FINAL
AUTUMNWOOD DEVELOPMENT INVESTIGATION REPORT WILDOMAR, CALIFORNIA

Prepared by the Department of Toxic Substances Control

OCTOBER 2014

Final

Autumnwood Development Investigation Report

Wildomar, California

Prepared by the Department of Toxic Substances Control

October 2014

Prepared By:

Theodore Johnson Date: 10-6-2014

Theodore Johnson, C.E.G., C.Hg., Senior Engineering Geologist

Date: 10/6/2014

William Bosan, Ph.D., Senior Toxicologist

Registered Geologist
Theodore R. Johnson III
No. 6170
Exp. 12/14
State of California

Reviewed by:

Date: 10/6/2014

Jim Polisini, Ph.D., Chief, Human and Ecological Risk Office

Craig C. Christmann Date: 10-6-2014

Craig Christmann, Senior Engineering Geologist (Sup.)

Dan Gallagher Date: 10-06-2014

Dan Gallagher, Senior Engineering Geologist

Table of Contents

FIGURES

TABLES

ATTACHMENTS

Attachment A……………….Previous Investigation Data

Attachment B……………….Previous Data Evaluation

Attachment C……………….City Encroachment Permit

Attachment D……………….Community Work Notice

Attachment E……………….Soil Boring Logs

Attachment F……………….Soil and Groundwater Sample Analytical Data Sheets

Attachment G……………….Soil Gas Sample Analytical Data Sheets

Attachment H……………….Formaldehyde Soil Gas Sample Analytical Data Sheets

Attachment I………………...Sub-Slab Soil Gas Sample Analytical Data Sheets

Attachment J………………. Level 4 Data Validation and Data Verification Narrative

Attachment K……………….Screening-Level Johnson and Ettinger Model Outputs

Attachment L………………. Wildomar meeting January 17, 2014 Final Response to Comments

Attachment M……………… Autumnwood Development Investigation Report review from OEHHA and CDPH

1.0 INTRODUCTION

This Investigation Report (Report) summarizes the environmental testing conducted at the Autumnwood Development in the City of Wildomar (City), California (herein referred to as the Study Area; Figure 1). Previous sampling events at the Study Area were conducted by the SCAQMD, Ami Adini and Associates and Nancy Carraway. AMEC Environment and Infrastructure, Inc. (AMEC) implemented field sampling activities in the Study Area on behalf of the Department of Toxic Substances Control (DTSC). This work was conducted in accordance with the *Soil, Soil Gas, and Groundwater Sampling Workplan for Autumnwood Development, Amaryllis Court and Vicinity Wildomar, California* [DTSC 2013].

The Study Area consists of a tract of single-family residential homes and associated roadways. As shown on Figure 2, the Study Area is located between Penrose Street and South Pasadena Street to the northwest and southeast, respectively. Palomar Street and a drainage channel south of Front Street define the approximate northeastern and southwestern boundaries of the Study Area, respectively. The Study Area is approximately 11 acres, consisting of 61 single-family homes and a common area park.

1.1 Objectives and Scope

The purpose of this investigation was to determine whether hazardous waste constituents are present in soil and groundwater under the Study Area and whether the contaminants, if present, are of sufficient concentrations to pose a human health risk. Risk to human health from industrial contaminants are primarily driven by exposure through the inhalation, dermal and ingestion exposure pathways. Of specific concern to DTSC is whether volatile organic compounds (VOCs) exist in the subsurface which could migrate into residential homes, causing an inhalation exposure. This type of exposure pathway is called vapor intrusion. Residences in the Study Area use municipal water, hence ingestion of groundwater is not considered to be an exposure pathway.

Through the Orphan Site Fund, DTSC receives funding from the United States Environmental Protection Agency (USEPA) to conduct soil, soil gas, and groundwater sampling at sites where there is a potential health risk and no responsible party has been identified. Using these funds, investigation activities were conducted to test soil, soil gas, and groundwater in the Study Area (DTSC 2013) to evaluate potential exposure at the Study Area (DTSC 2013). DTSC’s field investigation was conducted in November 2013. Sampling was conducted on Amaryllis Court, Pink Ginger Court, Protea Court, Front Street, Penrose Street, Palomar Street, and South Pasadena Street in the City of Wildomar. Additionally, sub-slab sampling was conducted inside three residences within the Study Area (See Figure 2).

1.2 Report Organization

This report is organized as follows:

Section 1.0	Introduction
Section 2.0	Study Area Background
Section 3.0	Environmental Setting
Section 4.0	Field Investigation
Section 5.0	Investigation Results
Section 6.0	Summary of Findings
Section 7.0	References

Additional supporting information is presented in the Tables, Figures, and Appendices.

The DTSC Workplan was implemented under the regulatory oversight and supervision of a DTSC registered geologist and the AMEC Project Manager who are qualified registered professional geologists (PGs) under the Professional Engineers Act, Business and Professions Code Sections 6700-6899 and Section 7838, and the Geologist and Geophysicists Act, Business and Professions Code Sections 7800-7887.

2.0 STUDY AREA BACKGROUND

The Study Area is a residential housing tract identified as the Autumnwood Development in Wildomar, California. The Autumnwood Development is bounded by South Pasadena Street on the southeast, Penrose Street on the northwest, Palomar Street on the northeast and drainage channel south of Front Street on the southwest. The development was constructed between 2004 and 2006, and consists of 61 single-family homes constructed with foundation slabs directly on surface grade. Additionally, there is a small neighborhood park on the southeast corner of Front and Penrose Streets.

2.1 Pre-Construction Investigations

Prior to construction of the Autumnwood Development, C.H.J. Incorporated (CHJ), of Colton, California, prepared a *Preliminary Environmental Site Assessment* (Phase 1), dated June 13, 2003. CHJ indicated, based on aerial photographs dating back to 1949, that the site was primarily vacant and undeveloped between 1949 and 2001(Petra 2005).

Prior to grading work Petra evaluated the engineering and geotechnical properties of the site soils to determine their suitability for the proposed project. Petra described the site soils as “low to medium” density and consisting of silty and clayey sands and silts. These sediments required densification to mitigate liquefaction potential and dynamic settlement of the proposed development. To remedy these potential hazards, the soils were removed to 10 to 15 feet below original grade and then re-compacted to form a stable base for the planned structures (Petra 2005).

2.2 Investigation by Nancy Carraway

A report documenting the sampling done at three Autumnwood Development residences on Amaryllis Court from May 2012 to July 2012 were presented in a document entitled *Indoor Air Quality Investigation Report* dated August 23, 2012 and included in Attachment A. Low levels of VOCs were detected during the sampling event; however, the submitted report does not include adequate quality control/quality assurance data to validate the representativeness of the sub-slab samples or the inertness of the materials used for the sampling system. Protocols used to sample sub-slab soil gas did not follow DTSC guidelines.

In addition to the initial sampling of three homes, nine additional homes in the Autumnwood Development were subsequently sampled. The data from the initial 3 homes sampled and the added nine homes sampled were provided by the consultant in a summary table containing seven of the chemical contaminants found in the sub-slab samples from two locations on Amaryllis Court and the indoor and outdoor air sample results from the 12 homes sampled between May 29, 2012 and January 2, 2013 in the Autumnwood Development. Eight of the houses sampled were on Amaryllis Court, two houses on Front Street, and one each on Pink Ginger and Protea Courts.

The summary table is presented in the OEHHA evaluation of the Autumnwood Development data. The table presents only a small number of the chemicals actually measured in the air and sub-slab (OEHHA 2013). The rationale for selection of the compounds listed in the table is unknown but may relate to the chemicals being carcinogens.

2.3 Investigation by Ami Adini and Associates (AA&A)

In September 12, 2012, AA&A installed seven 5 foot soil gas probes, seven 10 foot soil gas probes and one 15 foot soil gas probe on Amaryllis Court. Soil gas samples were analyzed for VOCs by US EPA Method 8260. Six soil samples were also analyzed for VOCs by US EPA Method 8260. Four soil samples were analyzed for total petroleum hydrocarbons by US EPA Method 8015 (TPH), semi-volatile organic compounds (SVOCs) by US EPA Method 8270, organochlorine pesticides (OCPs) by US EPA Method 8081, and polychlorinated biphenyls (PCBs) by US EPA Method 8082. Additionally, a sub-slab sample was collected from each of two homes on Amaryllis Court. SVOCs, OCPs, TPH, and PCBs were not detected below the method detection limit in soil samples. Low levels of VOCs were detected in soil gas samples and the analytical results are presented in Attachment A.

