air being exhausted from under the garage by the depressurization system was collected on each date. The benzene level in all of the samples was less than or equal to  $1.5 \mu\text{g}/\text{m}^3$ . Additional soil vapor and indoor sampling was performed in December 2009, however the data was not available at the time of this report.

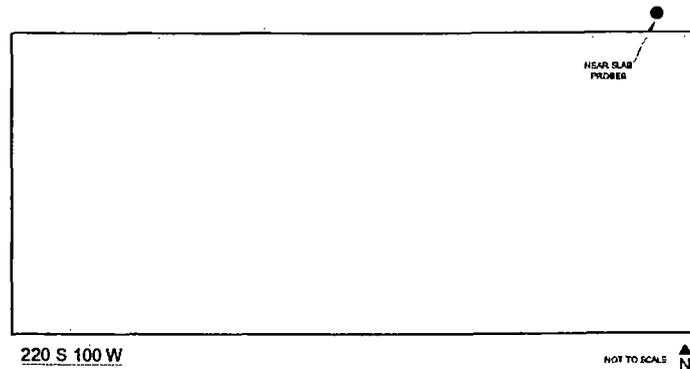


### 3.17 220 South 100 West

Between 11/9/07 and 3/23/09, thirteen indoor air samples were collected at this residence. The highest benzene level measured in the home was  $78 \mu\text{g}/\text{m}^3$ . This measurement occurred on

9/4/08. All indoor benzene levels measured in the home in the past year (since 10/21/08) have been less than or equal to  $1.5 \mu\text{g}/\text{m}^3$ .

Two near-slab soil vapor probes were nested in a single boring within 10 feet of the northeast corner of the home. One probe was installed at a depth of 120 inches and the other was installed at a depth of 56 inches. The diagram below shows the general location of the probes. Two near slab soil vapor samples have been collected. The near-slab benzene levels measured at the deeper probe at the residence on 5/28/09 and on 9/30/09 were  $3.5 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.18 20 East Center Street

One indoor air sample was collected at this property on 11/7/07. The benzene level measured in this sample was  $3.2 \mu\text{g}/\text{m}^3$ . Subsequent to this sampling event, it was determined that this property is not situated above the groundwater gasoline plume and, therefore, it was not included in the on-going indoor air and subsurface monitoring in Gunnison.

Based on the monitoring history and location of this property relative to the groundwater plume, RMEC recommends no further monitoring for this property.

### 3.19 12 East Center Street

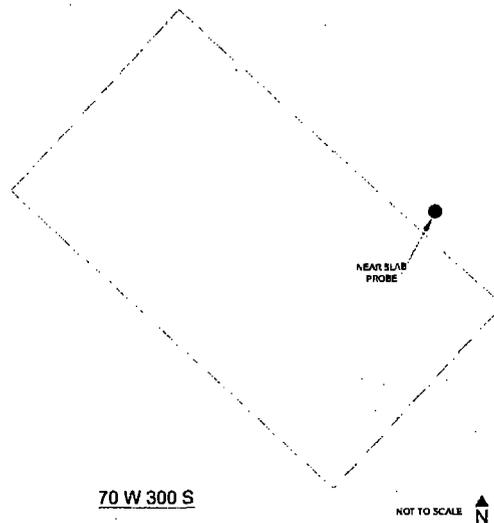
Two indoor air samples were collected at this property on 11/9/07. The highest benzene level measured in the samples was  $2.2 \mu\text{g}/\text{m}^3$ . Subsequent to this sampling event, it was determined that this property is not situated above the groundwater gasoline plume and, therefore, it was not included in the on-going indoor air and subsurface monitoring in Gunnison.

Based on the monitoring history and location of this property relative to the groundwater plume, RMEC recommends no further monitoring for this property.

### 3.20 70 West 300 South

Between 11/12/07 and 3/23/09, six indoor air samples were collected at this residence. The highest benzene level measured home was  $1.1 \mu\text{g}/\text{m}^3$ . This measurement occurred on 9/5/08. The most recent indoor air sampling was performed on 3/23/09. The benzene level measured during this sampling event was  $0.55 \mu\text{g}/\text{m}^3$ .

