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**Stantec**

August 13, 2010

Mr. Robert Breeden  
366 E. 40<sup>th</sup> Avenue  
Eugene, OR 97405

**Reference: Vapor Intrusion Summary Report  
Edgewood Shopping Center  
40th Avenue and Donald Street  
Eugene, Oregon 97405  
STANTEC PROJECT NO.: 187902018.400**

Dear Mr. Breeden:

Stantec Consulting Corporation (Stantec) is pleased to present this *Vapor Intrusion Summary Report* which documents all activities conducted to date at and near the Edgewood Shopping Center (the Site) to investigate and assess the potential for indoor air exposure to chlorinated solvent vapors in the Edgewood Shopping Center businesses, including the building formerly housing the drycleaner and the Edgewood Animal Clinic and evaluating the potential for indoor exposure to chlorinated solvent vapors by neighboring properties. The following material documents the methodologies used and the results obtained from that effort.

**BACKGROUND**

Bergeson-Boese and Associates (BBA) identified the presence of tetrachloroethylene (aka perchloroethylene or PCE) in water that had infiltrated the tank holds during removal of the decommissioned underground storage tanks (USTs) associated with a former gasoline station at the northeast corner of the subject property in 1991 (Former McCool Brothers property). Although BBA originally attributed the presence of PCE to the former gasoline station, subsequent investigations by BBA, including installing five groundwater monitoring wells across the subject property, determined that the on-site dry cleaner (Siegmond Dry Cleaners) was the likely source.

Since approximately 1993, the highest concentrations of PCE (120,000 micrograms per liter [ $\mu\text{g/L}$ ]) have been detected in MW-5 which is located in the alley directly adjacent to the south of the former dry cleaner space (Figure 3). This well is located in an upgradient position relative to groundwater flow which has been reported by BBA to be to the north/northeast toward E 40<sup>th</sup> Avenue. As such the groundwater flows from the area of highest concentration under the former dry cleaner.

Three monitoring wells were installed by BBA in 1993 in the parking lot north of the former dry cleaner. Since that time, PCE (a low of 740  $\mu\text{g/L}$  in MW-2 [2008] to a high of 5,300  $\mu\text{g/L}$  in MW-4 [1993]) and trichloroethylene (TCE) (a low of 6.5  $\mu\text{g/L}$  in MW-2 [2008] to a high of 210  $\mu\text{g/L}$  in MW-4 [1993]) have been detected in these wells at relatively stable concentrations.

Groundwater has been routinely present at depths ranging from 1.6 to 7.5 feet below the ground surface. The site is underlain by relatively permeable materials consisting of sand, sand and gravel and silty sand to approximately 6 feet below the ground surface where weathered bedrock is encountered.

In January 2006, the Oregon Department of Environmental Quality (DEQ) collected a sample(s) of indoor air from the interior of one of the shopping center tenant spaces. According to the DEQ



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Groundwater has been routinely present at depths ranging from 1.6 to 7.5 feet below the ground surface. The site is underlain by relatively permeable materials consisting of sand, sand and gravel and silty sand to approximately 6 feet below the ground surface where weathered bedrock is encountered.

In January 2006, the Oregon Department of Environmental Quality (DEQ) collected a sample(s) of indoor air from the interior of one of the shopping center tenant spaces. According to the DEQ database, PCE was detected at a concentration exceeding the DEQ indoor air Risk Based Concentration for Occupational Exposure.

Based on this information, Stantec concluded that a potential existed for the transport of chlorinated hydrocarbons in groundwater into at least the portion of the site structures overlying the plume and recommended further assessment regarding the potential for vapor intrusion.

A site plan for the Edgewood Shopping Center is presented in **Figure 1**.

### **November 2008 Assessment**

On November 19, 2008, Stantec collected three time-integrated air samples using laboratory provided and individually certified 6-liter Summa® canisters fitted with mass flow controllers (critical orifice type) in accordance with U.S. EPA Method TO-15<sup>1</sup>. One sample was collected from within the on-site management office (Breedon Office); one from the former dry cleaner tenant space; and one ambient air sample was collected near the parking lot. The objective of the sampling and analysis was to determine if dry cleaning chemicals were present in the indoor air in the former dry cleaner space. The sample collected from the Breedon Homes office was intended to act as a background sample from an area not likely to be impacted by the former dry-cleaning operation.

Immediately prior to sample collection, Stantec staff conducted a building survey of the subject property. The purpose of the survey was to:

- Determine optimal placement of indoor air sampling devices and an appropriate location for the collection of the outdoor (ambient) air sample.
- Identify current on-site chemical usage with the potential to contribute volatile organic compounds to the indoor air.
- Visually assess normal airflow patterns including the presence of partitions, normally closed rooms or other features that restrict airflow and thus could cause artificial concentration of any soil vapor that may be entering the space.
- Identify the location of nearby facilities that could contribute VOCs to the ambient air (i.e., other dry cleaners, gasoline stations). If VOCs are emitted from these types of facilities, they could enter the subject property by normal opening and closing of doors, airflow through windows and inadequately sealed areas of the building exterior. VOCs entering the building via these routes could erroneously be attributed to indoor air sources.

All samples were collected as follows:

- The initial vacuum of each canister was noted and recorded.
- Once the canisters were positioned in pre-selected sampling locations and at a height considered

to represent a normal breathing zone, the canister valve was opened approximately ½ turn. The valves on each canister remained open for approximately 8 hours and were then closed.

- At the end of the sampling period a unique sample identification number was affixed to each canister.

All canisters were submitted to Columbia Analytical Services (CAS) of Simi Valley, California, an offsite, independent laboratory under strict chain-of-custody control for analysis of VOCs by US EPA Method TO-15 (SIM)<sup>2</sup>. CAS is accredited by the Oregon Environmental Laboratory Accreditation Program (#CA200007) to perform analysis of air samples using US EPA Method TO-15.

At the time of sampling the building HVAC systems were reportedly operating in a normal fashion. Except for normal ingress/egress, the doors remained closed for the sampling duration. At the time of sampling, the former dry cleaner space was used for temporary office/storage by a contractor conducting remodeling activities at the property. Stantec noted the storage of paint and paint thinners in the space accompanied by noticeable and typical paint-related odors. Completed building surveys for each sampled space are included in **Attachment A**.

Laboratory analysis identified the presence of several chlorinated and petroleum hydrocarbons in both indoor and ambient air samples. Of the compounds reported to be above laboratory method reporting limits, benzene (2.4 to 3.9 µg/m<sup>3</sup>) and tetrachloroethene (PCE) (0.4 to 2.6 µg/m<sup>3</sup>) were detected at concentrations exceeding the Risk-Based Concentrations (RBCs) established by DEQ for air (Occupational Exposure).

The frequency of detections and pattern of distribution were essentially the same within the building envelopes and the outdoor air. There were some expected and slight variations with respect to detected concentrations of some chemicals within the buildings<sup>3</sup>. The presence of toluene and xylenes at higher concentrations within the former dry cleaner space can be directly attributed to the storage of paint and paint thinners.

Although the detected concentrations of benzene in both ambient and indoor air samples exceed its RBC, the concentrations were within background concentration ranges developed as part of national studies (US EPA, 1998; Shah and Singh, 1988). The reported concentrations of benzene are remarkable in their relative uniformity both in indoor and ambient air. Moreover, the presence of contaminants including benzene, at levels approximating ambient air concentrations but exceeding regulatory screening levels (e.g., ESLs) has been widely reported in the literature (McHugh, T.E. et al, 2004; Weisel, 2005).

Since both the presence and concentrations of chemicals in the indoor air vary with time, Stantec recommended that another set of samples be collected at a seasonally disparate time to determine what

<sup>2</sup> Selective Ion Monitoring (SIM) was chosen to achieve the lowest method reporting limits necessary for comparison of the results with the RBCs. In the SIM mode, the mass spectrometer (MS) searches for only two to three ions at the appropriate retention times for the target analytes. Although the SIM analysis may produce a more restricted list of analytes than the full scan mode, the analytes reported include all volatile organic compounds previously identified in soil and groundwater near the Subject Property and have met the data quality objectives set forth by Stantec.

<sup>3</sup> It is widely recognized that airborne concentrations of many VOCs in residences, office buildings and other indoor environments are higher than concentrations in outdoor air Pellizzari, 1986; Wallace, 1987; Daisey et al, 1994 (see Hodgson and Levin VOCs in Indoor air). This is due in part to the numerous sources of VOCs within the building envelope and because of the lower rates of outdoor ventilation typically used in residences and commercial buildings.

effect, if any, operation of the heating system and different meteorological conditions may have on the level of chemicals within the indoor air.

Following enrollment of the facility in the Oregon DEQ Voluntary Cleanup Program (VCP) in January 2009 on March 20, 2009 the DEQ issued a letter indicating that based on the potential for human exposure to unsafe levels of chlorinated solvent vapors they 1) consider the Edgewood Cleaners site a high priority for additional investigation; and, 2) had prioritized the issues at the site to include the following tasks in order of importance which should be performed in sequence:

1. Evaluating the potential for indoor air exposure to chlorinated solvent vapors in the Edgewood Shopping Center businesses, including the building the formerly housed the drycleaner and the Edgewood Animal Clinic.
2. Evaluating the full horizontal extent of groundwater impact,
3. Evaluating the potential for indoor exposure to chlorinated solvent vapors by neighbors
4. Evaluating the full extent of shallow soil contamination to the south of MW-5
5. Establishing E/W groundwater flow direction by installing additional monitoring well(s)
6. Establishing vertical distribution of chlorinated solvents.

### **May to June 2009 Assessment**

On May 26, 2009, Stantec submitted the *Vapor Intrusion Assessment Work Plan, Edgewood Shopping Center, 366 E. 40<sup>th</sup> Avenue, Eugene, Oregon 97405* (the Work Plan) to DEQ to assess DEQ Task 1: the potential for indoor air exposure to chlorinated solvents in the Edgewood Shopping Center businesses. Following review of the Work Plan, DEQ requested that one, exterior soil gas sample be collected from a location approximately halfway between the south alleyway and the south property boundary. Stantec requested that the number be increased to two samples due to the uncertainty regarding the extent of soil contamination in this area. DEQ issued approval of the amended Work Plan on June 4, 2009 via electronic-mail.

On June 17 and June 18, 2009 collected the following samples:

- Edgewood Vet Clinic                      2 indoor air samples (1 primary and 1 duplicate)
- Outside Edgewood Vet Clinic        1 sub-slab soil gas sample
- Former Dry Cleaner                      1 indoor and 2 sub-slab soil gas samples
- Flower Shop                                1 indoor air and 1 sub-slab soil gas sample
- Deli    1 indoor air and 1 sub-slab soil gas sample
- Taqueria                                     1 indoor air and 1 sub-slab soil gas sample
- Only the Best truck broker            1 indoor air and 1 sub-slab soil gas sample
- Wells Fargo ATM                         1 outdoor air sample
- Sloped bank south of MW-5          2 soil gas samples

Sub-slab soil gas samples were collected the day after collection of indoor air samples since penetration of the slab could cause transport of soil gas into the building thus producing higher than typical chemical concentration in the indoor air.

Although three sub-slab soil gas sample locations were proposed for the Edgewood Animal Clinic (4010 Donald Street) in the Work Plan the tenant would not allow drilling in the clinic since a new floor had just been installed. Stantec elected to collect a sample near the clinic foundation and below the centerline of the poured concrete sidewalk; however as discussed with DEQ, this sample may not be representative

of conditions below the actual building slab since sub-slab soil gas concentrations may change dramatically within short distances away from the building slab perimeter.<sup>4</sup>

Following collection, all samples were submitted to Air Toxics Ltd. of Folsom, California. Air Toxics is certified by the Oregon Laboratory Accreditation Program (#CA200012) to perform analysis of air samples using US EPA Method TO-15.

## Results

Barometric pressure at the start and completion of indoor air sampling on June 17, 2009 (measured at the Eugene, Oregon airport) was 30.05 and 30.01 inches of mercury respectively. The wind speed and direction were estimated to be approximately 5.6 km/h to the north at the start of sampling with the same wind speed but variable wind direction at the completion of sampling.

Barometric pressure at the start and completion of sub-slab and exterior soil vapor sampling (June 18, 2009) was 30.06 and 29.94 inches of mercury, respectively. The wind speed was estimated to be approximately 7.4 kilometers per hour (km/h) to the west at the start and 9.3 km/hr with variable wind direction at the completion of sampling.

The assembled meteorological data do not indicate large barometric pressure differences during the sampling interval that might cause fluctuations in soil gas concentrations noted by other investigators<sup>5</sup>.

## Building Survey

A building survey of all tenant spaces scheduled for sampling was performed on June 17, 2009. No chemical use or storage was identified, and no painting or replacement of carpeting and floors has occurred in at least the last 4-6 months. Discoloration was noted on the walls and ceiling in the backroom of the former dry cleaner space which might be from residual chemicals from the former dry-cleaning operation.

## Indoor Air Samples

Laboratory analysis identified benzene, 1,2-dichloroethane, 1,4-dichlorobenzene methylene chloride, trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, tetrachloroethene, toluene, xylenes, ethylbenzene and *cis*-1,2-dichloroethene in one or more indoor air samples. Of these compounds, tetrachloroethene (PCE), *cis*-1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene (TCE), 1,4-dichlorobenzene and methylene chloride were detected in the indoor air samples but not in the outdoor air sample indicating that the source of these chemicals was not from transport of outdoor air into the buildings (ventilation or infiltration through cracks or gaps around windows and doors). The DEQ Inhalation Risk-Based Concentration (indoor air) for occupational receptors<sup>6</sup> was exceeded for PCE (RBC = 1.9  $\mu\text{g}/\text{m}^3$ ) in sample IA-7 collected from the former dry cleaner space (PCE=9.6  $\mu\text{g}/\text{m}^3$ ) and for TCE (RBC = 0.10  $\mu\text{g}/\text{m}^3$ ) in sample IA-3 collected from the Deli (TCE=0.76  $\mu\text{g}/\text{m}^3$ ).

Except for the dry cleaner samples, tetrachloroethene was the only target analyte detected in soil gas samples and was detected in all sub-slab soil gas samples (except for the sample collected in the

<sup>4</sup> *Sub-slab vs. Near Slab Soil Vapor Profiles at a Chlorinated Solvent Site*, US EPA NERL, 2008.

<sup>5</sup> Massman, J. and Farrier, D.F., 1992. *Effects of Atmospheric Pressure on Gas Transport in the Vadose Zone*, Water Resources Research, 28(3), 777-791.

<sup>6</sup> OAR 340-122-0244 et. Seq. *Risk Based Concentrations*.

Taquieria where no detections above the MRL were identified) at concentrations ranging from a low of 9.0 µg/m<sup>3</sup> (Only the Best truck broker) to a high of 9,300 µg/m<sup>3</sup> (Flower Shop). Sub-slab soil gas samples collected in two locations within the dry cleaner space contained benzene (9.4 µg/m<sup>3</sup>), trichloroethene (8.1 and 12 µg/m<sup>3</sup>), toluene (8.4 and 14 µg/m<sup>3</sup>), and tetrachloroethene (350 and 360 µg/m<sup>3</sup>).