2.4 Investigation by South Coast Air Quality Management District (SCAQMD)

January 2, 2013, the SCAQMD conducted indoor and outdoor air sampling at two homes on Amaryllis Court and one home on Front Street. Outdoor air was also screened for VOCs using a hand held instrument. Air samples were collected in stainless steel canisters at each of the three homes, with one sample collected in the backyard, and two collected inside each home. An upwind air sample was collected on Front Street. All samples collected were "grab" samples collected over one minute in duration. All air samples were analyzed using US EPA Method TO-15. Low levels of VOCs were detected in both indoor and outdoor air and results are presented in Attachment B.

Soil samples were collected at two of the homes and at the SCAQMD headquarters in Diamond Bar, CA for comparison. Most samples were collected at the surface, with the exception of two samples, which were collected 11 inches below the surface. Several samples of a white material on top of the soil were also collected. All samples were analyzed by Energy Dispersive X-Ray Fluorescence for metals content. The samples with the white material were also analyzed by microscopy and X-Ray Diffraction.

SCAQMD staff returned to one of the homes on Amaryllis Court on January 15, 2013 to collect additional soil samples, indoor and outdoor air grab samples and 3-hour indoor and outdoor air samples. The results of this second investigation are also included in Attachment B.

The SCAQMD reported that all samples were within typical expected ranges for outdoor air, indoor air and soil, with the exception of soil samples collected specifically to evaluate the "white material" collected.

Indoor air samples were compared to two studies of indoor air from California homes; one with 34 homes and the other with over 100 homes. Results from the samples taken in Autumnwood and average values from the studies are shown in Attachment B. The SCAQMD concluded that all samples collected and analyzed by the SCAQMD staff are within the range of these studies.

Outdoor air samples were compared to typical levels found by the SCAQMD in the South Coast Air Basin. Outdoor air sampling results are also shown in Attachment B. The SCAQMD concluded that all samples collected and analyzed by the SCAQMD are within the typical expected range.

The white material collected from the landscape areas surrounding the house is residue from the evaporation of municipal water. Minerals and salts originally in the water and dissolved from the soil precipitate onto the soil once the water is evaporated.

2.5 Evaluations by the California Department of Public Health (CDPH) and the Office of Environmental Health Hazard Assessment (OEHHA)

On May 30, 2013, DTSC's Director, Debbie Rafael, requested support from both the CDPH and OEHHA in evaluating the available environmental data for the Autumnwood Development. In addition to the data evaluation, CDPH also reviewed the resident's reported health symptoms, consulted with CDPH's Indoor Air Quality Program regarding the assessment of indoor air, and provided data gap recommendations. Data evaluation included laboratory data on indoor air, ambient air, soil gas, soil, and fill material, as well as records provided from several families, and other information and reports. Additional materials and reports were provided by DTSC, the Swanson Law Firm (Adini 2012 report), CDPH's Division of Drinking Water and Environmental Management, the SCAQMD, and by some of the residents during a meeting on July 16, 2013.

DTSC requested OEHHA independently interpret analytical data generated during investigations in the Autumnwood Development for chemical contaminant concentrations in the soil, ambient air, indoor air, and soil gas. OEHHA was requested to interpret the findings of the studies in terms of potential health implications to the residents. OEHHA evaluated whether chemical levels found in the environmental media were sufficiently elevated to explain the residents' reported illnesses. The evaluation looked at indoor air and soil gas monitoring performed or overseen by the residents' consulting industrial hygienist, Nancy Carraway, and indoor air monitoring performed by the SCAQMD.

Ms. Carraway prepared a table of results from selected air samples taken from 12 homes in the development and selected chemicals from the suite of chemicals sampled. These sampling results were evaluated by OEHHA for health hazards to a person exposed to the detected chemical concentrations in a residential setting. The indoor air samples taken by the SCAQMD were similarly evaluated. Soil gas samples were evaluated for vapor intrusion potential and health hazards the chemicals may pose in a residential setting.

Following their review of the environmental data collected at the Autumnwood Development (see Attachment B), OEHHA concluded that the indoor air concentrations of chemicals represent a potential long-term cancer risk but most of the chemicals do not represent a noncarcinogenic health hazard. OEHHA further concluded that the concentrations of chemicals measured indoors at the Autumnwood Development are comparable to levels measured in homes located in areas with higher than normal air pollutants and are also comparable to levels seen in new homes. OEHHA identified formaldehyde as one chemical of concern in indoor air since it was found at levels higher than the median for new homes. Finally, OEHHA concluded that subsurface soil gas sampling does not suggest that the soil is contaminated with volatile chemicals.

Following their review of the environmental data collected at the Autumnwood Development (see Attachment B), CDPH concluded that based on the range of VOC concentrations found in homes studied by EPA where there was no vapor intrusion, most of the VOCs detected in the Autumnwood homes were within “background”. CDPH identified three chemicals of potential concern that might be above background, specifically formaldehyde, 1,2-dichloroethane and 1,2-dibromoethane (EDB). EDB was only detected in the SCAQMD indoor air samples. According to the SCAQMD, a detailed manual review determined that the computer software used in the sample analysis misidentified a very small peak in the chromatograms as EDB. As a result, it was verified that none of the samples had EDB present above detection limits. CDPH also identified shallow groundwater as a data gap and a potential source of vapor intrusion.

3.0 ENVIRONMENTAL SETTING

3.1 Geologic Setting

The site is located in the Peninsular Range Geomorphic Province of California. The Peninsular Range is characterized by steep, elongated valleys that trend west to northwest. The Autumnwood Development is located within the Elsinore Trough, a fault controlled, down-dropped graben, which borders the Santa Ana Mountains on the northeast and the Perris Block on the southwest. The Elsinore Trough is believed to contain as much as 3,000 feet of alluvium (Petra 2005).

The Elsinore Trough is bounded on the northeast by the Wildomar fault and on the southwest by the Willard fault. These faults are part of the Elsinore fault zone which extends from the San Gabriel River Valley to the United States/Republic of Mexico border. The Wildomar fault is considered active and the Willard fault is considered active north of Slaughterhouse Canyon (Petra 2005).

The Santa Ana Mountains are west of the Elsinore fault zone, while the Perris Block is along the eastern side of the fault zone. These mountain ranges are underlain by pre-Cretaceous metasedimentary and metavolcanic rocks and Cretaceous plutonic rock of the Southern California Batholith. Tertiary and quaternary rocks are comprised generally of nonmarine sediments consisting of sandstone, mudstones, conglomerates and occasional volcanic units (Petra 2005).

Sediments encountered during drilling show that the Study Area is underlain primarily by silty and clayey sands with some sandier and gravely zones, to depths of approximately 36 feet below ground surface (bgs), the total depth of this investigation. Petra reported similar lithology to 50 feet bgs.

Seven soil borings were continuously cored to depths up to 36 feet bgs. Sediments encountered within the borings are classified as sand with varying amounts of clay. Some gravelly zones were also encountered mainly in the central section of the Study Area.

Two geological cross sections were constructed to show the spatial distribution of subsurface lithologies (Figure 3 and 4)

3.2 Hydrogeologic Setting

The City of Wildomar lies on the border of the San Jacinto Sub-basin of the Santa Ana drainage basin and the San Dieguito Basin of the greater San Diego drainage basin. The sediments of the hydrologic basin below Wildomar can be characterized as a series of interconnected alluvium filled valleys, bounded by bedrock mountains and cut by the Elsinore Fault Zone. Within the Elsinore Fault Zone are the parallel Wildomar Fault to the east and the Willard Fault to the west of Wildomar. These faults form a down dropped fault block or graben, creating scarps and sag ponds, such as Lake Elsinore. Surface water flows from the Murrieta-Temecula Basin, to the southeast of Wildomar, to the Lake Elsinore area in the northwest (Kennedy 1977).

Groundwater produced for potable purposes in the area north of Wildomar is typically encountered in excess of 250 ft. bgs. (City 2011).

During the November 2013 investigation conducted by AMEC, groundwater was encountered in grab groundwater sampling locations 1, 7, 11, and 13 at depths of approximately 21 to 30 feet bgs. (See Figures 3 and 4).