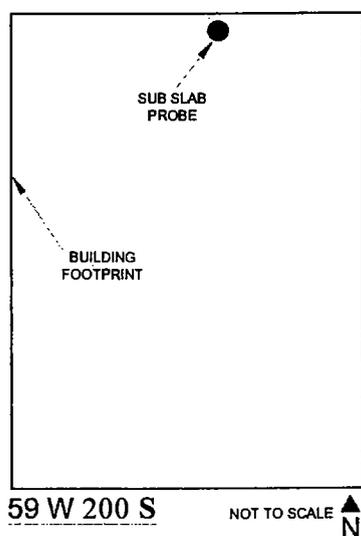
One near-slab soil vapor probe was installed in a boring within 10 feet of the north east corner of the home. The probe was installed at a depth of 63 inches. Two near slab soil vapor samples have been collected. The near-slab benzene levels measured at the residence on 6/9/09 and on 9/30/09 were  $2.1 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.21 59 West 200 South

A sub-slab ventilation system has been installed in this home. Between 11/14/07 and 3/23/09, six indoor air samples were collected at this residence. The highest benzene level measured in the home was  $13 \mu\text{g}/\text{m}^3$ . This measurement occurred on 8/14/08. The most recent indoor air sampling was performed on 3/23/09. The benzene level measured during this sampling event was  $0.61 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the along the north wall in the basement area of the residence. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the residence on 6/9/09 and on 9/30/09 were  $1.8 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



### 3.22 50 West 100 South

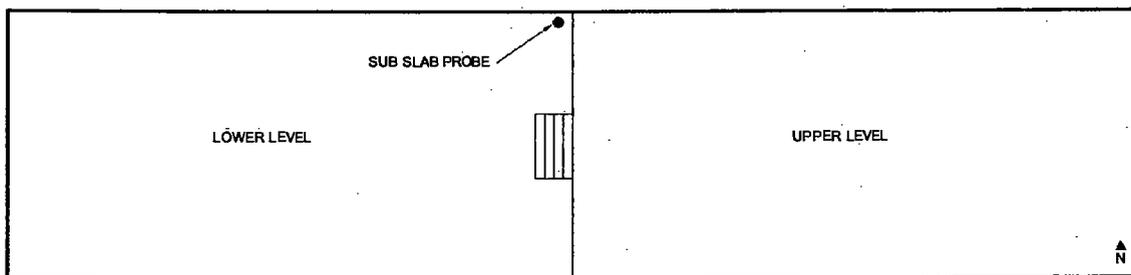
Between 11/14/07 and 3/23/09, three indoor air samples were collected at this residence. The highest benzene level measured in the home was  $1.4 \mu\text{g}/\text{m}^3$ . This measurement occurred on 11/14/07. Eventually, this property was determined not to be above the groundwater gasoline plume and was not included in the on-going indoor air monitoring in Gunnison.

Based on the monitoring history and location of this property relative to the groundwater plume, RMEC recommends no further monitoring for this property.

### 3.23 Body Barn – 62 South Main

Between 9/18/07 and 11/18/09, nine indoor air samples were collected at this business. The highest benzene level measured in the building was  $43 \mu\text{g}/\text{m}^3$ . This measurement occurred on 4/16/2009. The most recent indoor air sample was collected on 11/18/09 and the benzene level in this sample was  $23 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the northeast corner of the back workout area in the building. The diagram below shows the general location of the probe. Sub-slab soil vapor samples were collected on 4/29/09, 6/9/09, 9/29/09 and 11/18/09. The benzene levels in the samples on these dates were  $22 \mu\text{g}/\text{m}^3$ ,  $5.7 \mu\text{g}/\text{m}^3$ ,  $2.3 \mu\text{g}/\text{m}^3$  and  $3.2 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



**BODY BARN**

NOT TO SCALE

Sometime after the Top Stop release, two different types of rubber floor mats were installed in the Body Barn. The exact date of the floor mat installation is unclear. The floor mats have a distinctive “rubber tire” smell. A head space analysis performed on these floor mats indicated that both types of floor mats emit various hydrocarbons, including benzene. Indoor air monitoring performed in the building during the initial phases of the release on 9/18/07, 7/15/08, 8/11/08 and 9/17/08 showed benzene levels of 4.1, <1.0, 1.4 and <1.0  $\mu\text{g}/\text{m}^3$ , respectively. Elevated levels of petroleum vapors were first discovered in the building during indoor air monitoring performed on 3/26/09 when 14  $\mu\text{g}/\text{m}^3$  of benzene was measured in the building. Subsequent indoor monitoring on 4/16/09, 6/9/09 9/29/09 and 11/18/09 showed benzene levels of 43, 12, 5.9 and 23  $\mu\text{g}/\text{m}^3$ , respectively. RMEC believes the floor mats are likely contributing to the elevated petroleum vapors measured in the indoor air of the building. RMEC recommends that the exact date of the floor mat installation be determined so this date can be compared to the time frame when elevated petroleum vapors appeared in the building.