PCE was detected in the exterior sub-slab soil gas sample collected near the Edgewood Animal Clinic at a concentration of 250 µg/m<sup>3</sup>.

### Exterior Soil Vapor Samples

Tetrachloroethene was detected in both primary soil vapor samples collected from the sloped bank behind the former dry cleaner space (790 µg/m<sup>3</sup>, 79,000 µg/m<sup>3</sup> and 88,000 µg/m<sup>3</sup> in the duplicate). Both results are above the Oregon DEQ RBC<sub>soil gas</sub> for land in residential use. Trichloroethene was detected only in Soil Vapor 2-Exterior (270 µg/m<sup>3</sup>) although the MRL for trichloroethene in the duplicate sample was elevated due to the high concentrations of tetrachloroethene. No other target analytes were detected.

Soil gas samples collected from the bank at the rear of the former dry cleaner space contained PCE at concentrations of 790 µg/m<sup>3</sup> (SV-1) to 88,000 µg/m<sup>3</sup> (SV-2 duplicate). TCE was detected only in the SV-2 primary sample (270 µg/m<sup>3</sup>).

Empirically derived attenuation factors (α) based on the synoptic data were calculated for each matching indoor air and sub-slab soil vapor sample as follows:

$$\alpha = C_{\text{indoor air}}/C_{\text{soil gas}}$$

where:  $C_{\text{indoor air}}$  = concentration of each VOC in the indoor air  
 $C_{\text{soil gas}}$  = concentration of the VOC in soil gas

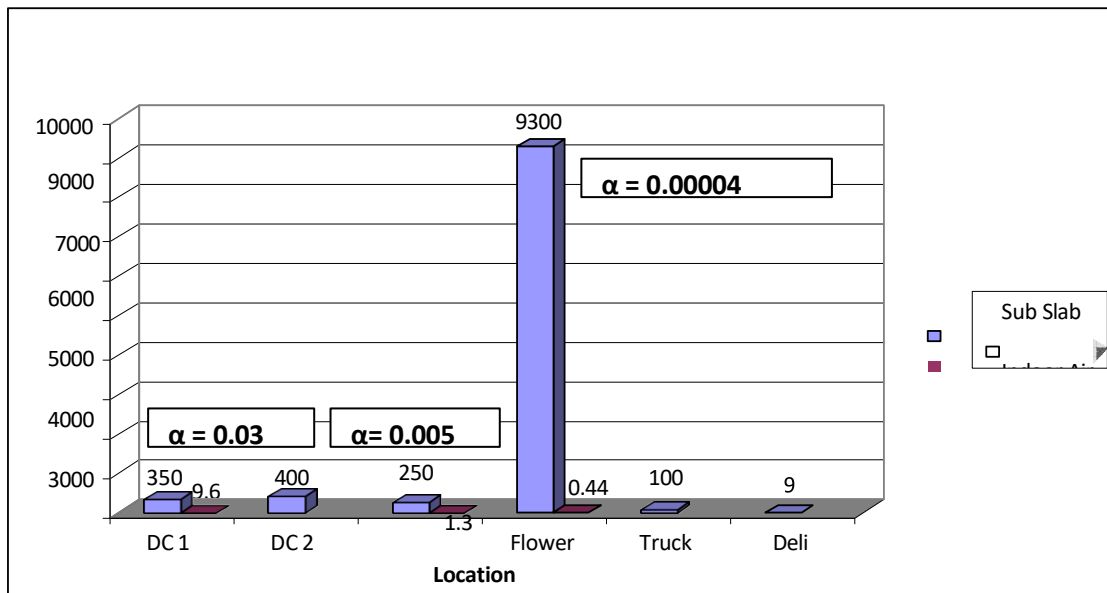
Attenuation factors were developed to provide an indication of the effectiveness of the concrete slab at retarding transport of impacted soil gas through the slab and into the building. The attenuation factors will vary depending on slab construction, age and presence of cracks and expansion joints. Attenuation factors are generally considered as one line of evidence to support the presence of vapor intrusion. For example, an α greater than 0.01 indicates a likely indoor source of the VOC<sup>7,8</sup> identified whereas an α <0.01 indicates the possibility that contaminants in subsurface soil gas are migrating upward through the slab. Based on the data collected as part of this sampling and analysis, α's for PCE at the dry cleaner, flower shop and the veterinary clinic were calculated to be 0.03, 0.0000473 and 0.005 respectively. Thus the α for the former dry cleaner space suggests that porous surfaces (sheetrock, exposed wood) may have retained dry cleaning chemicals emitted during normal operations and are gradually releasing them to the indoor air over time. A graphical depiction of site-specific α's is presented in the following table.

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<sup>7</sup> *Recommendations for the Investigation of Vapor Intrusion*, Dr. Thomas McHugh, GSI Environmental, Inc. for US Department of Defense Project ER-0423, April 2008.

<sup>8</sup> *Multiple Lines of Evidence for Evaluating A Vapor Intrusion Scenario-Case Studies*, Shukla Roy-Semmen, Chawn Y. Jeng and Gerald Pollack, Society of Toxicology, March 2009

### PCE In Sub-Slab and Indoor Air



Data collected during the June 2009 Sampling and analysis is summarized in **Table 1** (Indoor and Outdoor Air) and **Table 2** (Sub-slab and Exterior Soil Gas).

At DEQs request, draft data tables from the June 2009 sampling and analysis were submitted in advance of the completed report on July 22, 2009. The complete *Vapor Intrusion Assessment Report, Edgewood Shopping Center, 366 E. 40<sup>th</sup> Avenue, Eugene, Oregon 97405*, was submitted to DEQ on behalf of the Edgewood Shopping Center LLC on August 6, 2009.

On July 28, 2009, DEQ issued the *Request for Soil Gas Sampling, Siegmund's Cleaners/Edgewood Shopping Center, 370 E. 40<sup>th</sup> Street, Eugene, Oregon*. The letter stated that "...the PCE concentrations were high enough that DEQ believes that additional work will be needed quickly" and requested that a work plan for additional soil gas sampling be prepared by August 7, 2009 to include the following:

- Collection of soil gas samples from depths of between 3 and 5 feet below the ground surface (bgs) immediately to the north of the offsite residences located at 295, 315, 345 and 375 E. 41<sup>st</sup> Street;
- Collection of a sufficient number of soil gas samples from depths of between 3 and 5 feet bgs along the east property line to adequately assess whether impacted soil gas is leaving the Site in this direction; and,
- Collection of a sufficient number of soil gas samples from depths of between 3 and 5 feet bgs along E. 40<sup>th</sup> Avenue and Donald Street to adequately assess whether or not impacted soil vapor is leaving the Site to the north and/or northeast.

On August 11, 2009, Stantec submitted the *Additional Soil Gas Sampling Work Plan, Edgewood Shopping Center, 366 E. 40<sup>th</sup> Avenue, Eugene, Oregon 97405*, to DEQ. Approval of the Work Plan was issued via

electronic mail on August 12, 2009, with the following considerations:

1. DEQ expressed concerns about installing a vapor sampling point using the method described which involves granulated bentonite. Therefore, a driven vapor sampling point method using hydrated bentonite was used.
2. The sampling along the north and east property looks very good. In fact, DEQ would be willing to accept two fewer sample points along the north property line and three fewer along the east property line. Based on this, Stantec reduced the number of sampling points to the north and east.
3. DEQ may request one additional residence to the east of the four identified in earlier correspondence be sampled for soil gas, and/or dropping the west most residence.

### **September 2009 Assessment**

On September 10, 2009, Stantec collected 11 soil gas samples (10 primary and 1 duplicate) along E. 40<sup>th</sup> Avenue, Donald Street and at residences identified as 315, 345 and 395 E. 41<sup>st</sup> in accordance with DEQ recommendations. Access to 395 E. 41<sup>st</sup> could not be arranged.

All work was performed in accordance with the approved Work Plan except for:

- Sample locations provided in the Work Plan were moved approximately 5 feet from the property boundaries due to the presence of landscape irrigation.
- Helium was used as the leak check compound instead of 1,1-difluoroethane (1,1-DFA) proposed in the Work Plan. The presence of relatively small concentrations of 1,1-DFA which are not indicative of a leak may potentially require elevation of laboratory reporting limits. Helium was added to the target analyte list and analyzed via ASTM D-1946 (modified).

Stantec retained the services of Cascade Drilling, Inc. of Portland, Oregon to advance temporary soil gas probes at all on-site locations using a track mounted Geoprobe drill rig equipped with a Post Run Tubing (PRT) sampling system. Probe installation and soil gas sampling were performed as follows:

- Probe rods were pushed vertically to a depth of approximately 5 feet below the ground surface.
- The probe rods were then retracted approximately 2 inches and a metal rod was then inserted to push out the expendable drive point.
- Vapor implants (Eon® Soil Vapor Probe SVP 105) consisted of a stainless-steel drive point, vapor port and screen and Teflon umbrella (to prevent debris clogging the screen) connected to ¼ inch Teflon tubing. Following emplacement, the borehole was filled with 6-12 inches of sand pack followed by dry granular Bentonite to a depth of approximately 6 inches from the ground surface. The remainder of the borehole was then filled with hydrated Bentonite and finished with a top layer of concrete slurry.

Following collection, all canisters were submitted to Air Toxics Ltd of Folsom, California under chain-of-custody control for analysis of VOCs using U.S. EPA Method TO-15 (Full Scan).

### **Results**

Review of the laboratory data indicates that appropriate QA/QC procedures were followed; there were no departures from the US EPA methodology; the level of sample dilution was appropriate for the volume

collected; and, the specified method reporting limits were achieved. Results of the indoor air and soil vapor primary and duplicate samples were comparable. None of the target analytes were detected in the laboratory blanks associated with the sample analysis. The data set is thus considered adequate for its intended use.

Prior to receipt of the laboratory analytical results, on September 15, 2009, DEQ issued revised Risk-Based Concentrations (RBCs) which included soil gas screening levels to address vapor intrusion into buildings in residential, urban residential and occupational use.

Laboratory analysis identified the highest concentrations of PCE at SV-3 (720  $\mu\text{g}/\text{m}^3$ ) located at the northeast corner of E. 40<sup>th</sup> and Donald Streets and at SV-7 (670  $\mu\text{g}/\text{m}^3$ ) located along the Site east property line abutting Donald Street. None of the detected concentrations of VOCs exceeded the newly established RBCs for soil gas. The results however indicated that the lateral extent of soil gas impacted by PCE has not been defined in these directions.

PCE was identified, albeit at very low concentrations (8.4 and 39  $\mu\text{g}/\text{m}^3$ ), near the southern edges of 345 and 395 E. 41<sup>st</sup> Street.

PCE detections in soil gas are depicted on **Figure 2**. A summary of the results of laboratory analysis is presented in **Table 3**.

### **November 2009 Assessment**

To further assess the potential for intrusion of soil gas impacted by chlorinated solvents into the residences directly to the south of the Edgewood Shopping Center (315, 345, 375 and 395 E. 41<sup>st</sup> Street), Stantec collected time-integrated samples of air within the crawlspaces of these residences. Although collection of indoor air samples was initially discussed, crawlspace air should be less affected by household chemical use or lifestyle choices such as smoking and is often used as a substitute for sub-slab sampling and indoor air sampling. For screening of possible human health risk, the US EPA<sup>9</sup> applies an attenuation factor of 1.0 to detected chemicals in crawlspace samples. Thus the indoor air quality is assumed to be equal to the crawl space air for evaluation purposes.

On November 13, 2009, Stantec at the request of DEQ, collected soil gas samples from approximately 5 feet below ground surface across E. 40<sup>th</sup> Avenue at a duplex located at 445 E. 40<sup>th</sup> Avenue; at the Edgewood Daycare; and, at the Eugene Unitarian Church located approximately 120 feet to the east of

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<sup>9</sup> *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*, US EPA Office of Solid Waste and Emergency Response, November 2002.

**Reference:** Vapor Intrusion Summary Report

the subject property. Based on a review of the laboratory report, DEQ requested that a Work Plan be prepared to further evaluate possible vapor intrusion at the duplex, daycare center and at the two condominium buildings (Edgewood Villa) located immediately across Donald Street to the east of the Edgewood Shopping Center.

## Results

### *Crawlspace and Ambient Air*

PCE was detected in all crawlspace air samples and the ambient (outdoor) air sample at concentrations ranging from 1.0 to 1.3  $\mu\text{g}/\text{m}^3$ . Compounds detected above the laboratory method reporting limits: benzene, toluene, ethylbenzene, m,p-xylenes, o-xylene and carbon tetrachloride, were detected both in crawlspace and ambient air at essentially the same concentrations.

### *Shallow Soil Gas (5 feet below ground surface)*

Laboratory analysis detected PCE at 8,400  $\mu\text{g}/\text{m}^3$  near the duplex and 51  $\mu\text{g}/\text{m}^3$  near the daycare center. Both concentrations are above the Oregon DEQ residential risk-based concentration for soil vapor (RBC<sub>sv</sub>). No PCE was detected above laboratory method reporting limits on the church property.

## December 2009 Assessment

On December 8, 2009 Stantec submitted the *Off-Site Vapor Intrusion Assessment Work Plan, Edgewood Shopping Center, 366 E. 40<sup>th</sup> Avenue, Eugene, OR 97405* to DEQ. Following review, on December 9, 2009 DEQ issued approval of the Work Plan with the following considerations:

- DEQ facilitation of access extends only to contacting owners and/or renters to advise them that Stantec will be contacting them directly to arrange access with adequate advance notice (*emphasis added by DEQ*); and,
- DEQ recommends that two samples be collected in each condominium unit (one from the beneath the center of the structure and one from near the wall nearest the source contamination) unless field conditions dictate otherwise.

On December 15 and 16, 2009 Stantec collected the following samples:

- Edgewood Daycare Center: 1 indoor and 1 crawlspace air sample
- Duplex at 435/445 E. 40<sup>th</sup> Ave. 2 indoor and 1 crawlspace air sample (shared crawlspace)
- Condominium at 4023 Donald St. 1 indoor air and 1 sub-slab soil gas sample
- Condominium at 4083 Donald St. 1 indoor air and 1 sub-slab soil gas sample
- Wells Fargo ATM 1 outdoor air sample

## Results

### *Indoor and Crawlspace Air*

**Reference:** Vapor Intrusion Summary Report

Laboratory analysis identified carbon tetrachloride, benzene, methylene chloride, PCE and vinyl chloride at concentrations above the DEQ RBC for urban residential air. Except for vinyl chloride and PCE, all detected chemicals were also present, albeit at lower concentrations, in the outdoor air sample indicating that these VOCs are entering the building through normal ventilation and/or infiltration around window and doors.

### *Sub-Slab Soil Gas*

Methylene chloride, PCE and 1,1,1-trichloroethane were detected in sub-slab soil gas samples; however, none of the reported concentrations of these chemicals exceeded DEQ RBCs for urban residential soil gas.

### **Conclusions**

The presence of PCE and vinyl chloride in crawlspace air at the day care center but not in outdoor air suggests that these compounds may originate from transport of subsurface soil gas through the exposed-soil floor and into the crawlspace. The other chemicals detected in the crawlspace air samples collected from the day care and the two duplexes were detected at similar concentrations in both crawlspace and outdoor air samples.