3.3 Site Conceptual Model

The intent of the DTSC field investigation was to evaluate whether hazardous waste constituents existed in the subsurface at the Study Area. Due to the lack of industrial activity at the Study Area prior to residential development, and the residents statements that potentially contaminated soil from two import sites was used for grading, the potential occurrence of contamination would be attributable to the use of contaminated soil as a portion of the engineered fill. Additionally, groundwater was identified as a data gap by CDPH in their review of the historical data. This scenario is the conceptual model for the Study Area from which the Workplan was derived. Accordingly, subsurface testing was conducted to verify or refute the supposition concerning the possibility of contamination in the soil and groundwater at the Study Area. The conjecture that contaminated backfill was used at the Study Area is based on statements made by Adini (2012) and by statements from several of the residents. Adini reports that the grading contractor used soil as engineered fill containing wood, trash, organics, unsuitable material, material from the Lake Elsinore wash out area, tires, plywood, and miscellaneous debris. Also, a grading technician observed a street sweeper dumping trash in the Study Area. Adini also notes that on some occasions during site rough grading the unsuitable fill used was removed from the grading area.

4.0 AMEC FIELD INVESTIGATION

Soil, soil gas, and grab groundwater samples were collected from the Study Area pursuant to the DTSC Work Plan. The field investigation was conducted in two phases. The first phase occurred November 6, through 9, 2013, and included soil and grab groundwater sampling, and the installation of nested soil gas probes. The second phase occurred November 13, through 15, 2013, and included collecting and analyzing soil gas samples from nested soil gas probes, and installation and sampling of sub-slab soil gas probes. DTSC staff was present during both phases of field investigation.

Sample locations are shown on Figure 2.

4.1 Deviations from Proposed Work Scope

The field investigation was implemented following the procedures and methods described in the DTSC Work Plan. Deviations from the DTSC Work Plan included the following:

Addition to the Workplan

- A groundwater split sample was collected in preserved VOA vials from sample location 7 and provided to Nancy Carraway, a community consultant, under chain-of-custody protocol.
- Selected soil gas samples were collected in dinitrophenylhydrazine (DNPH) coated cartridges and were analyzed for formaldehyde by Environmental Analytical Services, Inc. using US EPA Method TO-11A.

Changed due to field conditions

- The Workplan recommended sub-slab samples be collected under similar protocols to the soil gas samples; however, following the mechanical failure of the mobile laboratory and to stay on schedule, a field decision was made to collect sub-slab soil gas samples in 400 milliliter passivated stainless steel canisters and analyzed the samples for VOCs using US EPA Method TO-15. The 5-foot depth soil gas probe at location 6 had no vapor flow and a replacement probe was installed at depth of 3 feet bgs and 3 feet to the south of the original boring location.
- The 5-foot depth soil gas probe at location 8 contained water and a replacement probe was installed at depth of 3 feet bgs and 3 feet to the north of the original boring location.
- The 15-foot depth soil gas probe at location 1 had no vapor flow and a replacement probe was installed at depth of 10 feet bgs.

DTSC staff was informed of the field conditions and the deviations were performed with DTSC concurrence.

4.2 DTSC Workplan Implementation

The following activities were performed during the implementation of the Workplan:

- Pre-field Activities;
- Soil Sampling;
- Groundwater Sampling;
- Soil Gas Sampling; and
- Sub-Slab Soil Gas Sampling.

Each activity is described in the following subsections.

4.2.1 Pre-field Activities

Before initiating each phase of the field work, AMEC conducted the following pre-field activities:

- Obtained an encroachment permit from the City of Wildomar (City) to work in public right-of-ways;
- Attend pre-construction meeting with the City;
- Notified DTSC and the City of planned field activities;
- Notified Underground Service Alert of the planned field activities;
- Erected “No Parking” signs in advance of conducting sampling activities;
- Retained Subsurface Surveys & Associates, Inc., a private utility locating company, to conduct geophysical surveys around the drilling and sampling locations to check for underground utilities and/or other obstructions; and
- Contracted and scheduled the drilling and laboratory services.

A copy of the City encroachment permit is provided in Attachment A.

4.2.2 Soil Sampling

To assess soil conditions in the Study Area, continuous core soil samples were collected using a direct push 6600 Geoprobe Dual Tube drill rig from sample locations 6, 8, and 12 located in the assumed central portion of the former fill area. The subsurface materials encountered were described in the field by an AMEC geologist, licensed by the State of California as a Professional Geologist (PG). Soil characteristics were described following visual-manual procedures of ASTM D2488 for guidance, which are based on the Unified Soil Classification System. Soil was screened in the field in accordance with US EPA SOP 2114 for the potential presence of VOCs using a photoionization detector (PID). Color, moisture content, grain size, PID readings, and other pertinent soil characteristics were recorded on the boring logs. Following soil sampling, the boreholes were subsequently converted to soil gas monitoring points (see ***Soil Gas Sampling***). Soil boring logs for sample locations 6, 8, and 12 are provided in Attachment E.

Soil samples were collected from sample locations 6, 8, and 12 at approximate depths of 5, 10, and 15 feet. A duplicate soil sample collected from a depth of 10 feet at sample location 6 was designated as “60” and was submitted as a “blind” sample to the laboratory. The soil samples were submitted to Calscience and select samples were analyzed for the following:

- Title 22 metals (metals) using US EPA Method 6010B/7470A;
- Semi-Volatile Organic Compounds (SVOCs) using US. EPA Method 8270C;
- Polychlorinated biphenyls (PCBs) using US EPA Method 8082; and
- Pesticides using US EPA Method 8081A.

Soil samples analytical results are summarized in Table 1, along with soil sample data collected by SCAQMD and Adini.

Laboratory reports and chain-of-custody records for the soil sample analyses are provided in Attachment F.

4.2.3 Groundwater Sampling

To assess groundwater conditions in the Study Area, groundwater samples were collected from sample locations 1, 7, 11, 13 (Figure 2). Groundwater was encountered in each sample location at depths ranging from approximately 21 to 30 feet bgs. Temporary PVC well casing was installed in each boring to prevent borehole caving and was used as a conduit to collect a “grab” groundwater sample. Groundwater samples were collected from each temporary well using a new disposable bailer. Duplicate samples designated as “110” and “130” were collected from sample locations 11 and 13, respectively, and were submitted as “blind” samples to the laboratory. Groundwater samples were submitted to Calscience and analyzed for the following:

- VOCs using US EPA Method 8260B; and
- Formaldehyde using US EPA Method 8315A.

The samples for formaldehyde analysis were subcontracted to Weck Laboratories, Inc. As shown in Table 2, VOCs and formaldehyde were not detected in any of the groundwater samples above the reporting limit. Laboratory reports and chain-of-custody records for the groundwater sample analyses are provided in Attachment F.

Continuous core soil samples were collected from sample locations 1, 7, 11, and 13, located around the perimeter of the Study Area (Figure 2). The geologic materials encountered were described in the field by an AMEC geologist, licensed by the State of California as a PG. Soil characteristics were described following visual-manual procedures of ASTM D2488 for guidance. The boreholes were subsequently converted to soil gas monitoring points (see Soil Gas Sampling). Soil boring logs for sample locations 1, 7, 11, and 13, are provided in Attachment E.

4.2.4 Soil Gas Sampling

To assess soil gas conditions in the Study Area, soil gas samples were collected and analyzed following the DTSC April 2012 *Advisory-Active Soil Gas Investigations* (Advisory). Soil gas samples were collected by H&P Mobile Geochemistry, Inc. (H&P) from temporary-type probes installed using direct push techniques. The temporary-type probes were installed during the first phase of field investigation and allowed to equilibrate for minimum of 48 hours before sampling commenced. At each location, soil gas probes were installed at approximate depths of 5 and 15 feet. Soil gas samples were analyzed for VOCs and fuel oxygenate compounds by an on-site mobile laboratory operated by H&P using US EPA Method 8260.