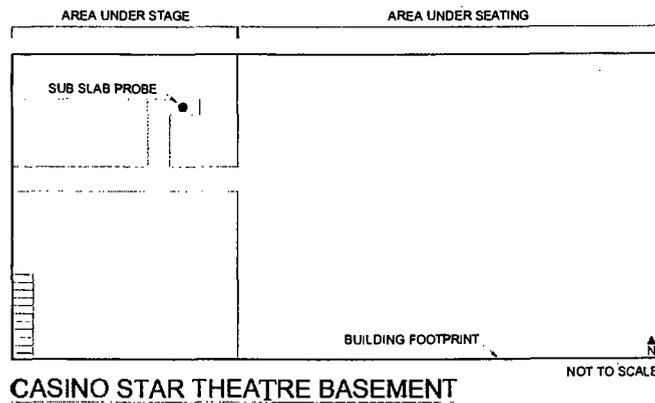
RMEC has not been contracted by Wind River to recommend or provide remedial actions for any of the properties in Gunnison. Therefore it is not in a position to comment on the status of the remedial actions for the Body Barn. Wasatch performed testing at the sub-slab probe in the building and verified that the Main Street SVE is providing negative pressure under the building. The last three rounds of monitoring indicated that indoor petroleum vapor concentrations were higher than sub-slab levels of these vapors. The leak test performed during the sub-slab monitoring indicated leakage did not occur. These data and the data from the floor mat head space analysis indicate that the petroleum vapors measured in the indoor air of the building were not entirely from a sub-surface source. In any case, RMEC will continue to monitor sub-slab soil vapors and indoor air at this commercial structure until the source of the elevated indoor petroleum vapors is determined.

### 3.24 Casino Star Theater – 78 South Main

Between 10/26/07 and 6/9/09, six indoor air samples were collected at this business. The highest benzene level measured in the building was 4200  $\mu\text{g}/\text{m}^3$ . This measurement occurred on 11/19/07. The benzene level in all indoor air samples collected in the past year (since 9/25/2008) has been less than or equal to 1.0  $\mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed to the south of the newly installed HVAC room along the north side of the basement of the building. The diagram below shows the general location of

the probe. The sub-slab benzene levels measured at the business on 6/10/09 and on 9/29/09 were  $4.5 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected early in January 2010, however the data was not available at the time of this report.

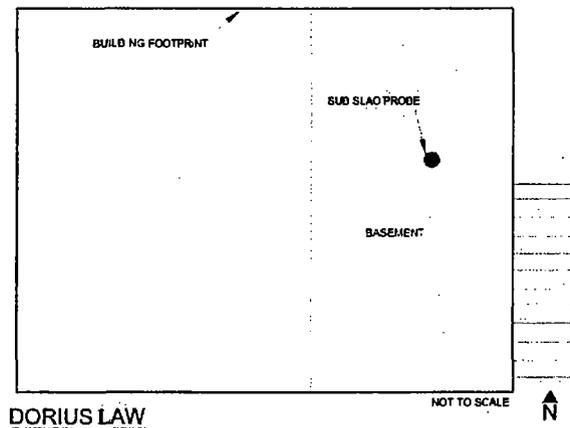


The Casino Star Theater has been the subject of numerous investigations to determine the source of the petroleum vapors and to prescribe remedial actions. An abandoned pipe in the basement was found to be a conduit that allowed sub-surface soil vapors to enter the building. This pipe was attached to the soil vapor extraction (SVE) system, after which indoor air measurements showed greatly reduced petroleum vapor levels.

### 3.25 Dorius Law Offices – 47 South Main

Between 9/6/07 and 3/26/09, five indoor air samples were collected at this business. The highest benzene level measured in the building was  $2 \mu\text{g}/\text{m}^3$ . This measurement occurred on 9/6/07. The benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $0.6 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the center of the basement on the east side of the building. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the business on 5/5/09 and on 9/30/09 were  $3.2 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected early in January 2010, however the data was not available at the time of this report.



### 3.26 Gunnison Barber Shop – 76 South Main

Between 7/15/08 and 3/26/09, five indoor air samples were collected at this business. The highest benzene level measured in the building was  $61 \mu\text{g}/\text{m}^3$ . This measurement occurred on 7/15/08. The most recent indoor air measurement was made on 3/26/09. The benzene level measured on this date was  $0.8 \mu\text{g}/\text{m}^3$ . This business is part of the Casino Star Theater building and remedial actions in the theater also affect the Gunnison Barber Shop.