### **February 2010 Sampling and Analysis**

On February 24, 2010 and February 25, 2010, Stantec performed an additional round of indoor air and sub-slab soil gas sampling at the following locations:

- Edgewood Daycare Center: 2 indoor and 1 crawlspace air sample
- Condominium at 4023 Donald St. 3 indoor air and 3 sub-slab soil gas samples
- Condominium at 4083 Donald St. 1 indoor air and 1 sub-slab soil gas sample
- Former Dry Cleaner Space 1 indoor air and 2 sub-slab soil gas samples
- Flower Shop 1 indoor air and 1 sub-slab soil gas sample
- Beauty Salon 1 indoor air and 1 sub-slab soil gas sample

The objective of the further sampling was to assist in determining:

- Temporal variability of contaminants previously detected in the Edgewood Daycare Center, former dry cleaner and flower shop. Samples were previously collected from these locations during a warm weather month, and it was necessary to evaluate changes both in indoor air and in sub-slab soil gas during the colder weather when outside ventilation is reduced, and the heating systems are in operation;
- If impacted soil gas was present below the previously un-assessed beauty salon. This tenant space adjoins the flower shop where elevated concentrations of PCE were detected previously. In addition, an indoor air sample was collected to evaluate quality of indoor air within that tenant space and if soil gas impacted by PCE was detected in the sub-slab soil gas sample, if there was evidence of vapor intrusion of soil gas into the interior of the space.
- The extent of PCE in soil gas below the two condominium buildings and if present to evaluate possible evidence of vapor intrusion into the residences where samples were collected.

Reference: Vapor Intrusion Summary Report

Although it was anticipated that 3 sub-slab soil gas samples would be collected in the condominium building at 4083 Donald Street, it was not possible to penetrate the slab for sample collection in 2 of the 3 locations approved for sampling by the condominium owners. As such, only indoor air samples were collected in these locations.

## Results

### Indoor Air

Laboratory analysis did not detect vinyl chloride, 1,1-dichloroethene, 1,1-dichloroethane, *cis* 1,2-dichloroethene, 1,1,2,2-tetrachloroethane, *trans* 1,2-dichloroethene or 1,2-dibromoethane (ethylene dibromide) above laboratory method reporting limits in any indoor air or crawlspace air sample.

Of the remaining compounds detected in one or more indoor or crawlspace air samples, benzene, trichloroethylene, and tetrachloroethylene were detected at concentrations exceeding the Oregon DEQ Risk Based Concentrations for indoor air in buildings in residential use (RBC<sub>Air</sub>).

### Sub-Slab Soil Gas

Tetrachloroethylene and/or trichloroethylene were detected in sub-slab soil gas samples collected from 2 locations in the Edgewood Villa Condominium building located at 4023 Donald Street (SS-1 and SS-4); in one sample collected from the Edgewood Villa Condominium building located at 4083 Donald Street (SS-5); the flower shop (SS-8); and, in the former dry cleaner space (SS-6 and SS-7). The crawlspace sample collected from beneath the Edgewood Day Care (CS-1) may be considered as a soil gas sample as well since it was collected immediately above the crawlspace dirt floor. Neither PCE nor TCE were detected in these samples at concentrations at or above DEQ RBC's established for either residential or commercial use.

Indoor air and soil gas results are summarized in **Table 6**. Laboratory results for PCE and TCE are also depicted along with sample locations on **Figures 4 and 5**.

## SUMMARY AND CONCLUSIONS

Based on the data collected to date, Stantec has developed the following conclusions:

- Releases of PCE to soil and groundwater have resulted in the presence of PCE in the vapor phase (soil gas).
- PCE has been detected at concentrations above Oregon DEQ RBCs in the day care crawlspace and at similar concentrations in the indoor air. PCE was not detected in the outdoor air sample collected near the day care. These findings are evidence suggesting that the vapor intrusion pathway may be complete at this location. Although a quantitative evaluation of risk has not been performed, because of the sensitive nature of receptors at this location and the fact that PCE in indoor air has exceeded the RBC, the DEQ has elected to require mitigation measures for the day care. Although an extensive mitigation system was originally proposed by DEQ, Stantec recommended placement of a cost-effective vapor barrier in the crawlspace along with performance monitoring which was subsequently approved by DEQ. A copy of the Vapor Intrusion Mitigation Work Plan is included in

August 13, 2010 Mr.  
Robert Breeden Page  
14 of 16

**Reference: Vapor Intrusion Summary Report**

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Ross Simmons  
Principal Consultant

PHV/ald

Attachment:

**Reference: Vapor Intrusion Summary Report**

## **REFERENCES**

McHugh, T.E. et al, 2004, *An Empirical Analysis of the Groundwater-to-Indoor Air Exposure Pathway: The Role of Background Concentrations in Indoor Air*, Environmental Forensics 5:33-44

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Stantec 2008, *Additional Phase II Environmental Site Assessment*, October 28, 2008.

Shah and Singh, 1988, *Distribution of Volatile Organic Chemicals In Outdoor and Indoor Air*, Environmental Science and Technology, v22 (12):1381-1388

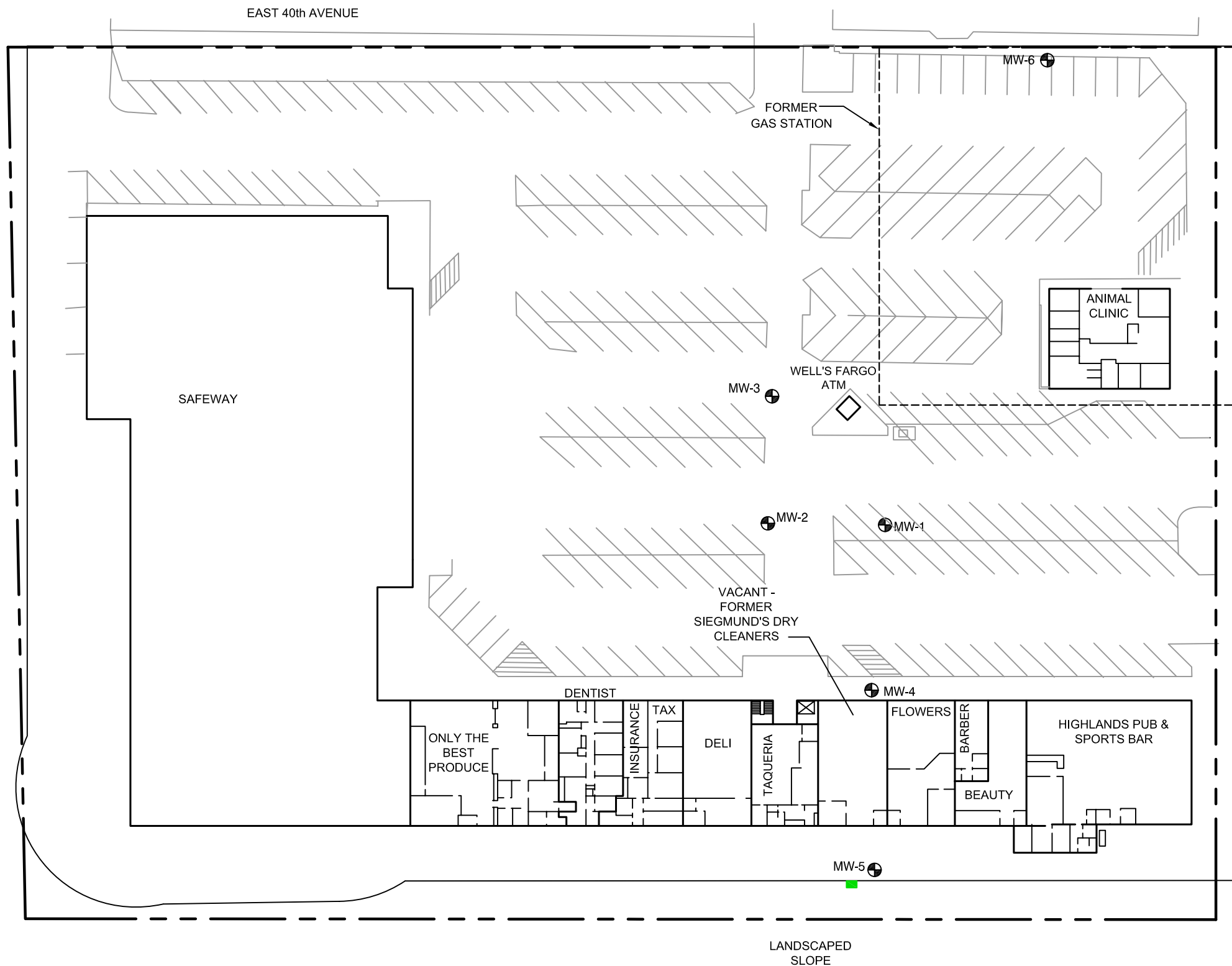
U.S. EPA 1998, *A Comparison of Indoor and Outdoor Concentrations of Hazardous Air Pollutants*.

Weisel, C., 2005, *Relationship of Indoor, Outdoor, and Personal Air*, Health Effects Institute, November

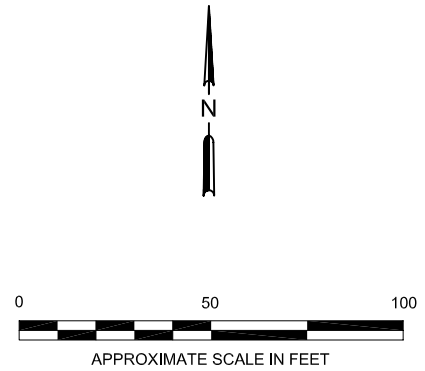



**Stantec**

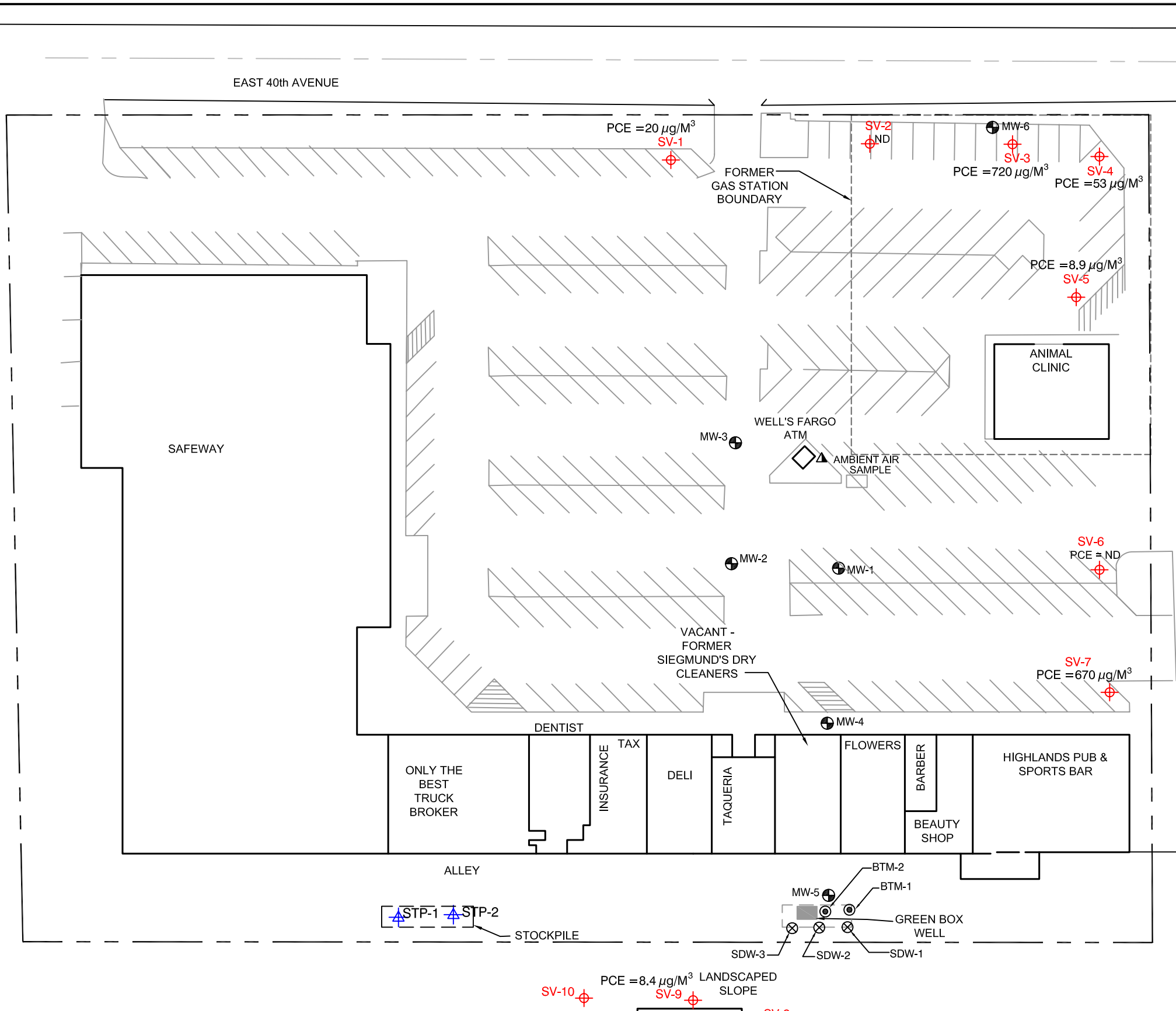
## **FIGURES**



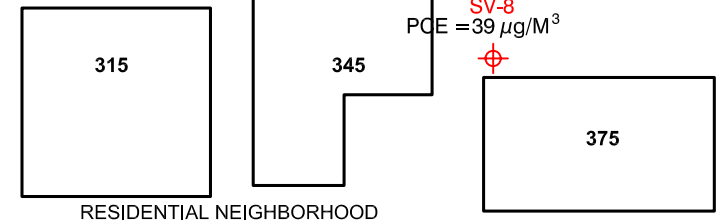
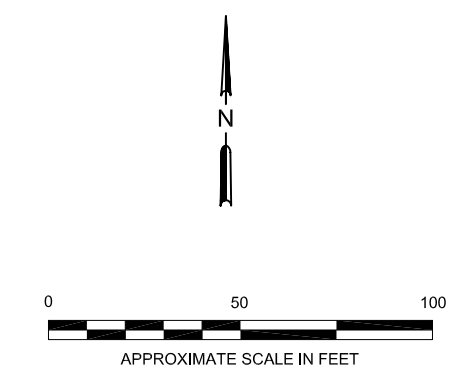
**LEGEND:**  
 - - - - - SITE BOUNDARY LINE  
 MW-3 ● MONITORING WELL LOCATION



|  |   |                      |                       |                            |                     |
|--|---|----------------------|-----------------------|----------------------------|---------------------|
| <br><b>Stantec</b><br>9400 SW BARNES ROAD<br>PORTLAND, OREGON<br>PH (503) 297-1631/FAX (503) 297-5429 | FOR:<br>BREEDEN BROTHERS, INC.<br>EDGEWOOD SHOPPING CENTER<br>350-390 E 40th AVENUE<br>EUGENE, OREGON |                      | <b>SITE PLAN</b>      |                            | FIGURE:<br><b>1</b> |
|  | JOB NUMBER:<br>187902018  | DRAWN BY:<br>DJH/ARA | CHECKED BY:<br>A.ZACH | APPROVED BY:<br>P. VAUGHAN | DATE:<br>5/21/09    |