Soil gas samples were collected from a total of 12 locations (Figure 2). Purge-volume tests were conducted at sampling location 2 (at 5 feet) and at sampling location 12 (at 15 feet) by collecting soil vapor samples after purging 1, 3 and 10 system volumes, as recommended by the Advisory. Based on the test results, a 3 purge volume was optimal at the 5-foot depth, while a 1 purge volume was optimal at the 15-foot depth. Initially, the five foot purge volume samples at Location 12 contained excessive amounts leak check compound (LCC); hence the five foot purge volume sample was switched to Location 2. When evaluating the data to determine the optimal five foot soil gas probe purge volume, field personnel evaluated the detected compounds in the purge volume samples at Location 12 and the purge volume samples at Location 2. Since the purge volume data at Location 2 was similar in concentration and constituents which drive risk for the 3 and 10 purge volume data and the 3 purge volume sample at Location 12 contained the most constituents which drive risk, the 3 purge volume was selected for the five foot depth.

During sampling, no flow conditions were observed at Locations 1 (15-foot probe) and 6 (5-foot probe) and replacement probes were installed at depths of 10 and 3 feet, respectively as specified in the Advisory Section 5.2.3. In addition, water was observed in location 8 (5-foot probe) and a replacement probe was installed at depth of 3 feet at that location in accordance with the Advisory Section 5.2.3. During initial purge testing, elevated concentrations of leak check compound (LCC) 1,1-difluoroethane were detected in location 12 at a depth of 5 feet. The source of LCC was later traced to faulty hardware at the surface. Following replacement of the faulty system parts, subsequent sample results were within acceptable limits, as specified in the DTSC Soil Gas Advisory.

Soil gas sample analytical results are summarized in Table 3, along with soil gas sample data collected by Adini and Associates in 2012.

Soil gas samples were collected from locations 2, 6 (and its duplicate), 8, 12, and 13 in DNPH cartridges and were submitted to Environmental Analytical Services, Inc. for analysis of formaldehyde using US EPA Method TO-11A. As shown in Table 5 formaldehyde was not detected in any of these soil gas probe samples.

Laboratory reports and chain-of-custody records for the VOC and formaldehyde analyses are provided in Attachments G and H, respectively.

4.2.5 Sub-slab Sampling

To assess soil gas conditions beneath concrete slabs for select residential homes, sub-slab soil gas samples were collected from three properties in the Study Area. These include:

- 21689 Front Street address (samples 3B-SV located beneath the bedroom and 3G-SV located beneath the garage);
- 21645 Protea Court address (samples 10B-SV located beneath the bedroom and 10L-SV located beneath in living room); and
- 21730 Amaryllis Court address (samples 14B-SV located beneath the bedroom and 14G-SV located beneath the garage).

Soil gas samples were collected by H&P Mobile Geochemistry, Inc. from temporary-type, sub-slab probes drilled through the concrete slab and into engineered fill below the structures foundation. Soil gas samples were collected in 400 milliliter passivated stainless steel canisters and analyzed for VOCs, including methanol, using US EPA Method TO-15. Sub-slab soil gas samples analytical results are summarized in Table 4. LCC in excess of ten times the reporting limit were detected in samples 10B-SV and its duplicate 10B-SV-Rep. Sub-slab soil gas samples 3B-SV, 10L-SV, and 14B-SV were collected in DNPH cartridges and analyzed for formaldehyde using US EPA Method TO-11A.

Laboratory reports and chain-of-custody records for the formaldehyde and VOC analyses are provided in Attachments H and I, respectively.

4.2.6 Equipment Cleaning and Investigative Derived Waste Management

During this investigation, all reusable downhole drilling and sampling equipment were cleaned before use by using Alconox-water solution, and rinsed twice using potable water. Soil cuttings and purged groundwater/equipment rinse water generated during this investigation were contained in Department of Transportation-approved 55-gallon drums. Each drum was labeled with the content, date of accumulation, and project contact information. Based on the sample results, the soil and waste water were characterized as non-hazardous and were subsequently transported for disposal at offsite facilities.

5.0 INVESTIGATION RESULTS

As noted in Section 1.0, the overall purpose of this investigation was to assess the presence, distribution, and potential origin of VOC impact to the subsurface in the Study Area. To meet this purpose, the investigation included implementation of a Sampling and Analysis Plan (SAP) to obtain data to evaluate the potential nature and concentrations of VOCs present in subsurface soil, soil gas, and groundwater, and their relationship, if any, to vapor intrusion in the Study Area.

The results of the data collection and quality assurance/quality control (QA/QC) evaluation are summarized in the following subsections.

5.1 Laboratory Results

The soil, soil gas, groundwater, and QA/QC sample results are summarized in the following subsections. The field procedures were described in Section 4.0.

5.1.1 Soil Sample Results

A total of 10 soil samples, including 1 duplicate, were collected at 3 locations (6, 8, and 12) from approximate depths of 5, 10, and 15 feet. Soil samples were analyzed for semivolatile organic compounds, polychlorinated biphenyls, organochlorine pesticides, and metals.

Soil samples analytical results are summarized in Table 1. PCBs and pesticide compounds were not detected in any of the soil samples. Bis (2-ethylhexyl) phthalate was the only SVOC detected and was reported at a concentration of 2.6 milligrams per kilogram (mg/kg) in the soil sample collected from a depth of 5 feet in sample location 12. Metal results are summarized in Table 1 and are considered within background levels for metals in soil. The laboratory analytical reports for soil samples are provided in Attachment F.

5.1.2 Grab Groundwater Sample Results

A total of 6 grab groundwater samples, including 1 duplicate and 1 split, were collected from 4 locations (1, 7, 11, and 13) from depth intervals between approximately 20 and 30 feet.

Groundwater samples were analyzed for VOCs using US EPA Method 8260B. As shown in Table 2, VOCs and formaldehyde were not detected in any of the groundwater samples above the reporting limit. Laboratory reports and chain-of-custody records for the groundwater sample analyses are provided in Attachment F.

5.1.3 Soil Gas Results

During this investigation, a total of 24 soil gas probes were installed at 12 locations (1, 2, 4 through 9, 11 through 13, and 15) at approximate depths of 5 and 15 feet except as noted in Section 4.2.4.

A total of 33 soil gas samples, including 6 purge volume test samples for the 5 and 15 foot depths and 3 replicate samples, were collected and analyzed for VOCs using US EPA Method 8260B.

BTEX compounds were the primary VOCs detected in soil gas samples. VOC concentrations were generally approximately double in the 15 foot samples compared to the five foot samples although both concentrations are considered very low levels. The following is a breakdown of the VOC concentration ranges detected in soil gas with depth during the investigation.

- <u>Sampling depth intervals between approximately 3 and 5 feet</u>:
    - Benzene was detected concentrations ranging from ND to 0.06 micrograms per liter (*µ*g/L).
    - Chloroform was detected at concentrations ranging from ND to 0.04 *µ*g/L.
    - m, p-Xylene was detected at concentrations ranging from ND to 0.27 *µ*g/L.
    - 1,2,4-Trimethylbenzene at concentrations ranging from ND to 0.11 *µ*g/L.
- <u>Sampling depth intervals between approximately 10 and 15 feet</u>:
    - Benzene was detected at concentrations ranging from ND to 0.10 *µ*g/L.
    - Toluene was detected at concentrations ranging from ND to 0.29 *µ*g/L.
    - Ethylbenzene was detected at concentrations ranging from ND to 0.25 *µ*g/L.
    - m, p-Xylene was detected at concentrations ranging from ND to 1.5 *µ*g/L.
    - o-Xylene was detected at concentrations ranging from ND to 0.42 *µ*g/L.
    - 1,2,4-Trimethylbenzene at concentrations ranging from ND to 0.37 *µ*g/L.
    - 1,3,5- Trimethylbenzene at concentrations ranging from ND to 0.14 *µ*g/L.
    - Naphthalene at concentrations ranging from ND to 0.20 *µ*g/L.

- p-Isopropyltoluene at concentrations ranging from ND to 0.22 µg/L.

Analytical results for VOCs detected in the soil gas samples are summarized in Table 3.
A comparison between the primary and replicate VOC sample are presented in Table 6. The laboratory analytical reports for soil gas samples analyzed by the mobile laboratory are provided in Attachment G.

Additionally, soil gas samples were collected from locations 2, 6 (and its duplicate), 8, 12, and 13 in DNPH cartridges and were submitted to Environmental Analytical Services, Inc. for analysis of formaldehyde using US EPA Method TO-11A. As shown in Table 4, formaldehyde was not detected in any of these soil gas probe samples.