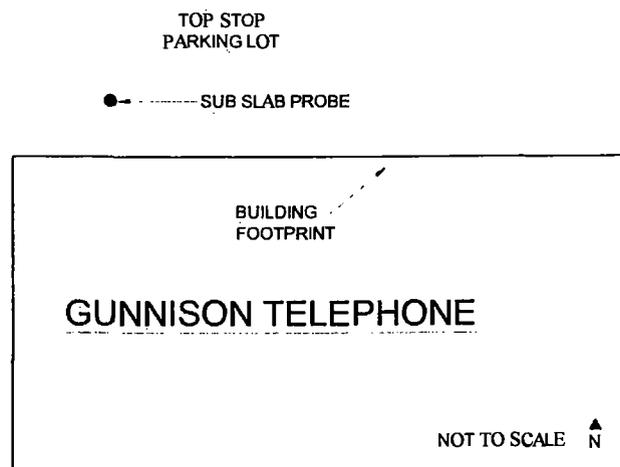
### 3.27 Gunnison Plumbing – 20 South Main

Between 9/18/07 and 9/17/08, four indoor air samples were collected at this business. The highest benzene level measured in the building was  $1.4 \mu\text{g}/\text{m}^3$  on 9/18/07. The building is now unoccupied.

### 3.28 Gunnison Telephone – 29 South Main

Between 9/6/07 and 3/26/09, five indoor air samples were collected at this business. The highest benzene level measured in the building was  $1.8 \mu\text{g}/\text{m}^3$  on 9/6/07. The benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $0.81 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed on the Top Stop property under the paved parking lot immediately adjacent to the northwest corner of the building. The diagram below shows the general location of the probe. The sub-slab benzene levels measured adjacent to the business on 5/5/09 and on 9/29/09 were  $1.8 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected early in January 2010, however the data was not available at the time of this report.



### 3.29 Gunnison Valley Bank – 10 South Main

Between 10/23/07 and 3/26/09, seven indoor air samples were collected at this business. The highest benzene level measured in the building was  $8.8 \mu\text{g}/\text{m}^3$  and occurred on 10/26/07. The benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $0.73 \mu\text{g}/\text{m}^3$ .

Lance Hess from Remedy, Inc. discovered that petroleum vapors were entering the Gunnison Valley Bank from an abandoned sewer line and toilet in the basement of the building. The sewer line was plugged in October of 2007 and all indoor air monitoring performed in the building after the sewer line was plugged showed very low levels of petroleum vapors.

### 3.30 Head Start – 189 South Main

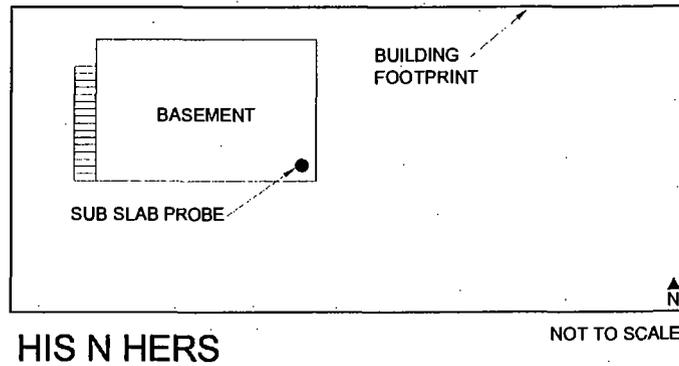
One air sample was collected at this business on 1/2/08. The benzene level in the sample was  $1.4 \mu\text{g}/\text{m}^3$ . The business was not located above the sub-surface petroleum plume and has since moved.

### 3.31 His N Hers – 98 South Main

A sub-slab ventilation system has been installed in this building. Between 9/6/07 and 3/26/09, eight indoor air samples were collected at this business. The highest benzene level measured in the building was  $53 \mu\text{g}/\text{m}^3$  and occurred on 11/19/07. The benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $0.87 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed in the center of the basement on the east side of the building. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the business on 5/5/09 and on 9/29/09 were both  $<1.3 \mu\text{g}/\text{m}^3$ . Another soil

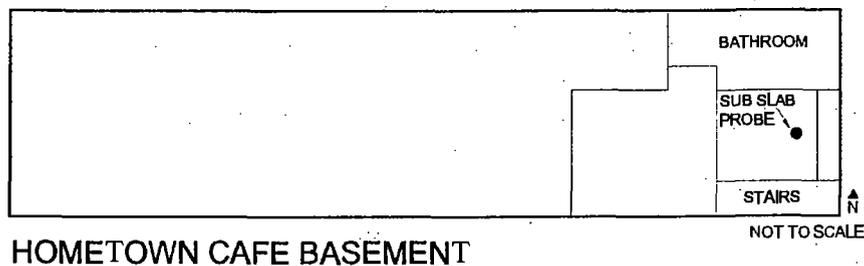
vapor sample was collected early in January 2010, however the data was not available at the time of this report.