- LEGEND:**
- SITE BOUNDARY LINE
  - MW-3 ● MONITORING WELL LOCATION
  - SV-1 ⊕ SOIL GAS SAMPLE LOCATION
  - STP-1 ⊕ STOCKPILE SAMPLE LOCATION
  - BTM-1 ⊙ BOTTOM OF EXCAVATION SAMPLE LOCATION (9-16-09)
  - SDW-1 ⊗ SIDEWALL SAMPLE FROM EXCAVATION (9-16-09)
  - ▲ AMBIENT AIR SAMPLE LOCATION (9-16-09)
  - ND NOT DETECTED
- THEORETICAL AND MEASURED PCE IN SOIL GAS



FOR: BREEDEN BROTHERS, INC.  
 EDGEWOOD SHOPPING CENTER  
 350-390 E 40th AVENUE  
 EUGENE, OREGON

JOB NUMBER: 187902018    DRAWN BY: DJH



**PCE SOIL GAS RESULTS  
 (SEPTEMBER 10, 2009)**

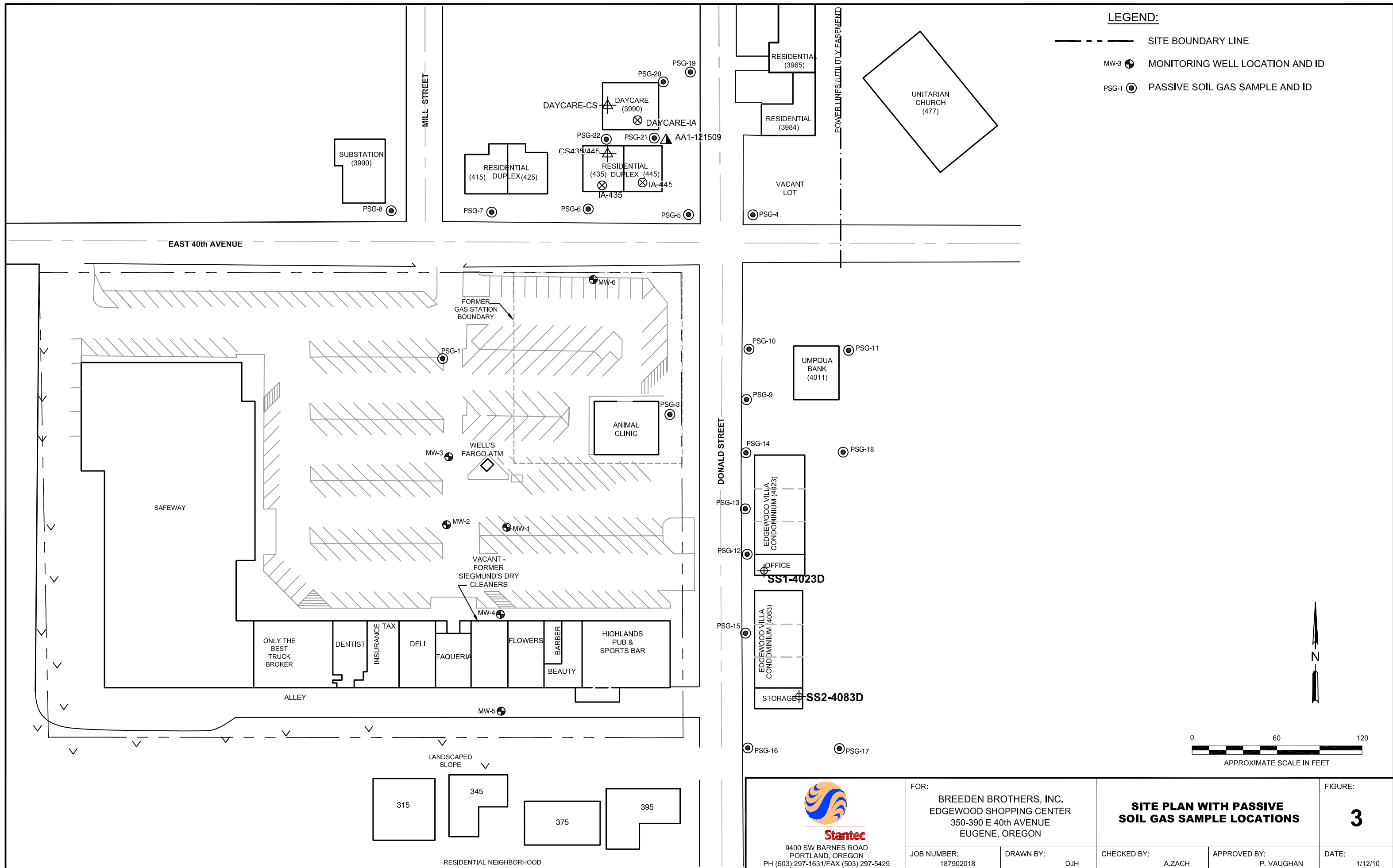
CHECKED BY: A.ZACH    APPROVED BY: P. VAUGHAN

FIGURE: **2**

DATE: 10/1/09

**LEGEND:**

- SITE BOUNDARY LINE
- MW-3  MONITORING WELL LOCATION AND ID
- PSG-1  PASSIVE SOIL GAS SAMPLE AND ID



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350-390 E 40th AVENUE  
EUGENE, OREGON

JOB NUMBER:  
187902018

DRAWN BY:  
DJH

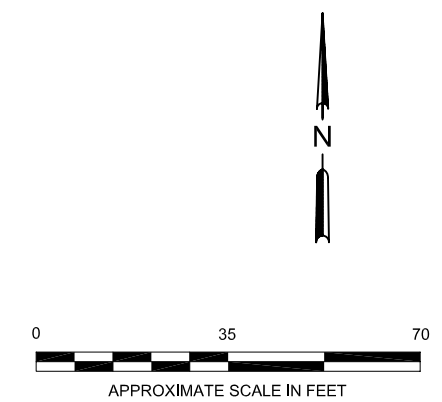
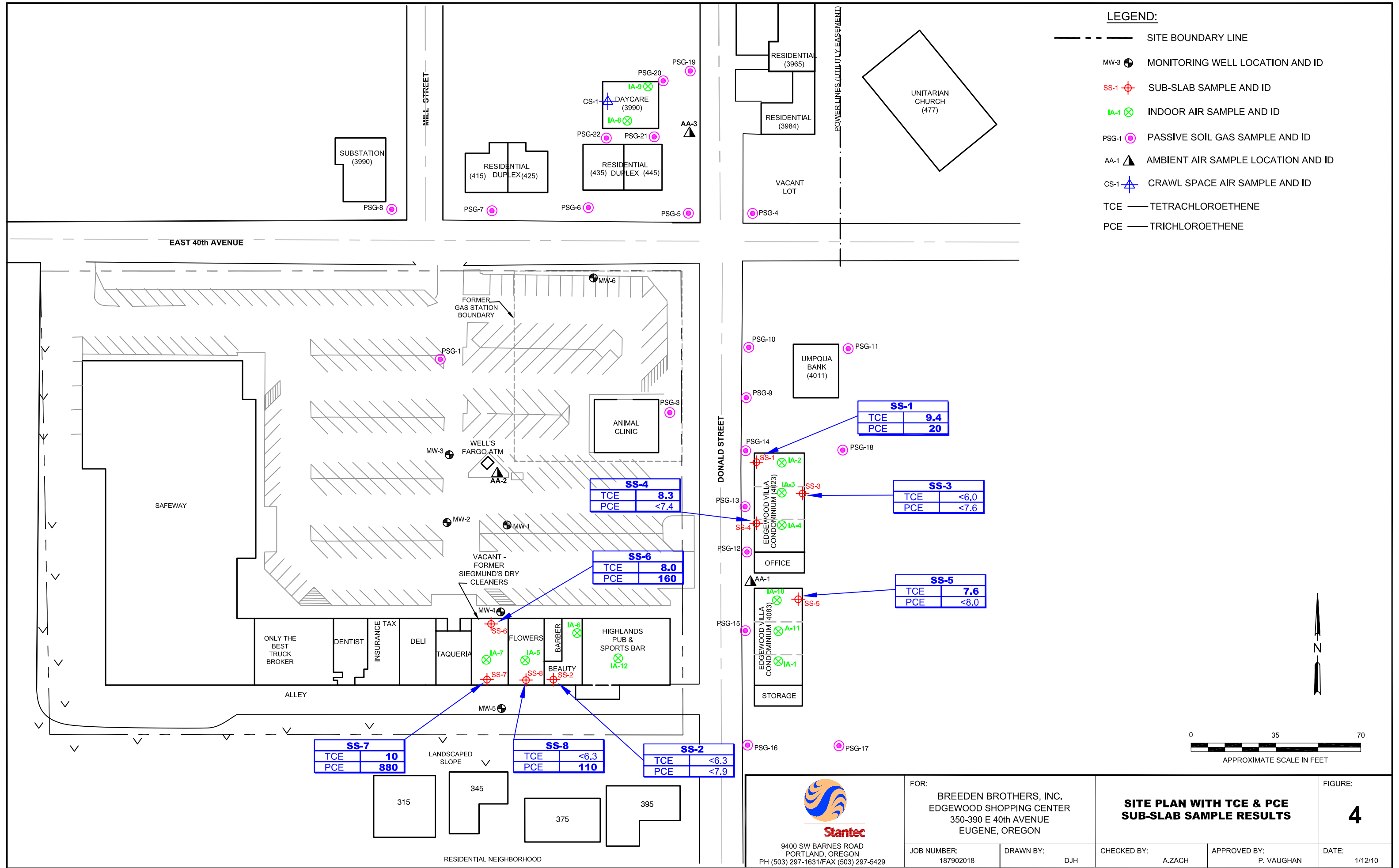
CHECKED BY:  
A.ZACH

APPROVED BY:  
P. VAUGHAN

FIGURE:  
**3**  
DATE:  
1/12/10

**LEGEND:**

- SITE BOUNDARY LINE
- MW-3 MONITORING WELL LOCATION AND ID
- SS-1 SUB-SLAB SAMPLE AND ID
- IA-1 INDOOR AIR SAMPLE AND ID
- PSG-1 PASSIVE SOIL GAS SAMPLE AND ID
- AA-1 AMBIENT AIR SAMPLE LOCATION AND ID
- CS-1 CRAWL SPACE AIR SAMPLE AND ID
- TCE — TETRACHLOROETHENE
- PCE — TRICHLOROETHENE



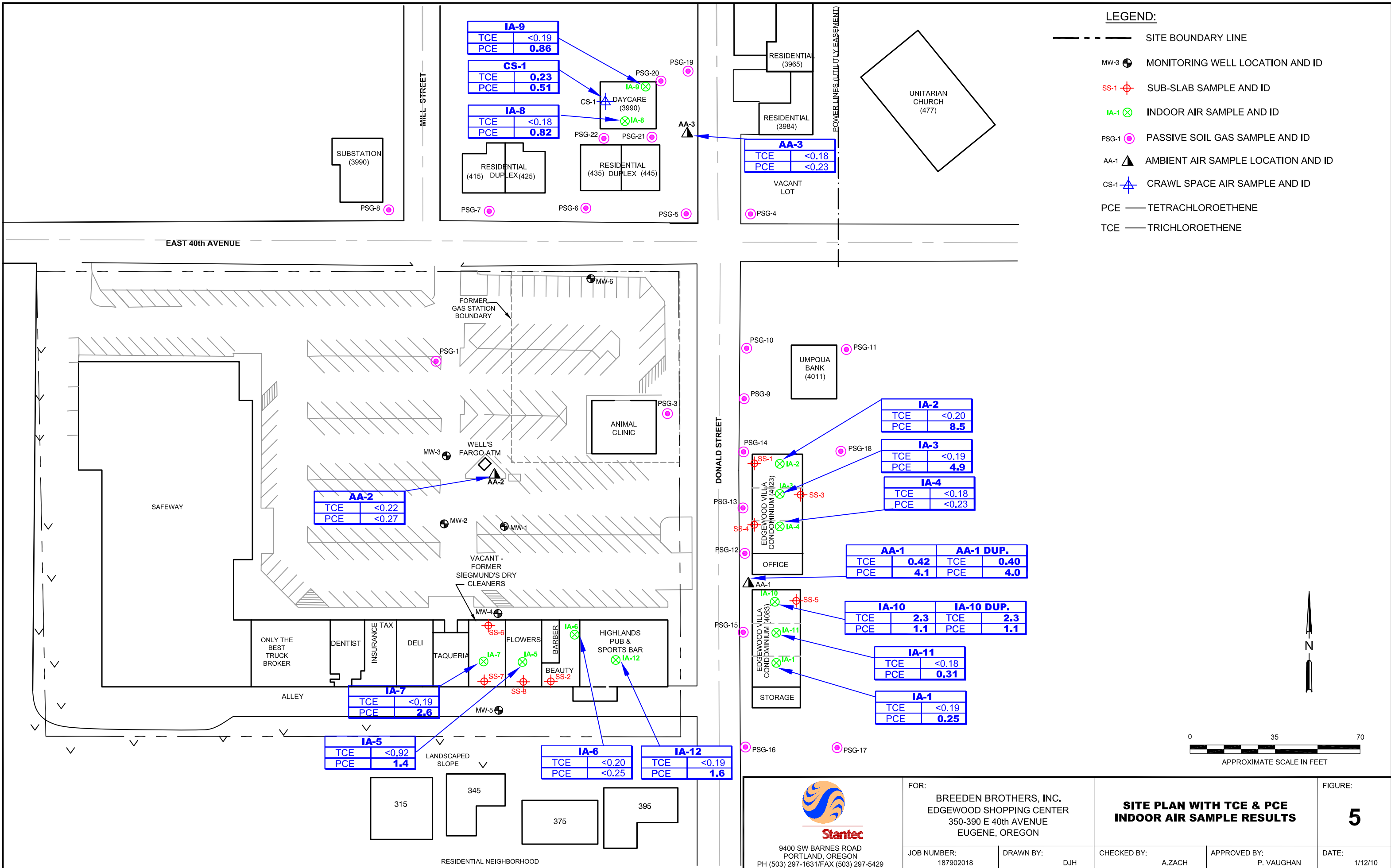
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EDGEWOOD SHOPPING CENTER  
350-390 E 40th AVENUE  
EUGENE, OREGON

**SITE PLAN WITH TCE & PCE  
SUB-SLAB SAMPLE RESULTS**

FIGURE:  
**4**

|                          |                  |                       |                            |                  |
|--------------------------|------------------|-----------------------|----------------------------|------------------|
| JOB NUMBER:<br>187902018 | DRAWN BY:<br>DJH | CHECKED BY:<br>A.ZACH | APPROVED BY:<br>P. VAUGHAN | DATE:<br>1/12/10 |
|--------------------------|------------------|-----------------------|----------------------------|------------------|



|  |  |                  |   |                            |                     |
|--|--|------------------|---|----------------------------|---------------------|
| <p>9400 SW BARNES ROAD<br/>PORTLAND, OREGON<br/>PH (503) 297-1631/FAX (503) 297-5429</p> | FOR:<br><b>BREEDEN BROTHERS, INC.</b><br>EDGEWOOD SHOPPING CENTER<br>350-390 E 40th AVENUE<br>EUGENE, OREGON |                  | <b>SITE PLAN WITH TCE &amp; PCE<br/>INDOOR AIR SAMPLE RESULTS</b> |                            | FIGURE:<br><b>5</b> |
|  | JOB NUMBER:<br>187902018   | DRAWN BY:<br>DJH | CHECKED BY:<br>A.ZACH   | APPROVED BY:<br>P. VAUGHAN | DATE:<br>1/12/10    |