5.1.4 Sub-Slab Sample Results

A total of 10 sub-slab soil gas samples were collected including 6 primary VOC and 1 replicate, and 3 for formaldehyde analysis. As shown in Table 5, several VOC analytes (including methanol) were detected in sub-slab soil gas samples. The following is a breakdown of the VOC concentration ranges detected in soil gas with depth during the investigation:

- Tetrachloroethylene was detected at concentrations ranging from ND to 0.02 µg/L.
- Chloroform was detected at concentrations ranging from ND to 0.01 µg/L.
- Benzene was detected at concentrations ranging from 0.01 to 0.11 µg/L.
- Toluene was detected at concentrations ranging from 0.01 to 0.16 µg/L.
- Ethylbenzene was detected at concentrations ranging from ND to 0.04 µg/L.
- m, p-Xylene was detected at concentrations ranging from 0.01 to 0.08 µg/L.
- o-Xylene was detected at concentrations ranging from 0.01 to 0.03 µg/L.
- 1,2,4-Trimethylbenzene was detected at concentrations ranging from 0.01 to 0.02 µg/L.
- Methyl tert-butyl ether was detected at concentrations ranging from ND to 0.01 µg/L.
- Methylene Chloride was detected at concentrations ranging from ND to 0.01 µg/L.
- Methanol was detected at concentrations ranging from ND to 0.54 µg/L.

In general, VOC concentrations, where detected, are relatively low. Elevated concentrations of LCC, greater than 0.055 µg/L, were detected in samples 10B-SV and its duplicate 10B-SV-Rep.; however, the elevated concentrations of LCC are most likely attributed to cracks or joints in the concrete slab. Sub-slab soil gas samples 3B-SV, 10L-SV, and 14B-SV were collected in DNPH cartridges and analyzed for formaldehyde using US EPA Method TO-11A. As shown in Table 4, formaldehyde was detected in each sub-slab soil gas sample at concentrations ranging from 0.0065 to 0.0081 μg/L.

Laboratory reports and chain-of-custody records for the formaldehyde and VOC analyses are provided in Attachments H and G, respectively.

5.2 Quality Assurance/Quality Control

Throughout the investigation, AMEC followed quality assurance (QA) and quality control (QC) procedures described in the DTSC Work Plan (DTSC 2013a) to demonstrate the proper collection of environmental samples and laboratory measurements of chemical concentrations.

5.2.1 Field Quality Control Samples

During implementation of the work plan, the following types of field QC samples were collected:

- trip blanks
- field equipment blanks
- field duplicates

The field QC sampling results are discussed in the following subsections.

5.2.1.1 Trip Blanks

A total of two trip blanks were collected and analyzed for VOCs in the ice chests containing the groundwater samples using US EPA Method 8260B. No VOCs were detected in any of the trip blanks.

5.2.1.2 Field Equipment Blanks

One field equipment blank was collected from non-dedicated soil sampling equipment and were analyzed for metals using US EPA Method 6010B/7470A, SVOCs using US EPA Method 8270C, PCBs using US EPA Method 8082, and pesticides using US EPA Method 8081A. No analytes were detected in the field equipment blank samples.

5.2.1.3 Field Duplicate Samples

A total of 6 field duplicate samples were collected (1 soil sample, 1 groundwater samples, 2 soil gas samples, and 2 sub-slab soil gas samples) and analyzed using the same methods as the primary samples. Primary/duplicate sample pair results were assessed using the relative percent difference (RPD) between the primary sample and the duplicate sample measurements.

As shown on Table 6, the precision goals for field duplicate were all within 30% for water samples and 50% for soil and soil gas samples.

5.2.2 Laboratory Quality Assurance/Quality Control Samples

The analytical data presented in this report were reviewed in general accordance with the US EPA data review methods.

- All samples were analyzed within the appropriate holding times specified by each laboratory method;

- No analytes were detected in the laboratory method blanks at concentrations above laboratory reporting limits;

- Matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed and the percent recovery (%R) for the MS and MSD samples and RPDs for the MS/MSD pairs for both analyses were within laboratory QC limits except for antimony in soil samples and formaldehyde in groundwater samples;

    - The MS/MSD %R was below QC limits for antimony due to suspected matrix interference. Antimony was not detected in any of the associated soil samples and thus, the results were qualified with UJ flags;

    - The MSD %R was above QC limits for formaldehyde. All other associated QA/QC sample analyses were within limits and data qualification was not necessary;

- Laboratory control samples (LCS) and duplicate (LCSD) were analyzed and the %R and RPD for the LCS and LCSD samples were within laboratory QC limits; and

- Surrogates recoveries were within the laboratory QC limits.

5.2.3 Summary of Data Quality Review

All samples proposed in the Workplan (DTSC, 2013) and as modified based on site/field conditions were collected and analyzed as planned. The specified numbers of QA/QC samples were also collected and analyzed as planned. Overall, the results of the QA/QC review indicate that the laboratory results are acceptable and meet the data quality objectives of the project. Other than antimony noted above, none of the assessment data for soil gas, soil, or groundwater required qualification because of the laboratory QA/QC results. The data obtained are considered sufficiently complete and acceptable for the purposes and intended use of this investigation.

5.2.4 Level 4 Data Validation and Data Verification

A Level 4 data package evaluation is the highest level of data scrutiny. The primary goal of the Level 4 Data Validation and Data Verification is to ensure that environmental programs and decisions are supported by data of the type and quality needed and expected for their intended use (EPA 2000). On February 20, 2014, DTSC's Environmental Chemistry Laboratory (ECL) began evaluating the analytical testing results for samples collected by DTSC at the Wildomar Autumnwood Development in November 2013. ECL was requested to review Level 4 data packages to assess the data usability for risk assessment and decision making at Wildomar. The review focused on water and air samples. Soil samples were not part of this review as the analytical results for OCPs, PCBs were non-detect at the method detection limits and detected soil metal concentrations were within background for southern California (See Section 6.1.1). Because the potential for vapor intrusion and potential impacts to indoor air were identified as a major concern for homes in the Autumnwood Development, the data review and evaluation focused on VOCs in groundwater, soil gas and sub-slab soil gas.

Level 4 data packages from four laboratories were provided to ECL for review: Calscience Environmental Laboratories in Garden Grove, CA (VOC (8260) water analysis); Weck Laboratories in City of Industry, CA (Formaldehyde (8315) water analysis); Environmental Analytical Services (EAS) in San Luis Obispo, CA (Formaldehyde (TO-11) air analysis); and H&P Mobile Geochemistry Inc. (H&P) in Carlsbad, CA (TO-15 and 8260SV air analysis)[Attachment J].

Additionally, the review evaluated the analytical data to assess whether the data are legally defensible and whether the use of the data for its intended purpose is able to withstand scrutiny if challenged by other technical experts.

ECL's review consists of the following steps:

i. Analytical Method requirements are compared to the laboratory's Standard Operating Procedure (SOP) to identify modifications from the Method and determine how the modifications may affect the data.

ii. Data reports are compared to the SOP to determine if the laboratory deviated from their SOP, if these deviations were documented properly, and if these deviations have an influence on the data results.

iii. The data are reviewed to determine whether quality control (QC) requirements specified in the Analytical Method and in the SOP were carried out.

iv. Any observed outliers or missing QC parameters are checked for narration and reviewed for influence on the data results.

v. Calculations are performed on one or two of the compounds reported to validate that the final results are being calculated correctly from the raw data.

Validity and usability of the data are determined from the results of this review. If the information provided for review is inadequate for ECL to make a determination, additional information is requested first. If the additional information is found inadequate for ECL to make a determination, a conclusion is reached that defensibility of the data could not be determined.

The entire ECL review can be found in Attachment J. Additionally, analytical data evaluations for each media sampled are included in Section 6.0 below.

6.0 SUMMARY OF FINDINGS

As discussed in the Objectives presented in Section 1.0, the purpose of this investigation was to determine whether VOCs are present in the soil and groundwater and if VOCs are present in sufficient concentrations to pose a current or future health risk.

6.1 Evaluation of Investigation Results

The following subsections evaluate the data summarized in Section 5.1 and discuss the Investigation findings as they relate to potential human health risk from vapor intrusion or direct contact with soil.