### 3.32 Home Town Café/Malt Shop – 50 South Main

Between 9/18/07 and 3/26/09, five indoor air samples were collected at this business. The highest benzene level measured in the building was  $8.1 \mu\text{g}/\text{m}^3$  and occurred on 9/18/07. The benzene level in all subsequent indoor air samples has been less than or equal to  $1.2 \mu\text{g}/\text{m}^3$ .

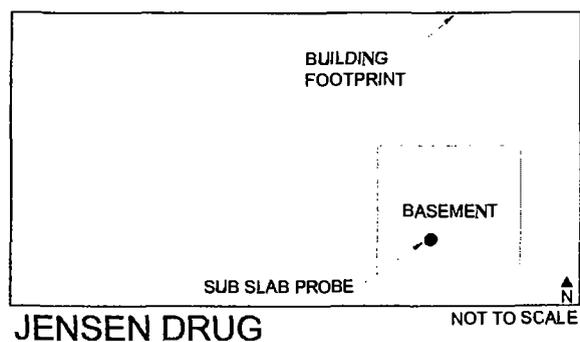
A sub-slab soil vapor probe was installed in the southeast portion of the basement area of the building. The diagram below shows the general location of the probe. The sub-slab benzene levels measured at the business on 6/10/09 and on 9/30/09 were  $<2.6 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected early in January 2010, however the data was not available at the time of this report.



### 3.33 Jensen Drug – 77 South Main

Between 12/3/07 and 3/23/09, five indoor air samples were collected at this business. The highest benzene level measured in the building was  $12 \mu\text{g}/\text{m}^3$  and occurred on 9/17/08. The most recent indoor air sample was collected on 3/23/09 and had a benzene level of  $1.8 \mu\text{g}/\text{m}^3$ .

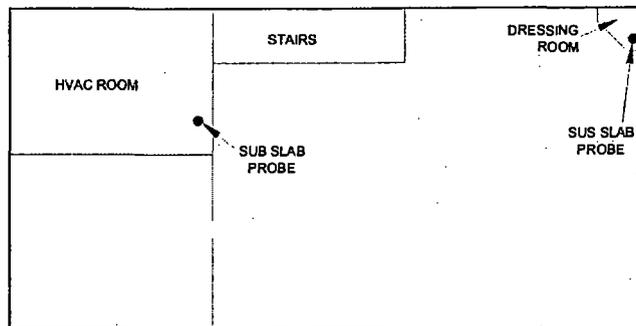
A sub-surface probe was installed at a depth of approximately 3 feet in the center of the dirt-floored crawl space beneath the center of the building. The diagram below shows the general location of the probe. The sub-surface benzene levels measured at the business on 6/9/09 and on 9/30/09 were  $1.3 \mu\text{g}/\text{m}^3$  and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected early in January 2010, however the data was not available at the time of this report.



### 3.34 Lila Lee's Apparel – 70 South Main

Between 9/7/07 and 9/17/08, six indoor air samples were collected at this business. The highest benzene level measured in the building was  $27 \mu\text{g}/\text{m}^3$  and occurred on 9/7/07. The most recent indoor air sample was collected on 9/17/08 and had a benzene level of  $1.2 \mu\text{g}/\text{m}^3$ .

Two sub-slab soil vapor probes were installed in the building. One probe was installed in the dressing room in the northeast corner of the basement of the building and the other probe was installed in the southeast corner of the HVAC room. The diagram below shows the general locations of the probes. Sub-slab soil vapor samples were collected from the HVAC and northeast probes on 5/5/09 and the benzene levels measured on this date were  $2.5$  and  $3.8 \mu\text{g}/\text{m}^3$ , respectively. These probes were sampled again on 9/30/09. A leak occurred in the HVAC probe and the data from this sampling event was rejected. The sub-slab benzene level measured in the northeast probe on 9/30/09 was  $<1.3 \mu\text{g}/\text{m}^3$ . Another soil vapor sample was collected early in January 2010, however the data was not available at the time of this report.