**Stantec**

Draft

**TABLES**

**Table 1. Indoor Air Sample Data Summary  
Edgewood Shopping Center  
June 17, 2009  
(All results expressed as ug/m3)**

| EPA Method TO-15          | DEQ RBCs <sup>1</sup> | Vet Clinic  | Vet Clinic Dup | Flower Shop | Deli Shop   | Produce Only | Breeden Off | Taqueria    | Cleaners    | Ambient Air |
|---------------------------|-----------------------|-------------|----------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|
| ANALYTE                   | (µg/m <sup>3</sup> )  | IA-1        | IA-1 DUP       | IA-2        | IA-3        | IA-4         | IA-5        | IA-6        | IA-7        | AA          |
| Vinyl Chloride            | 2.7                   | <0.043      | <0.043         | <0.044      | <0.046      | <0.045       | <0.042      | <0.049      | <0.055      | <0.055      |
| 1,1-dichloroethene        | 830                   | <0.067      | <0.067         | <0.068      | <0.071      | <0.069       | <0.065      | <0.076      | <0.086      | <0.086      |
| 1,1-dichloroethane        | 7.3                   | <0.14       | <0.14          | <0.14       | <0.14       | <1.4         | <0.13       | <0.15       | <0.18       | <0.18       |
| cis -1,2-dichloroethene   | 150                   | <0.13       | <0.13          | <0.14       | <b>0.40</b> | <1.4         | <0.13       | <0.15       | <0.17       | <0.17       |
| 1,1,1-trichloroethane     | 9,200                 | <0.18       | <0.18          | <0.19       | <0.20       | <0.19        | <b>0.28</b> | <0.21       | <0.24       | <0.24       |
| Benzene                   | 1.5                   | <b>1</b>    | <b>1</b>       | <b>0.88</b> | <b>0.85</b> | <b>0.56</b>  | <b>0.44</b> | <b>0.59</b> | <b>0.78</b> | <b>1.0</b>  |
| 1,2-dichloroethane        | 0.26                  | <b>0.48</b> | <b>0.49</b>    | <b>0.57</b> | <0.14       | <b>0.14</b>  | <0.13       | <0.15       | <0.18       | <b>0.18</b> |
| Trichloroethene           | 0.10                  | <0.18       | <0.18          | <0.18       | <b>0.76</b> | <0.19        | <0.18       | <0.20       | <0.23       | <0.23       |
| Toluene                   | 20,000                | <b>31</b>   | <b>31</b>      | <b>22</b>   | <b>7.2</b>  | <b>9.3</b>   | <b>2.1</b>  | <b>2.4</b>  | <b>2.5</b>  | <b>12</b>   |
| Tetrachloroethene         | 1.9                   | <b>1.3</b>  | <b>1.3</b>     | <b>0.44</b> | <0.24       | <0.24        | <0.22       | <b>0.52</b> | <b>9.6</b>  | <0.29       |
| Ethylbenzene              | 4.6                   | <b>2.7</b>  | <b>2.8</b>     | <b>1.4</b>  | <b>0.44</b> | <b>0.71</b>  | <b>0.17</b> | <b>0.23</b> | <b>0.33</b> | <b>0.84</b> |
| m,p-xylene                | 420                   | <b>4.2</b>  | <b>4.4</b>     | <b>3.0</b>  | <b>1.1</b>  | <b>1.5</b>   | <b>0.48</b> | <b>0.59</b> | <b>0.71</b> | <b>1.5</b>  |
| o-xylene                  | 420                   | <b>1.5</b>  | <b>1.5</b>     | <b>1.2</b>  | <b>0.38</b> | <b>0.50</b>  | <b>0.15</b> | <b>0.21</b> | <b>0.31</b> | <b>0.52</b> |
| 1,1,2,2-tetrachloroethane | NE                    | <0.23       | <0.23          | <0.23       | <0.24       | <0.24        | <0.22       | <0.26       | <0.30       | <0.30       |
| trans -1,2-dichloroethene | 250                   | <0.67       | <0.67          | <0.68       | <0.71       | <0.69        | <0.65       | <0.76       | <0.86       | <0.86       |
| 1,4-dichlorobenzene       | 1.7                   | <0.20       | <0.20          | <b>0.20</b> | <b>0.28</b> | <0.21        | <b>0.54</b> | <b>0.24</b> | <0.26       | <0.26       |
| Carbon tetrachloride      | 0.77                  | <b>0.6</b>  | <b>0.59</b>    | <b>0.51</b> | <b>0.57</b> | <b>0.53</b>  | <b>0.54</b> | <b>0.54</b> | <b>0.52</b> | <b>0.50</b> |
| Methylene chloride        | 26                    | <b>2.6</b>  | <b>2.6</b>     | <b>1.6</b>  | <1.2        | <1.2         | <b>1.4</b>  | <1.3        | <1.5        | <1.5        |
| 1,2-dibromoethane         | 0.020                 | <0.26       | <0.26          | <0.26       | <0.28       | <0.27        | <0.25       | <0.29       | <0.33       | <0.33       |

1. Oregon DEQ Risk Based Concentrations-Air in Occupational Use (µg/m<sup>3</sup>)

NE = Not established

Concentration exceeds Oregon DEQ RBC<sub>air</sub>

**Table 2. Sub-Slab and Exterior Soil Vapor Data Summary  
Edgewood Shopping Center  
June 17, 2009  
(all results expressed as ug/m3)**

| ANALYTE                          | Soil Vapor 1    | Soil Vapor 2  | Soil Vapor 2 Dup | SS-1          | SS-2              | SS-2 Dup         | SS-3           | SS-4            | SS-5           | SS-6           | SS-7           |
|----------------------------------|-----------------|---------------|------------------|---------------|-------------------|------------------|----------------|-----------------|----------------|----------------|----------------|
|                                  | Exterior        | Exterior      | Exterior         | Cleaner       | Cleaner-Back Room | Back Room Dup    | Vet Outside    | Flower Shop     | Taqueria       | Truck broker   | Deli           |
| Vinyl Chloride                   | <2.7            | <110          | <220             | <2.7          | <3.3              | <22              | <2.8           | <11             | <2.8           | <2.8           | <2.8           |
| 1,1-dichloroethene               | <4.2            | <170          | <340             | <4.2          | <5.2              | <34              | <4.3           | <17             | <4.4           | <4.3           | <4.4           |
| Methylene chloride               | <3.7            | <150          | <300             | <3.7          | <4.5              | <30              | <3.8           | <15             | <3.8           | <3.8           | <3.9           |
| <i>trans</i> -1,2-dichloroethene | <4.2            | <170          | <340             | <4.2          | <5.2              | <34              | <4.3           | <17             | <4.4           | <4.3           | <4.4           |
| 1,1-dichloroethane               | <4.3            | <170          | <350             | <4.3          | <5.3              | <35              | <4.4           | <17             | <4.4           | <4.4           | <4.5           |
| <i>cis</i> -1,2-dichloroethane   | <4.2            | <170          | <340             | <4.2          | <5.2              | <34              | <4.3           | <17             | <4.4           | <4.3           | <4.4           |
| 1,1,1-trichloroethane            | <5.8            | <230          | <470             | <5.8          | <7.1              | <47              | <5.9           | <24             | <6.0           | <5.9           | <6.1           |
| Carbon tetrachloride             | <6.7            | <270          | <540             | <6.7          | <8.2              | <54              | <6.8           | <27             | <6.9           | <6.8           | <7.0           |
| Benzene                          | <3.4            | <140          | <270             | <3.4          | <b>9.4</b>        | <28              | <3.4           | <14             | <3.5           | <3.4           | <3.6           |
| 1,2-dichloroethane               | <4.3            | <170          | <350             | <4.3          | <5.3              | <35              | <4.4           | <17             | <4.4           | <4.4           | <4.5           |
| Trichloroethene                  | <5.7            | <b>270</b>    | <460             | <b>8.1</b>    | <b>12</b>         | <46              | <5.8           | <23             | <5.9           | <5.8           | <6.0           |
| Toluene                          | <4.0            | <160          | <320             | <b>14</b>     | <b>8.4</b>        | <32              | <4.1           | <16             | <4.1           | <4.1           | <4.2           |
| Tetrachloroethene                | <b>790</b>      | <b>79,000</b> | <b>88,000</b>    | <b>350</b>    | <b>360</b>        | <b>400</b>       | <b>250</b>     | <b>9,300</b>    | <7.5           | <b>100</b>     | <b>9.0</b>     |
| 1,2-dibromoethane                | <8.2            | <300          | <660             | <8.1          | <10               | <66              | <8.3           | <33             | <8.4           | <8.3           | <8.6           |
| Ethylbenzene                     | <4.6            | <190          | <370             | <4.6          | <5.7              | <38              | <4.7           | <19             | <4.8           | <4.7           | <4.8           |
| m,p-xylene                       | <4.6            | <190          | <370             | <4.6          | <5.7              | <38              | <4.7           | <19             | <4.8           | <4.7           | <4.8           |
| o-xylene                         | <4.6            | <190          | <370             | <4.6          | <5.7              | <38              | <4.7           | <19             | <4.8           | <4.7           | <4.8           |
| 1,1,2,2-tetrachloroethane        | <7.3            | <300          | <590             | <7.3          | <9.0              | <59              | <7.4           | <30             | <7.6           | <7.4           | <7.6           |
| 1,4-dichlorobenzene              | <6.4            | <260          | <520             | <6.4          | <7.8              | <52              | <6.5           | <26             | <6.6           | <6.5           | <6.7           |
| 1,1-difluoroethane               | <b>32</b>       | <460          | <930             | <b>2,400E</b> | <b>560</b>        | <b>140,000 E</b> | <b>3,300 E</b> | <b>13,000 E</b> | <b>2,000 E</b> | <b>8,100 E</b> | <b>2,900 E</b> |
| % 1,1-difluoroethane             | <b>0.000001</b> | <460          | <930             | <b>0.0080</b> | <b>0.000019</b>   | <b>0.0047</b>    | <b>0.0001</b>  | <b>0.0004</b>   | <b>0.0001</b>  | <b>0.0003</b>  | <b>0.0001</b>  |

Concentration exceeds Oregon DEQ RBC<sub>soil gas</sub>

**Table 3. Soil Gas Sampling Results  
Edgewood Shopping Center  
September 10, 2009**

| ANALYTE                          | SV-1              | SV-2 | SV-2 Dup | SV-3       | SV-4       | SV-5       | SV-6       | SV-7       | SV-8      | SV-9       | SV-10      | AA <sup>2</sup> |
|----------------------------------|-------------------|------|----------|------------|------------|------------|------------|------------|-----------|------------|------------|-----------------|
| Vinyl Chloride                   | <3.3 <sup>1</sup> | <3.9 | <3.3     | <3.5       | <3.6       | <3.1       | <3.2       | <3.2       | <3.0      | <3.2       | <3.2       | <1.7            |
| 1,1-dichloroethene               | <5.1              | <6.0 | <5.1     | <5.5       | <5.6       | <4.8       | <4.9       | <4.9       | <4.7      | <4.9       | <5.0       | <2.7            |
| Methylene chloride               | <4.5              | <5.3 | <4.5     | <4.8       | <4.9       | <4.2       | <4.3       | <4.3       | <4.1      | <4.3       | <4.4       | <2.4            |
| <i>trans</i> -1,2-dichloroethene | <5.1              | <6.0 | <5.1     | <5.5       | <b>39</b>  | <4.8       | <4.9       | <4.9       | <4.7      | <4.9       | <5.0       | <2.7            |
| 1,1-dichloroethane               | <5.2              | <6.1 | <5.2     | <5.6       | <5.7       | <4.9       | <5.0       | <5.0       | <4.8      | <5.0       | <5.1       | <2.8            |
| <i>cis</i> -1,2-dichloroethene   | <5.1              | <6.0 | <5.1     | <b>19</b>  | <b>37</b>  | <4.8       | <4.9       | <4.9       | <4.7      | <4.9       | <5.0       | <2.7            |
| 1,1,1-trichloroethane            | <7                | <8.3 | <7.0     | <7.5       | <7.7       | <6.6       | <6.7       | <6.7       | <6.5      | <6.7       | <6.9       | <3.7            |
| Carbon tetrachloride             | <8.1              | <9.5 | <8.1     | <8.7       | <8.9       | <7.6       | <7.8       | <7.8       | <7.5      | <7.8       | <8.0       | <4.3            |
| Benzene                          | <b>10</b>         | <4.8 | <4.1     | <b>5.9</b> | <b>8.3</b> | <b>17</b>  | <b>8.2</b> | <3.9       | <3.8      | <3.9       | <4.0       | <2.2            |
| 1,2-dichloroethane               | <5.2              | <6.1 | <5.2     | <5.6       | <5.7       | <4.9       | <5.0       | <5.0       | <4.8      | <5.0       | <5.1       | <2.8            |
| Trichloroethene                  | <6.9              | <8.1 | <6.9     | <b>55</b>  | <b>73</b>  | <6.5       | <6.6       | <6.6       | <6.4      | <6.6       | <6.8       | <3.6            |
| Toluene                          | <b>20</b>         | <5.7 | <4.9     | <b>9.4</b> | <b>20</b>  | <b>50</b>  | <b>19</b>  | <b>9.3</b> | <4.5      | <4.6       | <4.8       | <2.6            |
| Tetrachloroethene                | <b>20</b>         | <10  | <8.8     | <b>720</b> | <b>53</b>  | <b>8.9</b> | <8.4       | <b>670</b> | <b>39</b> | <b>8.4</b> | <8.6       | <4.6            |
| 1,2-dibromoethane                | <9.9              | <12  | <9.9     | <11        | <11        | <9.3       | <9.5       | <9.5       | <9.1      | <9.5       | <9.7       | <5.2            |
| Ethylbenzene                     | <b>5.7</b>        | <6.6 | <5.6     | <6.0       | <b>6.8</b> | <b>21</b>  | <5.4       | <5.4       | <5.2      | <5.4       | <5.5       | <3.0            |
| m,p-xylene                       | <b>13</b>         | <6.6 | <5.6     | <6.0       | <b>16</b>  | <b>52</b>  | <b>8.5</b> | <b>6.6</b> | <5.2      | <5.4       | <b>13</b>  | <3.0            |
| o-xylene                         | <b>6.3</b>        | <6.6 | <5.6     | <6.0       | <b>8.7</b> | <b>32</b>  | <5.4       | <5.4       | <5.2      | <5.4       | <b>5.9</b> | <3.0            |
| 1,1,2,2-tetrachloroethane        | <8.8              | <10  | <8.8     | <9.5       | <9.7       | <8.3       | <8.5       | <8.5       | <8.2      | <8.5       | <8.7       | <4.7            |
| 1,4-dichlorobenzene              | <7.8              | <9.1 | <7.8     | <8.3       | <8.5       | <7.3       | <7.4       | <7.4       | <7.2      | <7.4       | <7.6       | <4.1            |
| Chlorobenzene                    | <5.9              | <7.0 | <5.9     | <6.4       | <6.5       | <5.6       | <5.7       | <5.7       | <5.5      | <5.7       | <5.8       | <3.1            |
| MTBE                             | <4.6              | <5.5 | <4.6     | <5.0       | <5.1       | <4.4       | <4.4       | <4.4       | <4.3      | <4.4       | <4.6       | <2.4            |
| 1,2,4-Trichlorobenzene           | <38               | <45  | <38      | <41        | <42        | <36        | <37        | <37        | <35       | <37        | <38        | <20             |
| 1,2-Dichlorobenzene              | <7.8              | <9.1 | <7.8     | <8.3       | <8.5       | <7.3       | <7.4       | <7.4       | <7.2      | <7.4       | <7.6       | <4.1            |
| % Helium                         |                   |      |          |            |            |            |            |            |           |            |            |                 |