6.1.1 Soil Sample Results

The soil metals results are presented in Table 1 and are compared to the range of background concentrations established for California (Kearney 1996). As shown in Table 1, all metals detected in the Autumnwood Development are considered background for southern California, and as such, none of the detected metals would be considered a chemical of potential concern (COPC). No PCBs or organochlorine pesticides (OCPs) were detected in the soil samples. As shown in Table 1, only one SVOC, bis(2-ethylhexyl)phthalate was detected in one sample (location 12) at the 5-foot depth. Bis(2-ethylhexyl)phthalate is a very common environmental contaminant resulting in its use as a plasticizer in all types of plastic products. This SVOC was detected at a concentration of 2.6 mg/kg, just at the reporting limit.

The EPA Regional Screening Levels (RSLs) for bis(2-ethylhexyl)phthalate in soil are 35 mg/kg for cancer effects and 1,200 mg/kg for noncancer effects. At a concentration of 2.6 mg/kg as observed in the Study Area, unrestricted, direct contact with soil through incidental ingestion, dermal contact and inhalation of particulates would result in a cancer risk and noncancer hazard of 7E-8 and 0.002, respectively. Consequently, exposure to bis(2-ethylhexyl)phthalate at this concentration would result in a negligible risk and hazard from unlimited exposure to soil, conservatively assuming that it was present at this concentration in soil throughout the Development.

6.1.2 Groundwater Sample Results

As shown in Table 2, no VOCs or formaldehyde were detected in shallow groundwater beneath the Autumnwood Development above the reporting limit. However, based on ECL's Level 4 Data Review (Attachment J), the formaldehyde data are usable with restrictions. The actual calculated values for formaldehyde have an uncertainty based on the chromatography interference by DNPH that was observed in the samples but not in the calibration standards. Quantitative use of the data for values near the reporting limit is not recommended. However, none of the samples had observed chromatographic peaks that were greater than the laboratory spike samples. Therefore, ECL concluded that none of the samples contained formaldehyde above 100 μg/L, the amount spiked in the laboratory spike samples. The significance of these elevated detection limits can be evaluated by assuming that formaldehyde exists in groundwater in the Study Area at concentrations at 100 μg /L and then extrapolating the associated potential health threat.

In order to estimate the soil gas concentration corresponding to a formaldehyde groundwater concentration of 100 μg/L, the following equilibrium partitioning equation from the DTSC Vapor Intrusion Guidance (DTSC 2011) was used:

$$C_{\text{soil gas}} = C_{\text{groundwater}} * H_c * C_f$$

where:

$C_{\text{soil gas}}$ = Soil gas concentration (μg/ m^3)

$C_{\text{groundwater}}$ = Groundwater formaldehyde concentration (100 μg/L)

H_c = Henry's law constant (unitless), 1.38E-5 for formaldehyde

C_f = Conversion factor (1000 L/m^3)

Assuming formaldehyde was present in groundwater at a concentration of 100 μg/L, the corresponding soil gas concentration would be 1.38 μg/m^3. Using a default attenuation factor of 0.002 for existing residential structures, as recommended in the DTSC Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance, DTSC 2011), the estimated indoor air concentration of formaldehyde would be 0.003 μg/m^3. This estimated indoor air concentration is below laboratory reporting limits and is 68-times lower than the risk-based indoor air concentration of 0.19 μg/m^3. Therefore, groundwater is not a source for any formaldehyde observed in indoor air. Likewise, due to the lack of detection of VOCs in groundwater, groundwater beneath the Study Area is not a source of indoor air contaminants.

As part of their independent Level 4 Data Review, CDPH identified benzene below the reporting limit of 0.5 μg/L in sample 1-GW-19-24, which corresponds to sample location 1 on Figure 2. As done above for formaldehyde, the estimated soil gas concentration of benzene would be calculated as follows:

$$C_{\text{soil gas}} = C_{\text{groundwater}} * H_c * C_f$$

where:

$C_{\text{soil gas}}$ = Soil gas concentration (μg/ m^3)

$C_{\text{groundwater}}$ = Groundwater benzene concentration (0.2 μg/L)

H_c = Henry's law constant (unitless), 2.27E-01 for benzene

C_f = Conversion factor (1000 L/m^3)

Assuming benzene was present in groundwater at the estimated concentration of 0.2 μg/L, the corresponding soil gas concentration would be 45.4 μg/m^3, which is below the benzene soil gas CHHSL of 85 μg/m^3. This estimated soil gas concentration would be at the soil-groundwater interface, which is approximately 30-feet bgs. Attenuation from groundwater to the surface was taken into account by using the J&E Groundwater Model and conservatively assuming a depth to groundwater of 25-feet; the estimated indoor air concentration of benzene would be 0.0015 μg/m3, corresponding to an estimated indoor air risk of 2E-08. Consequently, the potential contribution of benzene to soil gas or indoor air from groundwater would be negligible. The J&E Model output is included in Attachment K. With the exception of this benzene detection in one groundwater sample below the reporting limit, no other unidentified peaks or peak patterns were observed in the sample chromatograms by ECL. Following their review of the Level 4 Data Package, ECL reported the VOC results in groundwater were useable for risk assessment and no VOCs were detected in groundwater above their reporting limits.

6.1.3 Soil Gas Results

Soil gas sample results are summarized in Table 3. The majority of soil gas detections were fuel-related VOCs, specifically benzene, ethylbenzene, toluene, xylenes (otherwise known as BTEX), and 1,2,4-trimethylbenzene. Naphthalene was detected in only two samples at 15-feet (2-SV-15 and 12-SV-15). 1,3,5-trimethylbenzene was detected in only one sample at 15-feet (9-SV-15). Isopropyltoluene was detected in only two samples at 15-feet (7-SV-15 and 8-SV-15). The only chlorinated VOC detected was chloroform, which was detected in only two samples at 5-feet (2-SV-5 and 5-SV-5). Table 3 also presents the soil gas screening criteria, specifically, the soil gas California Human Health Screening Levels (CHHSLs) developed by the Office of Environmental Health Hazard Assessment (OEHHA)(Cal/EPA 2005, 2010). If CHHSLs were not available for a specific chemical a soil gas screening concentration was derived using the EPA Indoor Air Regional Screening Level (RSL) (EPA 2013) and applying the default residential soil gas attenuation factor of 0.002, as recommended in the DTSC Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance)(DTSC 2011). As shown in Table 3, benzene slightly exceeded its CHHSL at one location (4-SV-15) and naphthalene slightly exceeded its CHHSL at one location (2-SV-15). The sample-specific cancer risks ranged from 1E-7 to 3E-6. The sample-specific hazards ranged from 1E-4 to 1E-1.

DTSC further evaluated the potential for vapor intrusion for each VOC detected in soil gas. DTSC conservatively selected the maximum soil gas concentration and assumed that these maximum reported soil gas concentrations were uniformly distributed throughout the Autumnwood Development, which is a very health protective assumption. Consistent with the DTSC Vapor Intrusion Guidance, DTSC conducted a more refined vapor intrusion risk evaluation using the DTSC-modified Johnson and Ettinger Vapor Intrusion Model. Consistent with the boring logs, a sandy clay loam (SCL) soil type was selected and default model parameters for SCL used. The Johnson and Ettinger Screening Model Outputs are presented in Attachment H. The soil gas screening-level indoor air risks and hazards are summarized in Table 7. The maximum estimated indoor air cancer risk and hazard were 1E-6 and 0.04, respectively. Based on the results of this very health protective screening evaluation of soil gas results, VOCs detected in soil gas do not pose an indoor air risk or hazard and soil gas does not pose a vapor intrusion threat for the Autumnwood Development.

In addition to the full suite of VOCs analyzed in soil gas samples, formaldehyde was also analyzed by EPA Method TO-11A. Based on ECL's Level 4 Data Review (Attachment J), the data are usable with restrictions. ECL determined that the actual calculated values have an uncertainty based on the chromatography interference by DNPH that was observed in the samples but not in the calibration standards. Quantitative use of the data for values near the reporting limit is not recommended. None of the samples had observed chromatographic peaks that were greater that the laboratory cartridge spike study samples. ECL concluded that none of the samples contained formaldehyde above 75 $\mu g/m^3$. Conservatively assuming that formaldehyde was present in soil gas at a concentration of 75 $\mu g/m^3$, and using the default soil gas attenuation factor of 0.002 for existing residential structures (DTSC 2011), the estimated maximum indoor air concentration of formaldehyde would be 0.15 $\mu g/m^3$, which is below the risk-based RSL of 0.19 $\mu g/m^3$. Previous indoor air sampling by the Swanson Law Firm (Carraway 2012) at four homes on Amaryllis Court showed formaldehyde between 23 and 82 $\mu g/m^3$. Based on the reporting limits of formaldehyde in both groundwater and soil gas, indoor air concentrations of formaldehyde could not result from vapor intrusion from either shallow groundwater or soil gas.