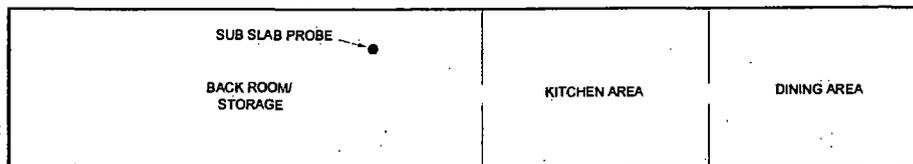
LILA LEEs - BASEMENT

NOT TO SCALE N

### 3.35 Lotsa Motsa Pizza – 54 South Main

Between 9/6/07 and 6/9/09, eight indoor air samples were collected at this business. The highest benzene level measured in the building was  $9.2 \mu\text{g}/\text{m}^3$  and occurred on 9/6/07. The most recent indoor air sample was collected on 6/9/09 and had a benzene level of  $0.46 \mu\text{g}/\text{m}^3$ .

A sub-slab soil vapor probe was installed along the north wall in the back storage area of the building. The diagram below shows the general location of the probe. Three sub-slab soil vapor samples were collected from the business on 4/30/09, 6/9/09 and 9/30/09. The benzene levels measured from the probe on 4/30/09, 6/9/09 and 9/30/09 were  $3.2 \mu\text{g}/\text{m}^3$ ,  $<1.3 \mu\text{g}/\text{m}^3$ , and  $<1.3 \mu\text{g}/\text{m}^3$ , respectively. Another soil vapor sample was collected in December 2009, however the data was not available at the time of this report.



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### 3.36 Nails and Hair – 65 South Main

Between 7/15/08 and 3/26/09, four indoor air samples were collected at this business. The highest benzene level measured in the building was  $1.5 \mu\text{g}/\text{m}^3$  and occurred on 8/11/08. The benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $0.82 \mu\text{g}/\text{m}^3$ .

### 3.37 State Farm Insurance – 28 South Main

Between 9/18/07 and 3/26/09, five indoor air samples were collected at this business. The highest benzene level measured in the building was  $1.7 \mu\text{g}/\text{m}^3$  and occurred on 8/11/08. The

benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $1.1 \mu\text{g}/\text{m}^3$ .

### **3.38 White Hills Trading Company – 74 South Main**

Between 9/6/07 and 3/26/09, seven indoor air samples were collected at this business. The highest benzene level measured in the building was  $45 \mu\text{g}/\text{m}^3$  and occurred on 7/15/08. After the  $45 \mu\text{g}/\text{m}^3$  benzene level was measured in the building, the crawl space was sealed off with plastic sheeting and a sub-slab depressurization system was installed. The benzene level in all indoor air samples collected in the past year (since 9/17/2008) has been less than or equal to  $1.2 \mu\text{g}/\text{m}^3$ .

### **3.39 Outdoor Sampling Locations**

Due to the limited number of outdoor air samples and the dates that they were collected, RMEC cannot draw any conclusions as to the significance of these data.

## **4.0 RECOMMENDATIONS FOR ON-GOING MONITORING**

As previously stated, the purpose of this Status Report is to detail the results of all indoor air monitoring and sub-slab/near-slab soil vapor monitoring performed to date in homes and businesses in Gunnison that were impacted by the Top Stop Petroleum release and to provide recommendations for ongoing monitoring and corrective actions at selected locations.

As can be seen in the data summarized in this report, indoor petroleum vapor levels in the homes and businesses in Gunnison have varied widely over time since the initial release was discovered. In general, the highest levels of petroleum vapors measured in the indoor air samples occurred shortly after the release. However, elevated levels of petroleum vapors were measured at some locations well after the early stages of the release. Petroleum-related vapors are ubiquitous in the environment and it is often difficult to ascertain the source of these vapors in an indoor environment. RMEC believes subsurface soil vapor monitoring, using sub-slab or near-slab soil sampling methods, is the best tool for evaluating the contribution of a sub-surface petroleum release to the overall petroleum vapor concentrations in an indoor environment and proposes to use this method to evaluate the impact from the Top Stop release. Therefore RMEC is providing a formal request to DERR to replace the requirement for monthly indoor air sampling at the properties situated above the groundwater gasoline plume from the Top Stop release with periodic sub-slab and or near-slab soil vapor monitoring, as appropriate.

### **4.1 Risk-Based Screening Level Calculations**

While there are a number of compounds found in petroleum, benzene poses the greatest health risk and typically is the driver for the establishment of remediation action levels. When benzene concentrations are within allowable risk-based limits, the concentrations of other petroleum-related compounds typically are also well within allowable risk levels. Therefore, RMEC will

use the benzene concentrations measured during the indoor air and sub-surface soil vapor monitoring as the primary driver for the recommended monitoring schedule.

Indoor air target benzene concentrations for residential and commercial structures were calculated in accordance with Table D1 of *Guidelines for Utah's Corrective Action Process for Leaking Underground Storage Tank Sites, October, 2005*, which was derived from the ASTM Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, E1739-95.