<sup>1</sup> All results expressed in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

<sup>2</sup> AA = Ambient (outdoor) air sample

< = Compound not detected above the laboratory reporting limit (in parenthesis)

**Table 4. Crawlspace, Ambient Air and Soil Gas Sampling Results  
Edgewood Shopping Center  
November 2009**

| <b>ANALYTE</b>            | <b>Crawlspace 315</b> | <b>Crawlspace 345</b> | <b>Crawlspace 375</b> | <b>Duplicate</b> | <b>AA <sup>1</sup></b> | <b>SV-13</b> | <b>SV-14</b> | <b>SV-15</b> |
|---------------------------|-----------------------|-----------------------|-----------------------|------------------|------------------------|--------------|--------------|--------------|
| Vinyl Chloride            | <0.041                | <0.041                | <0.045                | <0.044           | <0.047                 | <2.8         | <14          | <2.6         |
| 1,1-Dichloroethene        | <0.064                | <0.064                | <0.069                | <0.068           | <0.072                 | <4.3         | <21          | <4.0         |
| 1,1-Dichloroethane        | <0.13                 | <0.13                 | <0.14                 | <0.14            | <0.15                  | <4.4         | <22          | <4.1         |
| cis-1,2-Dichloroethene    | <0.13                 | <0.13                 | <0.14                 | <0.14            | <0.14                  | <4.3         | <21          | <4.0         |
| 1,1,1-Trichloroethane     | <0.18                 | <0.18                 | <0.19                 | <0.19            | <0.20                  | <5.9         | <29          | <5.5         |
| Benzene                   | <b>2.2</b>            | <b>2.3</b>            | <b>2.2</b>            | <b>2.1</b>       | <b>2.0</b>             | <b>3.9</b>   | <17          | <3.2         |
| 1,2-Dichloroethane        | <0.13                 | <0.13                 | <0.14                 | <0.14            | <0.15                  | <4.4         | <22          | <4.1         |
| Trichloroethene           | <0.17                 | <0.17                 | <0.19                 | <0.18            | <0.20                  | <5.8         | <b>150</b>   | <5.4         |
| Toluene                   | <b>5.4</b>            | <b>5.8</b>            | <b>6.0</b>            | <b>5.4</b>       | <b>6.4</b>             | <b>370</b>   | <20          | <b>310</b>   |
| Tetrachloroethene         | <b>1.2</b>            | <b>1.2</b>            | <b>1.2</b>            | <b>1.0</b>       | <b>1.3</b>             | <7.3         | <b>8,100</b> | <b>51</b>    |
| Ethyl Benzene             | <b>0.89</b>           | <b>0.95</b>           | <b>0.92</b>           | <b>0.89</b>      | <b>0.95</b>            | <4.7         | <23          | <4.4         |
| m,p-Xylene                | <b>2.7</b>            | <b>2.7</b>            | <b>2.7</b>            | <b>2.5</b>       | <b>2.5</b>             | <b>9.9</b>   | <23          | <b>6.5</b>   |
| o-Xylene                  | <b>0.98</b>           | <b>1.0</b>            | <b>0.96</b>           | <b>0.93</b>      | <b>0.89</b>            | <4.7         | <23          | <6.9         |
| 1,1,2,2-Tetrachloroethane | <0.22                 | <0.22                 | <0.24                 | <0.23            | <0.25                  | <7.4         | <37          | <4.0         |
| trans-1,2-Dichloroethene  | <0.64                 | <0.64                 | <0.69                 | <0.68            | <0.72                  | <4.3         | <32          | <4.0         |
| 1,4-Dichlorobenzene       | <0.19                 | <0.19                 | <0.21                 | <0.20            | <0.22                  | <6.5         | <21          | <6.1         |
| Carbon Tetrachloride      | <b>0.49</b>           | <b>0.52</b>           | <b>0.50</b>           | <b>0.49</b>      | <b>0.49</b>            | <6.8         | <34          | <6.4         |
| Methylene Chloride        | <1.1                  | <1.1                  | <1.2                  | <1.2             | <1.3                   | <3.8         | <19          | <3.5         |
| 1,2-Dibromoethane (EDB)   | <0.25                 | <0.25                 | <0.27                 | <0.26            | <0.28                  | <8.3         | <41          | <7.8         |

<sup>1</sup>. All results expressed in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

<sup>2</sup>. AA = Ambient (outdoor) air sample

< = Compound not detected above the laboratory reporting limit (in parenthesis)

Exceeds OR DEQ Residential  $\text{RBC}_{\text{soil vapor}}$

**Table 5. Indoor, Outdoor, Crawlspace Air and Sub-Slab Soil Gas Sample Results  
Edgewood Shopping Center  
December 15, 2009  
(Results expressed as ug/m3)**

| ANALYTE                          | DEQ RBC   | DEQ RBC   | Daycare     |             | 435         | 435/445     | 4023 D      |            |            | 4083 D      |                            | 445         | Ambient Air |
|----------------------------------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|------------|------------|-------------|----------------------------|-------------|-------------|
|                                  | Urban Air | Soil Gas  | IA          | CS          | IA          | CS          | IA          | SS         | SS DUP     | IA          | SS                         | IA          |             |
| Vinyl Chloride                   | 0.059     | 41        | <0.11       | <b>0.62</b> | <0.045      | <0.042      | <0.045      | <2.9       | <2.7       | <0.034      | <2.8                       | <0.047      | <0.049      |
| 1,1-dichloroethene               | 210       | 42,000    | <0.17       | <0.059      | <0.069      | <0.065      | <0.069      | <4.4       | <4.2       | <0.053      | <4.3                       | <0.072      | <0.076      |
| Methylene chloride               | 14        | 2,800     | <2.9        | <b>1.7</b>  | <1.2        | <1.1        | <1.2        | <3.9       | <3.6       | <b>27</b>   | <b>13</b>                  | <1.3        | <1.3        |
| <i>trans</i> -1,2-dichloroethene | 63        | 13,000    | <1.7        | <0.59       | <0.69       | <0.65       | <0.69       | <4.4       | <4.2       | <0.53       | <4.3                       | <0.72       | <0.76       |
| 1,1-dichloroethane               | 4.1       | 830       | <0.34       | <0.12       | <0.14       | <0.13       | <b>1.2</b>  | <4.5       | <4.2       | <0.11       | <4.4                       | <0.15       | <0.15       |
| <i>cis</i> -1,2-dichloroethene   | NE        | NE        | <0.34       | <0.12       | <0.14       | <0.13       | <0.14       | <4.4       | <4.2       | <0.11       | <4.3                       | <0.14       | <0.15       |
| 1,1,1-trichloroethane            | 5,200     | 1,000,000 | <0.46       | <0.16       | <0.19       | <0.18       | <b>95</b>   | <b>9.3</b> | <b>7.8</b> | <b>0.44</b> | <5.9                       | <0.20       | <0.21       |
| Carbon tetrachloride             | 0.82      | 88        | <b>5.4</b>  | <b>0.45</b> | <b>0.42</b> | <b>0.42</b> | <b>0.54</b> | <7.0       | <6.6       | <b>0.47</b> | <6.8                       | <b>0.44</b> | <b>0.45</b> |
| Benzene                          | 1.7       | 170       | <b>7.3</b>  | <b>1.0</b>  | <b>2.1</b>  | <b>0.71</b> | <b>0.65</b> | <3.6       | <3.4       | <b>0.82</b> | <3.4                       | <b>1.8</b>  | <b>0.63</b> |
| 1,2-dichloroethane               | 0.69      | 51        | <0.34       | <0.12       | <0.14       | <0.13       | <0.14       | <4.5       | <4.2       | <0.11       | <4.4                       | <0.15       | <0.15       |
| Trichloroethene                  | 0.18      | 15        | <0.45       | <0.16       | <0.19       | <0.18       | <0.19       | <6.0       | <5.6       | <0.14       | <5.8                       | <0.20       | <0.20       |
| Toluene                          | 4,600     | 1,000,000 | <b>29</b>   | <b>2.6</b>  | <b>10</b>   | <b>1.7</b>  | <b>3.7</b>  | <4.2       | <4.0       | <b>7.6</b>  | <4.1                       | <b>7.0</b>  | <b>0.97</b> |
| Tetrachloroethene                | 0.34      | 220       | <b>0.90</b> | <b>1.4</b>  | <0.24       | <b>0.28</b> | <0.24       | <7.6       | <b>67</b>  | <b>0.90</b> | <7.3                       | <0.25       | <0.26       |
| 1,2-dibromoethane                | 0.031     | 2.2       | <0.65       | <0.23       | <0.27       | <0.25       | <0.27       | <8.6       | <8.1       | <0.20       | <8.3                       | <0.28       | <0.29       |
| Ethylbenzene                     | 6.7       | 530       | <b>4.0</b>  | <b>0.44</b> | <b>1.4</b>  | <b>0.25</b> | <b>0.57</b> | <4.9       | <4.6       | <b>0.61</b> | <4.7                       | <b>0.87</b> | <b>0.17</b> |
| m,p-xylene                       | 100       | 21,000    | <b>14</b>   | <b>1.4</b>  | <b>5.0</b>  | <b>0.74</b> | <b>1.6</b>  | <4.9       | <4.6       | <b>1.9</b>  | <4.7                       | <b>2.7</b>  | <b>0.50</b> |
| o-xylene                         | 100       | 21,000    | <b>4.1</b>  | <b>0.44</b> | <b>1.7</b>  | <b>0.26</b> | <b>0.50</b> | <4.9       | <4.6       | <b>0.57</b> | <4.7                       | <b>1.0</b>  | <b>0.18</b> |
| 1,1,2,2-tetrachloroethane        | NE        | NE        | <0.58       | <0.20       | <0.24       | <0.22       | <0.24       | <7.7       | <7.2       | <0.18       | <7.4                       | <0.25       | <0.26       |
| 1,4-dichlorobenzene              | 2.3       | 120       | <0.51       | <0.18       | <0.21       | <0.20       | <b>0.32</b> | <6.7       | <6.3       | <b>0.26</b> | <6.5                       | <0.22       | <0.23       |
| Helium (%)                       | NE        | NE        | NS          | NS          | NS          | NS          | NS          | <0.11      | <0.10      | NS          | <b>0.29</b> <sup>(1)</sup> | NS          | NS          |

**Notes:**

RBC = Risk-Based Concentration

IA = Indoor Air

CS = Crawl Space

SS = Sub Slab

NS = Not Sampled

<sup>(1)</sup> Lab Report is mislabeled as SS2-4023D. The results are for SS2-4083D.