6.1.4 Sub-Slab Soil Gas Results

The sub-slab analytical results for three homes are summarized in Table 4. As seen for the soil gas samples, low levels of BTEX and fuel-related VOCs were detected in the sub-slab soil gas samples. In addition, low levels of tetrachloroethene were also detected in the sub-slab samples. Consistent with the DTSC Vapor Intrusion Guidance, maximum potential indoor air concentrations were estimated from the sub-slab concentrations using a conservative, default attenuation factor of 0.05. Based on DTSC's experience, this health protective attenuation factor overestimates potential indoor air concentrations from the sub-slab concentrations. Table 8 compares the predicted maximum indoor air concentrations to their respective indoor air screening concentrations, which were either indoor air CHHSLs or RSLs. As can be seen, the estimated indoor air concentrations of benzene, chloroform, ethylbenzene and tetrachloroethene were above their respective indoor air screening levels. However, the predicted indoor air concentrations of these VOCs were within the range of median or average background indoor air concentrations for a home with no vapor intrusion, as determined by EPA (EPA 2011). The maximum outdoor air concentrations detected by the Swanson Law Firm for benzene, chloroform, ethylbenzene and tetrachloroethene were 2.3, 1.24, 2.83 and 1.31 μg/m^3, respectively. Consequently, the contribution of sub-slab soil gas concentrations of these VOCs would not be distinguishable from the contribution from indoor air sources and ambient air levels.

Using benzene as an example, if the maximum estimated indoor air concentration of 5 μg/m^3 was coming from the subsurface, the corresponding soil gas concentration should be 2,500 μg/m^3 using the default attenuation factor of 0.002 for an existing home. The highest concentration of benzene detected in soil gas was 100 μg/m^3. Based on multiple lines of evidence, including groundwater data, soil gas data, sub-slab soil gas data and previous indoor and outdoor air data, VOCs in the subsurface were so low or minimal that no discernable impact could be detected in the indoor air at Autumnwood.

Table 5 presents the soil gas and sub-slab soil gas results for formaldehyde. As discussed previously, no formaldehyde was detected in the soil gas samples. Low levels of formaldehyde were detected in the sub-slab samples and ranged from 6.5 to 8.1 μg/m^3. Based on ECL's Level 4 Data Review (Attachment J), the data are usable with restrictions. ECL determined that the actual calculated values have an uncertainty based on the chromatography interference by DNPH that was observed in the samples but not in the calibration standards. Quantitative use of the data for values near the reporting limit is not recommended. None of the samples had observed chromatographic peaks that were greater that the laboratory cartridge spike study samples. ECL concluded that none of the samples contained formaldehyde above 75 μg/m^3. Conservatively assuming that formaldehyde was present in sub-slab soil gas at a concentration of 75 μg/m^3, and using the default soil gas attenuation factor of 0.05 for existing residential structures (DTSC 2011), the estimated maximum indoor air concentration of formaldehyde would be 3.75 μg/m^3. Previous indoor air sampling by the Swanson Law Firm at four homes on Amaryllis Court showed formaldehyde between 23 and 82 μg/m^3. Again, using the health protective, default attenuation factor of 0.05, if the formaldehyde was coming from the subsurface, the sub-slab soil gas concentrations would have to be between 460 and 1,640 μg/m^3. Likewise, using the default soil gas attenuation factor of 0.002, the soil gas concentration of formaldehyde would have to be between 11,500 and 41,000 μg/m^3 to account for the measured indoor air concentrations of formaldehyde. Based on the discussions presented above in Sections 6.1.2 and 6.1.3 and using the reporting limits of formaldehyde as recommended by ECL in their Level 4 Data Review (Attachment J) for both groundwater and soil gas, indoor air concentrations of formaldehyde could not result from vapor intrusion from either shallow groundwater or soil gas. Indoor air quality studies have shown formaldehyde to be a very common indoor air contaminant associated with building materials. Offermann and Hodgson (2012) studied indoor air quality in 108 new, single family homes in California. Formaldehyde had the highest indoor emission rate and was the only VOC with an elevated hazard quotient.

6.1.5 Tentatively Identified Compounds (TICs)

As part of the Level 4 Data Evaluation (see Attachment J), ECL determined that a review of the chromatograms showed unidentified peaks and peak patterns in both the sub-slab TO-15 and soil gas 8260SV chromatograms. . Groundwater samples were also reviewed but were found to have peak responses below the low concentration level of the calibration. Further evaluation was not requested of the laboratory. Based on a review of all chromatograms, ECL concluded that the pattern observed was primarily C_5 – C_{11} aliphatic range fuel hydrocarbons. In response to DTSC’s request, the laboratory provided TPH estimations for all samples and TIC reports for three of the soil gas samples and three of the sub-slab soil gas samples (Tables 9 and 10, respectively. Also see Attachments G and I). Samples for TIC identification were selected by ECL based on those samples with the highest number of unidentified peaks and those samples showing the highest constituent concentration for the respective unidentified peaks.

The most toxic of the aliphatic soil gas compounds detected was n-hexane, which causes neurotoxicity at higher doses. To be health protective in evaluating potential noncarcinogenic health hazards, all C_5 – C_8 aliphatic hydrocarbon concentrations were summed and evaluated using the Reference Concentration (RfC) of 700 μg/m^3, provided in the TPH Toxicity Table in the DTSC Preliminary Endangerment Assessment Manual (DTSC 2013b). This is identical to the RfC for n-hexane, and conservatively assumes that all C_5 – C_8 aliphatic hydrocarbons are equivalent in toxicity to n-hexane, the most toxic aliphatic hydrocarbon. Some TICs had no available toxicity data, such as decahydro-2-methyl-naphthalene, 1-ethyl-3-methyl benzene and trimethylcyclohexane. For decahydro-2-methyl-naphthalene, the RfC for C9 – C-16 aromatic fractions, 50 $\mu g/m^3$, was utilized from the TPH Toxicity Table of the PEA Manual (DTSC 2013b). For 1-ethyl-3-methyl benzene, the RfC for xylenes (730 $\mu g/m^3$) was used as a surrogate. For the trimethyl cyclohexanes, the RfC for cyclohexane (6,000 $\mu g/m^3$) was used as a surrogate.

Using the above reference concentrations for air, the TIC-specific soil gas screening value was estimated using the attenuation factor of 0.002 for current residential structures, as specified in the DTSC Vapor Intrusion Guidance (DTSC 2011). The TIC-specific sub-slab screening value was estimated using the attenuation factor of 0.05, as specified in the Vapor Intrusion Guidance. Table 9 summarizes the TIC soil gas concentrations and estimated indoor air hazards. The highest estimated indoor air hazard index associated with TICs detected in soil gas was 0.1. Table 10 summarizes the TIC sub-slab soil gas concentrations and estimated indoor air hazards. The highest estimated indoor air hazard index associated with TICs detected in sub-slab soil gas was 0.07. The maximum estimated hazards associated with TICs detected in soil gas samples, are well below the threshold of concern of 1.0 and therefore, the fuel-related TICs detected in soil gas and sub-slab soil gas do not pose a noncarcinogenic health threat.

6.1.6 Conclusions

The results of DTSC's investigation at the Autumnwood Development identified 10 target VOCs in soil gas and11 VOCs in sub-slab soil gas, while up to 26 VOCs were identified in indoor air samples collected in select homes. VOC concentrations detected in soil gas were shown not to adversely affect indoor air quality from vapor intrusion. One of the significant risk drivers identified in indoor air by both the CDPH and OEHHA, was 1,2-dichloroethane, which was never detected in shallow groundwater, soil gas or sub-slab soil gas samples. In 2013, Maddalena et al. conducted a study of 108 new California homes and identified 238 individual volatile organic compounds, the majority of which came from indoor sources. In an earlier 2009 indoor air quality study of 107 homes by Offermann, benzene and formaldehyde exceeded risk-based indoor air concentrations for carcinogens in 63 percent and 100 percent of the homes, respectively. In the Offermann study, new homes with attached garages were shown to be a source of benzene and xylenes with emission rates impacting the indoor air environment. Emissions rates of these VOCs were even higher in homes with garages under living spaces (Offermann et al., 2012).