The target indoor air concentration for residential environments was calculated in accordance with the following equation:

$$RBSL_{air-c} \frac{ug}{m^3 air} = \frac{TER \times BW \times AT_c \times 365 days/yr}{SF_i \times IR_{air} \times EF \times ED} \times 10^3 \frac{ug}{mg}$$

Where:  $AT_c$  = averaging time for carcinogens = 70 years  
 $BW$  = adult body weight = 70 kg  
 $ED$  = exposure duration = 30 years  
 $EF$  = exposure frequency = 350 days/year  
 $IR_{air}$  = daily indoor inhalation rate = 15 m<sup>3</sup>/day  
 $RBSL_{air-c}$  = indoor air risk based screening level (μg/m<sup>3</sup>)  
 $SF$  = inhalation cancer slope factor = 0.029 (mg/kg-day)<sup>-1</sup>  
 $TER$  = target excess risk = 10<sup>-6</sup>

Using these site-specific parameters, the calculated residential indoor target benzene concentration is:

$$0.39 \mu g/m^3$$

The target indoor air concentration for commercial environments was calculated using the same equation with the following parameters:

$AT_c$  = averaging time for carcinogens = 70 years  
 $BW$  = adult body weight = 70 kg  
 $ED$  = exposure duration = 25 years  
 $EF$  = exposure frequency = 250 days/year  
 $IR_{air}$  = daily indoor inhalation rate = 15 m<sup>3</sup>/day  
 $RBSL_{air-c}$  = indoor air risk based screening level (μg/m<sup>3</sup>)  
 $SF$  = inhalation cancer slope factor = 0.029 (mg/kg-day)<sup>-1</sup>  
 $TER$  = target excess risk = 10<sup>-6</sup>

Using these site-specific parameters, the calculated commercial indoor target benzene concentration is:

$$0.49 \mu g/m^3$$

## 4.2 Target Sub-Surface Soil Vapor Calculations

The State of Utah has not adopted attenuation factors for use in relating indoor air concentrations to sub-surface or sub-slab vapor sources. Several other states and professional organizations have adopted attenuation factors ranging from 0.1 to 0.001 for sub-slab vapor sources. In the absence of a regulatory or consensus standard, RMEC applied the most conservative attenuation factor of 0.1 to the target indoor benzene levels for residential and commercial structures. Application of this attenuation factor allows us to establish target sub-surface concentrations that can be used as the basis for establishing a future monitoring schedule for the properties. This attenuation factor was used to establish both the sub-slab and near-slab target levels. Using these criteria, target sub-surface benzene concentrations in the residential structures is  $3.9 \mu\text{g}/\text{m}^3$  and in the commercial structures is  $4.9 \mu\text{g}/\text{m}^3$ . Please note that these target sub-surface concentrations do not necessarily pose an unacceptable risk, they only represent the sub-surface benzene concentrations that could result in indoor air benzene levels above the  $10^{-6}$  risk level.

## 4.3 Monitoring Schedule Criteria

RMEC is requesting a formal change in the DERR requirement for monthly indoor air monitoring at the Gunnison properties affected by the Top Stop release. RMEC proposes to replace the monthly indoor air monitoring at the Gunnison properties with the sub-surface soil vapor monitoring in accordance with the criteria described below.

Sub-slab and/or near-slab soil vapor samples will be collected on a monthly basis from the residential properties where the sub-slab or near-slab benzene levels have been shown to be greater than  $3.9 \mu\text{g}/\text{m}^3$  and at commercial properties where the sub-surface benzene levels have been shown to be greater than  $4.9 \mu\text{g}/\text{m}^3$ . The monthly monitoring will continue at these properties until two consecutive benzene measurements are at or below the target concentration. After such time, the monitoring frequency will be reduced to a quarterly basis.

In addition to this proposed subsurface soil vapor monitoring, indoor air samples will be collected simultaneously with the soil vapor samples at the residential properties where the sub-surface benzene levels have exceeded  $3.9 \mu\text{g}/\text{m}^3$  and at commercial properties where the sub-surface benzene levels have exceeded  $4.9 \mu\text{g}/\text{m}^3$ . When two consecutive sub-surface benzene measurements are below the specified target levels, the indoor air monitoring will be discontinued.

Sub-slab and/or near-slab soil vapor samples will be collected on a quarterly basis from the residential properties where sub-slab or near-slab benzene levels have been shown to be less than or equal to  $3.9 \mu\text{g}/\text{m}^3$  and at commercial properties where the sub-surface benzene levels have been shown to be less than  $4.9 \mu\text{g}/\text{m}^3$ . The overall soil vapor monitoring will continue for one year (the last monitoring event being at the end of the first quarter of 2010) at which time the monitoring data will be evaluated and the need for continued on-going monitoring will be reassessed.