NE = Not Established

**Table 6. Indoor, Outdoor and Crawlspace Air Sample Results  
Edgewood Shopping Center  
February 24, 2010**

| COMPOUND                  | DEQ RBC Air Residential | DEQ RBC Air Commercial | CS-1        | AA-1        | AA-1 Lab Dup | All results in micrograms per cubic meter (ug/m <sup>3</sup> ) |             |             |            |             |             |             |             |             |             |             |              | IA-10 Lab Dup | IA-11       | IA-12       |
|---------------------------|-------------------------|------------------------|-------------|-------------|--------------|--|-------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|---------------|-------------|-------------|
|                           |                         |                        |             |             |              | AA-2   | IA-1        | AA-3        | IA-2       | IA-3        | IA-4        | IA-5        | IA-6        | IA-7        | IA-8        | IA-9        |              |               |             |             |
| Vinyl Chloride            | 0.2                     | 2.8                    | <0.046      | <0.043      | <0.043       | <0.051   | <0.046      | <0.044      | <0.047     | <0.045      | <0.043      | <0.22       | <0.047      | <0.046      | <0.043      | <0.046      | <b>0.067</b> | <0.080        | <0.044      | <0.045      |
| 1,1-Dichloroethene        | 210                     | 880                    | <0.071      | <0.067      | <0.067       | <0.080   | <0.071      | <0.068      | <0.072     | <0.069      | <0.067      | <0.34       | <0.072      | <0.071      | <0.067      | <0.071      | <b>0.19</b>  | <b>0.17</b>   | <0.068      | <0.069      |
| 1,1-Dichloroethane        | 4.1                     | 7.7                    | <b>0.19</b> | <0.14       | <0.14        | <0.16  | <0.14       | <0.14       | <0.15      | <0.14       | <0.14       | <0.69       | <0.15       | <0.14       | <0.14       | <0.14       | <0.15        | <0.25         | <0.14       | <0.14       |
| cis-1,2-Dichloroethene    | NE                      | NE                     | <0.14       | <0.13       | <0.13        | <0.16  | <0.14       | <0.14       | <0.14      | <0.14       | <0.13       | <0.68       | <0.14       | <0.14       | <0.13       | <0.14       | <0.15        | <0.25         | <0.14       | <0.14       |
| 1,1,1-Trichloroethane     | 5,200                   | 22,000                 | <0.20       | <0.18       | <0.18        | <0.22  | <b>0.25</b> | <0.19       | <0.20      | <0.19       | <0.18       | <0.93       | <0.20       | <0.20       | <0.18       | <0.20       | <b>0.52</b>  | <b>0.52</b>   | <0.19       | <0.19       |
| Benzene                   | 0.85                    | 1.6                    | <b>2.2</b>  | <b>0.82</b> | <b>0.80</b>  | <b>0.83</b>  | <b>3.1</b>  | <b>1.5</b>  | <b>1.9</b> | <b>1.0</b>  | <b>1.4</b>  | <1.4        | <b>0.64</b> | <b>0.63</b> | <b>13</b>   | <b>12</b>   | <b>1.1</b>   | <b>1.1</b>    | <b>0.70</b> | <b>1.0</b>  |
| 1,2-Dichloroethane        | 0.26                    | 0.47                   | <0.14       | <b>0.17</b> | <0.14        | <0.16  | <b>10</b>   | <0.14       | <b>7.4</b> | <b>0.17</b> | <0.14       | <0.69       | <0.15       | <0.14       | <b>0.26</b> | <b>0.27</b> | <b>1.0</b>   | <b>1.1</b>    | <b>0.21</b> | <0.14       |
| Trichloroethene           | 0.074                   | 0.14                   | <b>0.23</b> | <b>0.42</b> | <b>0.40</b>  | <0.22  | <0.19       | <0.18       | <0.20      | <0.19       | <0.18       | <0.92       | <0.20       | <0.19       | <0.18       | <0.19       | <b>2.3</b>   | <b>2.3</b>    | <0.18       | <0.19       |
| Toluene                   | 5,200                   | 22,000                 | <b>6.1</b>  | <b>14</b>   | <b>14</b>    | <b>2.6</b>   | <b>18</b>   | <b>3.8</b>  | <b>46</b>  | <b>6.2</b>  | <b>11</b>   | <b>520</b>  | <b>5.7</b>  | <b>39</b>   | <b>34</b>   | <b>31</b>   | <b>13</b>    | <b>12</b>     | <b>7.6</b>  | <b>2.9</b>  |
| Tetrachloroethene         | 1.1                     | 2.1                    | <b>0.51</b> | <b>4.1</b>  | <b>4.0</b>   | <0.27  | <b>0.25</b> | <0.23       | <b>8.5</b> | <b>4.9</b>  | <0.23       | <b>1.4</b>  | <0.25       | <b>2.6</b>  | <b>0.82</b> | <b>0.86</b> | <b>1.1</b>   | <b>1.1</b>    | <b>0.31</b> | <b>1.6</b>  |
| Ethyl Benzene             | 2.7                     | 4.9                    | <b>0.80</b> | <b>1.1</b>  | <b>1.0</b>   | <b>0.45</b>  | <b>3.5</b>  | <b>0.57</b> | <b>1.4</b> | <b>0.81</b> | <b>0.54</b> | <b>0.93</b> | <b>0.24</b> | <b>0.26</b> | <b>4.6</b>  | <b>4.1</b>  | <b>0.80</b>  | <b>0.83</b>   | <b>0.48</b> | <b>0.38</b> |
| m,p-Xylene                | 100                     | 440                    | <b>2.2</b>  | <b>1.9</b>  | <b>1.8</b>   | <b>1.1</b>   | <b>13</b>   | <b>1.9</b>  | <b>3.2</b> | <b>1.8</b>  | <b>1.4</b>  | <b>1.9</b>  | <b>0.62</b> | <b>0.54</b> | <b>14</b>   | <b>13</b>   | <b>2.2</b>   | <b>2.1</b>    | <b>1.1</b>  | <b>1.0</b>  |
| o-Xylene                  | 100                     | 440                    | <b>0.71</b> | <b>0.56</b> | <b>0.52</b>  | <b>0.37</b>  | <b>3.7</b>  | <b>0.69</b> | <b>1.3</b> | <b>0.68</b> | <b>0.50</b> | <0.74       | <b>0.24</b> | <b>0.20</b> | <b>4.4</b>  | <b>3.9</b>  | <b>0.78</b>  | <b>0.74</b>   | <b>0.38</b> | <b>0.39</b> |
| 1,1,2,2-Tetrachloroethane | NE                      | NE                     | <0.24       | <0.23       | <0.23        | <0.28  | <0.24       | <0.23       | <0.25      | <0.24       | <0.23       | <1.2        | <0.25       | <0.24       | <0.23       | <0.24       | <0.26        | <0.43         | <0.23       | <0.24       |
| trans-1,2-Dichloroethene  | 63                      | 260                    | <0.71       | <0.67       | <0.67        | <0.80  | <0.71       | <0.68       | <0.72      | <0.69       | <0.67       | <3.4        | <0.72       | <0.71       | <0.67       | <0.71       | <0.74        | <1.2          | <0.68       | <0.69       |
| 1,4-Dichlorobenzene       | 0.6                     | 1.1                    | <0.22       | <0.20       | <0.20        | <0.24  | <b>13</b>   | <0.20       | <0.22      | <0.21       | <0.20       | <1.0        | <0.22       | <0.22       | <0.20       | <0.22       | <0.22        | <0.38         | <0.20       | <0.21       |
| Carbon Tetrachloride      | 0.44                    | 0.82                   | <b>0.59</b> | <b>0.65</b> | <b>0.60</b>  | <b>0.57</b>  | <b>1.4</b>  | <b>0.56</b> | <b>1.2</b> | <b>0.89</b> | <b>0.68</b> | <1.1        | <b>0.56</b> | <b>0.59</b> | <b>0.59</b> | <b>0.61</b> | <b>0.61</b>  | <b>0.62</b>   | <b>0.63</b> | <b>0.61</b> |
| Methylene Chloride        | 14                      | 26                     | <1.2        | <1.2        | <1.2         | <b>4.5</b>   | <b>7.5</b>  | <1.2        | <1.3       | <1.2        | <1.2        | <5.9        | <1.3        | <1.2        | <b>1.4</b>  | <1.2        | <1.3         | <2.2          | <1.2        | <1.2        |
| 1,2-Dibromoethane (EDB)   | 0.011                   | 0.02                   | <0.28       | <0.26       | <0.26        | <0.31  | <0.28       | <0.26       | <0.28      | <0.27       | <0.26       | <1.3        | <0.28       | <0.28       | <0.26       | <0.28       | <0.29        | <0.48         | <0.26       | <0.27       |

Value Exceed Air residential RBC

Value Exceeds Air commercial RBC

NE = Not Established

**Table 7. Edgewood Shopping Center  
Sub-Slab Soil Gas Results  
February 25, 2010  
All results in micrograms per cubic meter (ug/m3)**

| ANALYTE                   | DEQ RBC Soil Gas Residential | DEQ RBC Soil Gas Commercial | SS-1       | SS-2       | SS-3  | SS-4       | SS-5       | SS-6       | SS-7       | SS-8       |
|---------------------------|------------------------------|-----------------------------|------------|------------|-------|------------|------------|------------|------------|------------|
| Vinyl Chloride            | 41                           | 2,800                       | <2.9       | <3.0       | <2.9  | <2.8       | <3.0       | <2.8       | <2.9       | <3.0       |
| 1,1-Dichloroethene        | 42,000                       | 880,000                     | <4.5       | <4.6       | <4.4  | <4.3       | <4.6       | <4.3       | <4.5       | <4.6       |
| Methylene Chloride        | 2,800                        | 26,000                      | <4.0       | <4.0       | <3.9  | <3.8       | <4.1       | <3.8       | <4.0       | <4.0       |
| trans-1,2-Dichloroethene  | 13,000                       | 260,000                     | <4.5       | <4.6       | <4.4  | <4.3       | <4.6       | <4.3       | <4.5       | <4.6       |
| 1,1-Dichloroethane        | 830                          | 7,700                       | <4.6       | <4.7       | <4.5  | <4.4       | <4.8       | <4.4       | <4.6       | <4.7       |
| cis-1,2-Dichloroethene    | NE                           | NE                          | <4.5       | <4.6       | <4.4  | <4.3       | <4.6       | <4.3       | <4.5       | <4.6       |
| 1,1,1-Trichloroethane     | 1,000,000                    | 2.20E+07                    | <6.2       | <6.4       | <6.1  | <5.9       | <6.4       | <5.9       | <6.2       | <6.4       |
| Carbon Tetrachloride      | 88                           | 820                         | <7.2       | <7.3       | <7.0  | <6.8       | <7.4       | <6.8       | <7.2       | <7.3       |
| Benzene                   | 170                          | 1,600                       | <3.6       | <3.7       | <3.6  | <3.5       | <3.8       | <3.5       | <3.6       | <3.7       |
| 1,2-Dichloroethane        | 51                           | 470                         | <4.6       | <4.7       | <4.5  | <4.4       | <4.8       | <4.4       | <4.6       | <4.7       |
| Trichloroethene           | 15                           | 140                         | <b>9.4</b> | <6.3       | <6.0  | <b>8.3</b> | <b>7.6</b> | <b>8.0</b> | <b>10</b>  | <6.3       |
| Toluene                   | 1,000,000                    | 2.20E+07                    | <4.3       | <4.4       | <4.2  | <4.1       | <4.4       | <b>4.5</b> | <b>10</b>  | <4.4       |
| Tetrachloroethene         | 220                          | 2,100                       | <b>20</b>  | <7.9       | <7.6  | <7.4       | <8.0       | <b>160</b> | <b>880</b> | <b>110</b> |
| 1,2-Dibromoethane (EDB)   | 2.2                          | 20                          | <8.8       | <9.0       | <8.6  | <8.4       | <9.0       | <8.4       | <8.8       | <9.0       |
| Ethyl Benzene             | 530                          | 4,900                       | <4.9       | <5.0       | <4.9  | <4.7       | <5.1       | <4.7       | <4.9       | <5.0       |
| m,p-Xylene                | 21,000                       | 440,000                     | <5.0       | <5.0       | <4.9  | <4.7       | <5.1       | <4.7       | <5.0       | <5.0       |
| o-Xylene                  | 21,000                       | 440,000                     | <5.0       | <5.0       | <4.9  | <4.7       | <5.1       | <4.7       | <5.0       | <5.0       |
| 1,1,1,2-Tetrachloroethane | NE                           | NE                          | <7.8       | <8.0       | <7.7  | <7.5       | <8.1       | <7.5       | <7.8       | <8.0       |
| 1,4-Dichlorobenzene       | 120                          | 1,100                       | <6.8       | <7.0       | <6.7  | <6.6       | <7.1       | <6.6       | <6.8       | <7.0       |
| Chlorobenzene             | 10,000                       | 220,000                     | <5.2       | <5.4       | <5.2  | <5.0       | <5.4       | <5.0       | <5.2       | <5.4       |
| Methyl tert-butyl ether   | 5,100                        | 47,000                      | <4.1       | <4.2       | <4.0  | <3.9       | <4.2       | <3.9       | <4.1       | <4.2       |
| 1,2,4-Trichlorobenzene    | NE                           | NE                          | <34        | <34        | <33   | <32        | <35        | <32        | <34        | <34        |
| 1,2-Dichlorobenzene       | 42,000                       | 880,000                     | <6.8       | <7.0       | <6.7  | <6.6       | <7.1       | <6.6       | <6.8       | <7.0       |
| Helium                    | NE                           | NE                          | <b>2.9</b> | <b>2.4</b> | <0.11 | <0.11      | <0.12      | <0.11      | <0.11      | <0.12      |

Value Exceed Soil Gas residential RBC

Value Exceeds Soil Gas commercial RBC

NE = Not Established



**Stantec**

**ATTACHMENT A  
SOIL GAS PROBE BORING LOGS**

Draft

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-1**

PAGE 1 OF 1



DATE: STARTED **9/9/2009** COMPLETED: **9/9/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description  | Sample | Time Sample ID Method                                      | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction |
|---------------------|-------------|------|--|--------|--|------------------------|------------|---------------------|--------------|-------------------|
| 14 05               |             |      | Asphalt  |        |  |                        |            |                     |              |                   |
| 5                   |             |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |  |                        |            |                     |              |                   |
|                     |             |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 17 52<br>SV-11 1-L<br>Summa<br>Canister<br>#34145<br>TO-15 |                        |            |                     | 5            |                   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-10**

PAGE 1 OF 1



DATE: STARTED **9/10/2009** COMPLETED: **9/10/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **3.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **3**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description   | Sample | Time Sample ID Method                       | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction   |
|---------------------|-------------|------|---|--------|---|------------------------|------------|---------------------|--------------|---|
|                     |             |      | Asphalt   |        |   |                        |            |                     |              |   |
|                     |             |      | Sampling rod installed with slam bar; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |   |                        |            |                     |              | <p>1/4" Teflon Tubing (Extends approximately 16 inches above the surface and clamped closed)<br/>         Dry Granular Bentonite (Hydrated from surface with water)<br/>         Sampling rod installed using slam bar.<br/>         Expendable PRT Point</p> |
| 14 05 5             |             |      | No groundwater was encountered. Hole terminated at 3 feet.  |        | 16 30 SV-11 1-L Summa Canister #35685 TO-15 |                        |            |                     | 5            |   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-2**

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DATE: STARTED **9/9/2009** COMPLETED: **9/9/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description  | Sample | Time Sample ID Method                       | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction |
|---------------------|-------------|------|--|--------|---|------------------------|------------|---------------------|--------------|-------------------|
| 14 05               |             |      | Asphalt  |        |   |                        |            |                     |              |                   |
| 5                   |             |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silly sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |   |                        |            |                     |              |                   |
|                     |             |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 16 10 SV-11 1-L Summa Canister #34170 TO-15 |                        |            |                     | 5            |                   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-3**

PAGE 1 OF 1



DATE: STARTED **9/9/2009** COMPLETED: **9/9/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description  | Sample | Time Sample ID Method                       | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction |
|---------------------|-------------|------|--|--------|---|------------------------|------------|---------------------|--------------|-------------------|
| 14 05               |             |      | Asphalt  |        |   |                        |            |                     |              |                   |
| 5                   |             |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |   |                        |            |                     |              |                   |
|                     |             |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 15 20 SV-11 1-L Summa Canister #94915 TO-15 |                        |            |                     | 5            |                   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:



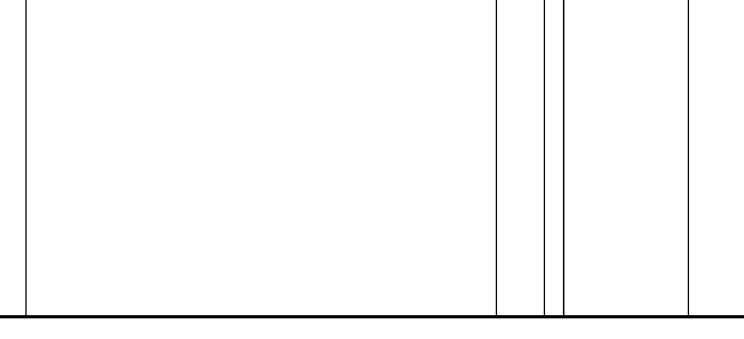
**SV-4**

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DATE: STARTED **9/9/2009** COMPLETED: **9/9/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log  | USCS | Description  | Sample | Time Sample ID Method                                      | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction   |
|---------------------|--|------|--|--------|--|------------------------|------------|---------------------|--------------|---|
| 14 05               |   |      | Asphalt  |        |  |                        |            |                     |              |   |
| 5                   |  |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |  |                        |            |                     |              |  <p>1/4" Teflon Tubing (Extends approximately 16 inches above the surface and clamped closed)<br/>         Dry Granular Bentonite (Hydrated from surface with water)<br/>         Direct Push Rod<br/>         Expendable PRT Point</p> |
|                     |  |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 12 56<br>SV-11 1-L<br>Summa<br>Canister<br>#34582<br>TO-15 |                        |            |                     | 5            |   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:



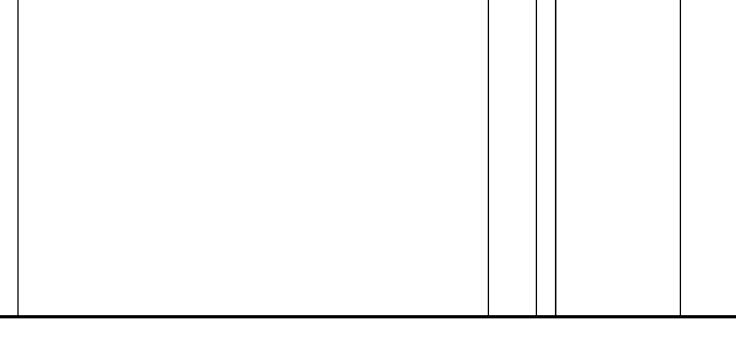
**SV-5**

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DATE: STARTED **9/10/2009** COMPLETED: **9/10/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log  | USCS | Description  | Sample | Time Sample ID Method  | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction   |
|---------------------|--|------|--|--------|--|------------------------|------------|---------------------|--------------|---|
| 14 05               |   |      | Asphalt  |        |  |                        |            |                     |              |   |
| 5                   |  |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |  |                        |            |                     |              |  <p>1/4" Teflon Tubing (Extends approximately 16 inches above the surface and clamped closed)<br/>         Dry Granular Bentonite (Hydrated from surface with water)<br/>         Direct Push Rod<br/>         Expendable PRT Point</p> |
|                     |  |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 10 41<br>SV-11 1-L<br>Summa<br>Canister<br>#000001487<br>TO-15 |                        |            |                     | 5            |   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-6**

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DATE: STARTED **9/10/2009** COMPLETED: **9/10/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description  | Sample | Time Sample ID Method  | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction |
|---------------------|-------------|------|--|--------|--|------------------------|------------|---------------------|--------------|-------------------|
| 14 05               |             |      | Asphalt  |        |  |                        |            |                     |              |                   |
| 5                   |             |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |  |                        |            |                     |              |                   |
|                     |             |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 10 22<br>SV-11 1-L<br>Summa<br>Canister<br>#000002214<br>TO-15 |                        |            |                     | 5            |                   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-7**

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DATE: STARTED **9/10/2009** COMPLETED: **9/10/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **5.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **5**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description  | Sample | Time Sample ID Method                                      | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction |
|---------------------|-------------|------|--|--------|--|------------------------|------------|---------------------|--------------|-------------------|
| 14 05               |             |      | Asphalt  |        |  |                        |            |                     |              |                   |
| 5                   |             |      | Direct push 7/8 inch rod was used to install the PRT points; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |  |                        |            |                     |              |                   |
|                     |             |      | No groundwater was encountered. Hole terminated at 5 feet.   |        | 12 53<br>SV-11 1-L<br>Summa<br>Canister<br>#35554<br>TO-15 |                        |            |                     | 5            |                   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-8**

PAGE 1 OF 1



DATE: STARTED **9/10/2009** COMPLETED: **9/10/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **3.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **3**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description   | Sample | Time Sample ID Method                       | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction   |
|---------------------|-------------|------|---|--------|---|------------------------|------------|---------------------|--------------|---|
|                     |             |      | Asphalt   |        |   |                        |            |                     |              |   |
|                     |             |      | Sampling rod installed with slam bar; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |   |                        |            |                     |              | <p>1/4" Teflon Tubing (Extends approximately 16 inches above the surface and clamped closed)<br/>         Dry Granular Bentonite (Hydrated from surface with water)<br/>         Sampling rod installed using slam bar.<br/>         Expendable PRT Point</p> |
| 14 05 5             |             |      | No groundwater was encountered. Hole terminated at 3 feet.  |        | 15 02 SV-11 1-L Summa Canister #34649 TO-15 |                        |            |                     | 5            |   |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09

PROJECT: **Edgewood Shopping Center**  
 LOCATION: **350 - 390 E 40th Avenue, Eugene, Oregon**  
 PROJECT NUMBER: **187902018.200.0006**

WELL / PROBEHOLE / BOREHOLE NO:

**SV-9**

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DATE: STARTED **9/10/2009** COMPLETED: **9/10/2009**  
 TIME: STARTED COMPLETED:  
 DRILLING COMPANY:  
 DRILLING EQUIPMENT: **Track-Mounted GeoProbe Rig**  
 DRILLING METHOD: **Direct Push**  
 SAMPLING EQUIPMENT: **PRT**

NORTHING (ft): EASTING (ft):  
 LATITUDE: LONGITUDE:  
 GROUND ELEV (ft): TOC ELEV (ft):  
 INITIAL DTW (ft): **N/A** BOREHOLE DEPTH (ft): **3.0**  
 STATIC DTW (ft): **N/A** WELL DEPTH (ft): **3**  
 WELL CASING DIAM. (in): **1/4** BOREHOLE DIAM. (in): **7/8**  
 LOGGED BY: **A. Zach** CHECKED BY: **P. Vaughan**

| Time & Depth (feet) | Graphic Log | USCS | Description   | Sample | Time Sample ID Method                       | Measured Recov. (feet) | Blow Count | Headspace PID (ppm) | Depth (feet) | Well Construction   |
|---------------------|-------------|------|---|--------|---|------------------------|------------|---------------------|--------------|---|
|                     |             |      | Asphalt   |        |   |                        |            |                     |              |   |
|                     |             |      | Sampling rod installed with slam bar; no soil samples were collected.; Silty sand to sand typical lithology seen to five feet below ground surface during previous subsurface investigations. |        |   |                        |            |                     |              |   |
| 14 05 5             |             |      | No groundwater was encountered. Hole terminated at 3 feet.  |        | 16 11 SV-11 1-L Summa Canister #35674 TO-15 |                        |            |                     | 5            | <p>1/4" Teflon Tubing (Extends approximately 16 inches above the surface and clamped closed)<br/>         Dry Granular Bentonite (Hydrated from surface with water)<br/>         Sampling rod installed using slam bar.<br/>         Expendable PRT Point</p> |

GEO FORM 304 STANTEC037 SECOND ROUND SOIL VAPOR SAMPLING - EDGEWOOD.GPJ SECOR037.GDT 10/7/09



**Stantec**

**ATTACHMENT B  
VAPOR INTRUSION MITIGATION WORK PLAN**

Draft



**Stantec Consulting Corporation**  
7730 Southwest Mohawk Street  
Tualatin OR 97062  
Tel: (503) 691-2030  
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**Stantec**

May 6, 2010

Mr. Geoff Brown  
Oregon Department of Environmental Quality  
165 East 7<sup>th</sup> Avenue, Suite 100  
Eugene, Oregon 97401

Re: **Vapor Intrusion Mitigation Work Plan**  
**Edgewood Family Daycare**  
**3990 Donald Street, Eugene, Oregon 97405**

Dear Mr. Brown:

Stantec Consulting Corporation (Stantec) is submitting this *Work Plan for Vapor Intrusion Mitigation* (Work Plan) for the above-referenced site (the Site) to the Oregon Department of Environmental Quality (DEQ) on behalf of the Edgewood Shopping Center LLC. This Work Plan is being submitted in response to a request by DEQ for abatement measures necessary to reduce levels of PCE in the indoor air.

## **BACKGROUND**

On November 13, 2009 Stantec, at the request of DEQ, collected soil gas samples from approximately 5 feet below ground surface at three locations across E. 40<sup>th</sup> Avenue from the Edgewood Shopping Center at a duplex located at 445 E. 40<sup>th</sup> Avenue; at the Edgewood Daycare; and, at the Eugene Unitarian Church located approximately 120 feet to the east of the subject property. Laboratory analysis detected tetrachloroethylene (PCE) at 8,400 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) near the duplex and  $51 \mu\text{g}/\text{m}^3$  near the daycare center. No PCE was detected on the church property. Based on a review of the laboratory report, DEQ requested that a Work Plan be prepared to further evaluate possible vapor intrusion at the duplex, daycare center and at the two condominium buildings (Edgewood Villa) located immediately across Donald Street to the east of the Edgewood Shopping Center. In response to the DEQ request, Stantec submitted the *Off-site Vapor Intrusion Assessment Work Plan* (Work Plan) for the 366 E. 40<sup>th</sup> Avenue site in Eugene, Oregon on December 8, 2009. DEQ issued approval of the Work via electronic mail on December 9, 2010.

On December 16, 2009, Stantec collected a primary and duplicate indoor air sample at the Edgewood Daycare along with an air sample collected within the crawlspace. Laboratory analysis using US EPA Method TO-15 in the Selective Ion Mode (SIM) identified the presence of PCE at  $0.90 \mu\text{g}/\text{m}^3$  in the primary indoor air sample and  $0.88 \mu\text{g}/\text{m}^3$  in the duplicate indoor air sample. PCE ( $4.1 \mu\text{g}/\text{m}^3$ ) and vinyl chloride ( $0.62 \mu\text{g}/\text{m}^3$ ) were detected in the crawlspace air sample.

On February 24, 2010, Stantec collected two indoor air samples at the day care along with one crawlspace sample. The objective of the sampling and analysis was to determine if PCE previously detected in indoor and crawlspace air persisted and, if so, how the concentrations varied over time. These activities were proposed in the *Further Investigation Work Plan, Edgewood Shopping Center, 366 E. 40<sup>th</sup> Avenue, Eugene, Oregon 97405*, submitted February 2, 2010 and approved by DEQ via electronic mail on February 9, 2010. Laboratory analysis detected PCE in indoor air sample IA-8 ( $0.82 \mu\text{g}/\text{m}^3$ ) and IA-9 ( $0.86 \mu\text{g}/\text{m}^3$ ). The sample collected from the crawlspace (CSA-1) was reported to contain PCE at a concentration of  $0.51 \mu\text{g}/\text{m}^3$ . Trichloroethylene [TCE] ( $0.23 \mu\text{g}/\text{m}^3$ ) and 1,1-Dichloroethane [1,1-DCA] ( $0.23 \mu\text{g}/\text{m}^3$ ) were also detected in the crawlspace sample but not in the outdoor air sample collected proximate to the day care facility or in either of the two indoor air samples.

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### Reference: Vapor Intrusion Mitigation Work Plan

All detections of PCE in indoor air exceed Oregon DEQ Risk Based Concentrations (RBCs) for the direct contact pathway established for residential indoor air ( $0.41 \mu\text{g}/\text{m}^3$ ).

Benzene, toluene, ethylbenzene, xylenes (BTEX) and carbon tetrachloride were detected in the outdoor air and crawlspace samples during both the December 2009 and February 2010 sampling events; however the concentrations were consistently higher in the crawlspace samples. This indicates that at the time of the sampling there was reduced cross ventilation within the crawlspace allowing accumulation of these compounds in crawlspace air.

Of note, carbon tetrachloride was detected in indoor air at essentially the same concentration as detected in outdoor air. However, BTEX was detected in indoor at levels 8 to 13 times higher than the concentrations observed in outdoor air indicating an indoor source (fuel use or storage, smoking, etc.) for these compounds.

On April 9, 2010 DEQ issued a letter requiring preparation and submission of a work plan regarding mitigation measures to be taken at the Edgewood Family Day Care to reduce potential risks to residents of the home in which the day care is located. This work plan has been prepared to satisfy the requirements contained within the letter.

### SCOPE OF WORK

Stantec proposes a step-wise approach to vapor mitigation at the Edgewood Family Day Care. This is based on the relatively low concentrations of PCE detected in crawlspace air which may be effectively controlled through initial abatement measures without the need for design and installation of a mitigation system requiring maintenance, monitoring and possible deed and use restrictions.

The proposed activities include the following tasks: Crawlspace Inspection, vapor barrier installation, evaluation of further mitigation measures and performance monitoring. These tasks are individually described below.

#### ***TASK 1 – Crawlspace Inspection***

Stantec will coordinate with the property owner to gain access to the crawlspace. Access to the crawlspace for sample tubing during previous sampling activities was via an exterior opening in the foundation covered by wire mesh. A dryer vent duct was secured to the mesh which prevented access to the crawlspace by Stantec personnel. Due to health and safety requirements, clear access to the crawlspace must be created before Stantec or sub-contractor personnel will be allowed to enter.

The results of the crawlspace inspection will be used to develop specifications and procedures to be used in the selection and installation of a vapor barrier and/or other mitigation measures and will focus on the following:

- Presence and extent of any existing moisture barrier. Although previous visual inspection from the exterior noted the presence of a dirt floor a portion of the residence has been recently remodeled and a partial moisture barrier may have been added at that time.
- The number and location of existing foundation vents;

## **Stantec**

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**Reference: Vapor Intrusion Mitigation Work Plan**

- The number of posts and footers which require sealing of the barrier;
- Presence of ductwork or utilities which may penetrate the residence sub-floor; and,
- Presence of sumps or drains.

### ***TASK 2 – Vapor Barrier Installation***

Immediately prior to vapor barrier installation, Stantec will collect one crawlspace air sample, two indoor and one outdoor air samples. These results will be used as a baseline for future post mitigation performance monitoring. All samples will be collected in the same locations as previously used.

Indoor, outdoor and crawlspace air samples will be collected into individually-certified 6-liter Summa™ canisters supplied by the project analytical laboratory. Individual certification means that each canister processed (i.e., cleaned using a combination of dilution, heat and high vacuum) is sampled and analyzed for the project-specific target analyte list by GC/MS, and that concentrations of target compounds are below project reporting limits. Each Summa™ canister will be equipped with a laboratory-supplied certified flow controller to regulate collection rates during sampling and vacuum gauge. Individual certification is made as a sampling train and must be sampled as such (i.e., a particular flow controller is matched with a particular canister). Accordingly the laboratory provides unique identification numbers for each canister and flow controller which will be entered on the field log and chain-of-custody form. All samples will be analyzed by US EPA Method TO-15 SIM.

Contingent upon the results of the crawlspace inspection, it is anticipated that a 30-60 mil sheet membrane (high density polyethylene or polyethylene) will be installed across the ground surface within the crawlspace. The membrane will be sealed (glued or taped) around each post, footing and other penetrations of the ground surface.

Approximately two weeks following vapor barrier installation, Stantec will again collect one crawlspace air sample, two indoor and one outdoor air samples. The results of laboratory analysis will be compared with the antecedent air sampling to determine effectiveness of vapor barrier installation.

### ***TASK 3-Reporting***

Within 2 weeks following receipt of laboratory data, Stantec will submit a letter report documenting initial mitigation activities and the results of verification sampling and analysis.

### ***TASK 4-Evaluation of Other Mitigation Measures***

Generally, enclosed crawlspaces that are freely ventilated do not require further mitigation measures<sup>1</sup>. However, in the event that installation of the vapor barrier does not achieve reduction of PCE below acceptable risk-based concentrations, further mitigation measures will be evaluated. Such measures could include:

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<sup>1</sup> *Engineering Issue, Indoor Air Vapor Mitigation Approaches*, EPA/600/R-08-115, US EPA, October 2008.

**Reference: Vapor Intrusion Mitigation Work Plan**

- Addition of one or more foundation vents following evaluation by an Oregon-licensed structural engineer.
- Design and installation of an active ventilation system to induce a positive pressure in the crawlspace. This is commonly performed by placement of a fan to force ambient air into the crawlspace.

***TASK 4-Performance Monitoring***

If initial mitigation (installation of vapor barrier) performance verification indicates substantial reduction or elimination of PCE in crawlspace air then indoor, outdoor and crawlspace air sampling and analysis will be performed on a quarterly basis for one year. Stantec proposes to collect the following samples during each quarter:

- Crawlspace-2 air samples
- Indoor Air-2 indoor air samples from normally occupied areas.
- Outdoor Air- 1 sample from a nearby, upwind location.

If further mitigation measures are required, Stantec will establish performance monitoring requirements and data quality objectives at that time.

Please feel free to contact the undersigned should you have any questions regarding the proposed scope of work.

Sincerely,  
**Stantec Consulting Corporation**



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