#### 4.4 Status of Monitoring Results

RMEC began collecting sub-surface soil vapor samples during the second quarter (April – June) of 2009. The initial monitoring indicated that the majority of the properties had sub-surface benzene soil vapor levels within the target limit. However, based on the initial monitoring results, three residential properties and one commercial property had sub-surface benzene levels above the target limit. These properties are listed below.

255 South 100 West  
96 West 200 South  
36 West 100 South  
Body Bam

In accordance with the criteria listed above, monthly soil vapor/indoor air monitoring at these properties began in the third quarter (September) of 2009 along with the quarterly soil vapor monitoring for the other Gunnison properties. Soil vapor and indoor air monitoring at these four properties was repeated in November of 2009. The sub-surface benzene level at each property in both the September and November monitoring events had dropped below the target levels specified above. Indoor benzene levels at each of the properties were also found to be relatively low. Therefore, based on these findings, the monthly indoor air/soil vapor monitoring at these properties will be discontinued and soil vapor monitoring only will be performed on a quarterly basis.

Soil vapor monitoring will be continued at the other properties on a quarterly basis. However, if valid concerns are raised regarding potential elevated indoor petroleum vapors (e.g. petroleum odors, occupant symptoms associated with acute petroleum vapor inhalation, etc.), DERR may request and RMEC will consider performing indoor air monitoring during scheduled sub-surface soil vapor sampling. RMEC may also collect indoor air samples at selected properties at its discretion. The next scheduled quarterly monitoring event will be at the end of the first quarter, 2010.

#### Additional Monitoring

Based on a request from DERR, RMEC installed a sub-slab soil vapor probe in the garage of the residence located at 60 West 200 South. The benzene level measured at this location was 4.8  $\mu\text{g}/\text{m}^3$  and exceeded the target limit of 3.9  $\mu\text{g}/\text{m}^3$ . Based on this finding, indoor air and sub-slab monitoring will be performed at this property on a monthly basis until favorable benzene levels are achieved.

#### 4.5 Monitoring Schedule

Based on the data collected to date, the proposed monitoring schedule is summarized in the table below:

**Proposed Sub-Surface Soil Vapor Monitoring Schedule**

Property Location/Name	Measured Sub-surface Concentration of Benzene ( $\mu\text{g}/\text{m}^3$ )	Target Sub-surface Benzene Concentration ( $\mu\text{g}/\text{m}^3$ )	Sampling Frequency	Next Sampling Date
<b>Residential Structures</b>				
26 West 100 South	<1.3 - 2.4	3.9	Quarterly	March 2010
36 West 100 South	<1.3 - 17	3.9	Quarterly	March 2010
29 West 100 South	<1.3	3.9	Quarterly	March 2010
39 West 100 South	<1.3 - 1.6	3.9	Quarterly	March 2010
40 West 100 South	<1.3 - 2.6	3.9	Quarterly	March 2010
49 West 100 South	<1.3 - 2.8	3.9	Quarterly	March 2010
59 West 200 South	<1.3 - 1.8	3.9	Quarterly	March 2010
70 West 300 South	<1.3 - 2.1	3.9	Quarterly	March 2010
68 West 200 South	<1.3	3.9	Quarterly	March 2010
60 West 200 South	<1.3 - 4.8	3.9	Monthly	February 2010
78 West 200 South	<1.3 - 1.6	3.9	Quarterly	March 2010
96 West 200 South	<1.3 - 4.5	3.9	Quarterly	March 2010
220 South 100 West	<1.3 - 3.5	3.9	Quarterly	March 2010
255 South 100 West*	<1.3 - 35	3.9	Quarterly	March 2010
<b>Commercial Structures</b>				
Body Barn	2.3 - 22	4.9	Quarterly	March 2010
Casino Star Theater	<1.3 - 4.5	4.9	Quarterly	March 2010
Dorius Law Office	<1.3 - 3.2	4.9	Quarterly	March 2010
Lila Lee's Apparel	<1.3 - 3.8	4.9	Quarterly	March 2010
His and Hers	<1.3	4.9	Quarterly	March 2010
Home Town Cafe	<1.3 - 2.6	4.9	Quarterly	March 2010
Jensen Drug	<1.3 - 1.3	4.9	Quarterly	March 2010
Lotsa Motsa Pizza	<1.3 - 3.2	4.9	Quarterly	March 2010
Gunnison Telephone	<1.3 - 1.8	4.9	Quarterly	March 2010