Formaldehyde was identified by OEHHA as a carcinogenic risk driver and above its acute threshold in indoor air. Offermann and Hodgson (2012) studied indoor air quality in 108 new, single family homes in California. Formaldehyde had the highest indoor emission rate and was the only VOC with an elevated hazard quotient. This study also showed that minimum ventilation rates cannot control formaldehyde emission rates in homes to acceptable levels.

Based on multiple lines of evidence, the following conclusions were reached by DTSC regarding the potential for vapor intrusion at the Autumnwood Development.

1. Low levels of fuel related hydrocarbons and chlorinated compounds were detected in a diffuse pattern throughout the Study Area. No data reviewed, either historical or current, were indicative of a significant hazardous substance release or a significant source of contamination in soil, groundwater or soil gas;

2. Groundwater is not a source of VOCs in the subsurface;

3. VOCs detected in soil gas were so low or minimal that they do not pose a significant indoor air risk or hazard; and

4. Based on multiple lines of evidence, including groundwater data, soil gas data, sub-slab soil gas data and previous indoor and outdoor air data, VOCs in the subsurface were so low or minimal that no discernable impact could be detected in the indoor air at Autumnwood.

At a Multi-Agency meeting on January 17, 2014 at the Center for Community Action and Environmental Justice in Riverside, California, the residents, Nancy Carraway, and Penny Newman presented a PowerPoint presentation covering their concerns regarding the Draft DTSC Investigation Report, dated December 2013. Formal written comments were not provided to DTSC; hence, DTSC summarized the verbal comments and provided responses to the community comments in Attachment L.

7.0 Independent Regulatory Agency Review

DTSC submitted the Draft Autumnwood Development Investigation Report to the OEHHA and CDPH for an independent review and evaluation. Any comments/recommendations received by DTSC were discussed with the appropriate Agency, incorporated into a revised report and re-submitted for final review. Each Agency's final review is included in Attachment M (Autumnwood Development Investigation Report review from OEHHA and CDPH). OEHHA concluded the following:

> *"The data is of sufficient quality for DTSC to draw its conclusion that there is no evidence for a hazardous chemical release in the soil and groundwater, and that no detected chemical vapors from the soil are infiltrating homes at levels that would explain illnesses reported by the residents."*

CDPH concluded the following:

> *"Based on the data presented in the DTSC Report, CDPH agrees with DTSC's conclusions regarding the investigation of the environmental media underneath the Autumnwood Development."*

DTSC utilized its regulatory authority to evaluate historical data and implement a subsurface investigation of soil, soil gas and groundwater in the vicinity of homes located in the Autumnwood tract of Wildomar California. DTSC's investigation focused on gathering data to determine if there has been a release of toxic chemicals in the area that could cause a potential community health issues related to exposure to subsurface contamination. In support of the investigation, DTSC enlisted the assistance of the California Department of Public Health (CDPH) and the Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA). Both CDPH and OEHHA reviewed existing historical investigative data, the investigation workplan and a draft report. DTSC's Environmental Chemistry Laboratory also completed an evaluation of the Level 4 Data Review Package provided by the laboratory which analyzed samples collected from the Autumnwood tract. Based on the diffuse nature and low concentrations of chemicals detected in the subsurface during the Autumnwood Investigation, DTSC, CDPH and OEHHA jointly concluded that the indoor air quality at the homes in the Autumnwood Tract is not being adversely impacted by subsurface contamination in soil, soil gas or groundwater in the area.

8.0 REFERENCES

Ami Adini and Associates, Inc., 2012. Preliminary Environmental Assessment Report Autumnwood Development, Amaryllis Court, Wildomar, California. September 25.

ASTM D2488 - 09A, 2009. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). DOI: 10.1520/D2488-09A, www.astm.org.

California Air Resources Board, 2009. Ventilation and Indoor Air Quality in New Homes, CARB and California Energy Commission, November, 2009.

Cal/EPA, 2005, updated 2010. Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties. January 2005. Updated Table, 09/23/10.

City of Murrieta, 2011. General Plan 2035 Final EIR, pg. 5.15-8, July.

Department of Toxic Substances Control (DTSC), 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance), October 2011. (http://www.dtsc.ca.gov/AssessingRisk/upload/Final_VIG_Oct_2011.pdf)

DTSC, 2012. Advisory – Active Soil Gas Investigations, April 13. (http://dtsc.ca.gov/SiteCleanup/upload/VI_ActiveSoilGasAdvisory_FINAL_043012.pdf).

DTSC, 2013a. Soil, Soil Gas, and Groundwater Sampling Workplan for Autumnwood Development, Amaryllis Court and Vicinity Wildomar, California.

DTSC 2013b. Preliminary Endangerment Assessment Guidance Manual, Interim Final Revised October 2013. (https://dtsc.ca.gov/SiteCleanup/Brownfields/upload/Preliminary-Endangerment-Assessment-Guidance-Manual.pdf)

Engle, R., 1959. Geology of the Lake Elsinore Quadrangle, California: California Division of Mines and Geology, Bulletin 146, scale 1:62,500 (Wildomar 7.5’ Quadrangle is in the SE corner of the Lake Elsinore 15’ Quadrangle).

Hull, A.G., 1990, Seismotectonics of the Elsinore-Temecula Trough, Elsinore Fault Zone, Southern California: Ph.D. dissertation, Santa Barbara, California, University of California, 233 p.

Kearney, 1996. Kearney Foundation Special Report, Background Concentrations of Trace and Major Elements in California Soils, Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996.

Kennedy, M.P., 1977. Recency and Character of Faulting along the Elsinore Fault Zone in Southern Riverside County: California Division of Mines and Geology Special Report 131, 12 p.

Maddalena, R., Na Li, Alfred Hodgson, Francis Offermann and Brett Singer, (2013). Maximizing Information from Residential Measurements of Volatile Organic Compounds. Ernest Orlando Lawrence Berkeley National Laboratory. LBNL-6120E.

Morton, D.M. and Weber, F.H., Jr., 2003. Geologic map of the Elsinore 7.5’ Quadrangle, Riverside County, California: U.S. Geological Survey, Open-File Report 03-281, scale 1:24,000, http://geopubs.wr.usgs.gov/open-file/ofo3-281.

Office of Environmental Health Hazard Assessment, 2013. Evaluation of Sampling Results from the Autumnwood Community in Wildomar, California: Memorandum from Chief of Air, Community and Environmental Research Dr. David Siegel to DTSC Director Debbie Raphael.

Offermann, F.J., 2009. Ventilation and Indoor Air Quality in New Homes: Pier Collaborative Report. Prepared by Indoor Environmental Engineering. Prepared for the Public Interest Energy Research (PIER), California Energy Commission and the California Air Resources Board. CEC-500-2009-085.

Offermann, F.J., Alfred T. Hodgson, Peggy L. Jenkins, Ryna D. Johnson and Thomas J. Phillips. Proceedings Health Buildings 2012, 10th International Conference, Brisbane Australia, Jul 8-12, 2012.

Offermann, F.J., and Alfred T. Hodgson,2012. Emission Rates of Volatile Organic Compounds in New Homes. Proceedings 12th International Conference on Indoor Air Quality and Climate 2011; Austin, TX, USA.

Petra, 2005. Geotechnical Report of Rough Grading, Lots 1 through 62, Amaryllis Court, Pink Ginger Court, Protea Court, Front Street, Tract 31175, Wildomar Area, Riverside County, California: For Inland Pacific Builders Inc. Temecula, California, May 23.

South Coast Air Quality Management District, 2013. Report on Air and Soil Samples Taken in Wildomar, CA in January 2013. South Coast Air Quality Management District.

Weber, F.H. Jr, 1976. Preliminary Map of faults of the Elsinore and Chino Fault Zones in Northeastern Riverside County, California, Showing Accompanying Features Related to Character and Recency of Movement: California Div. Mines and Geology Open-file Report 76-1 LA.

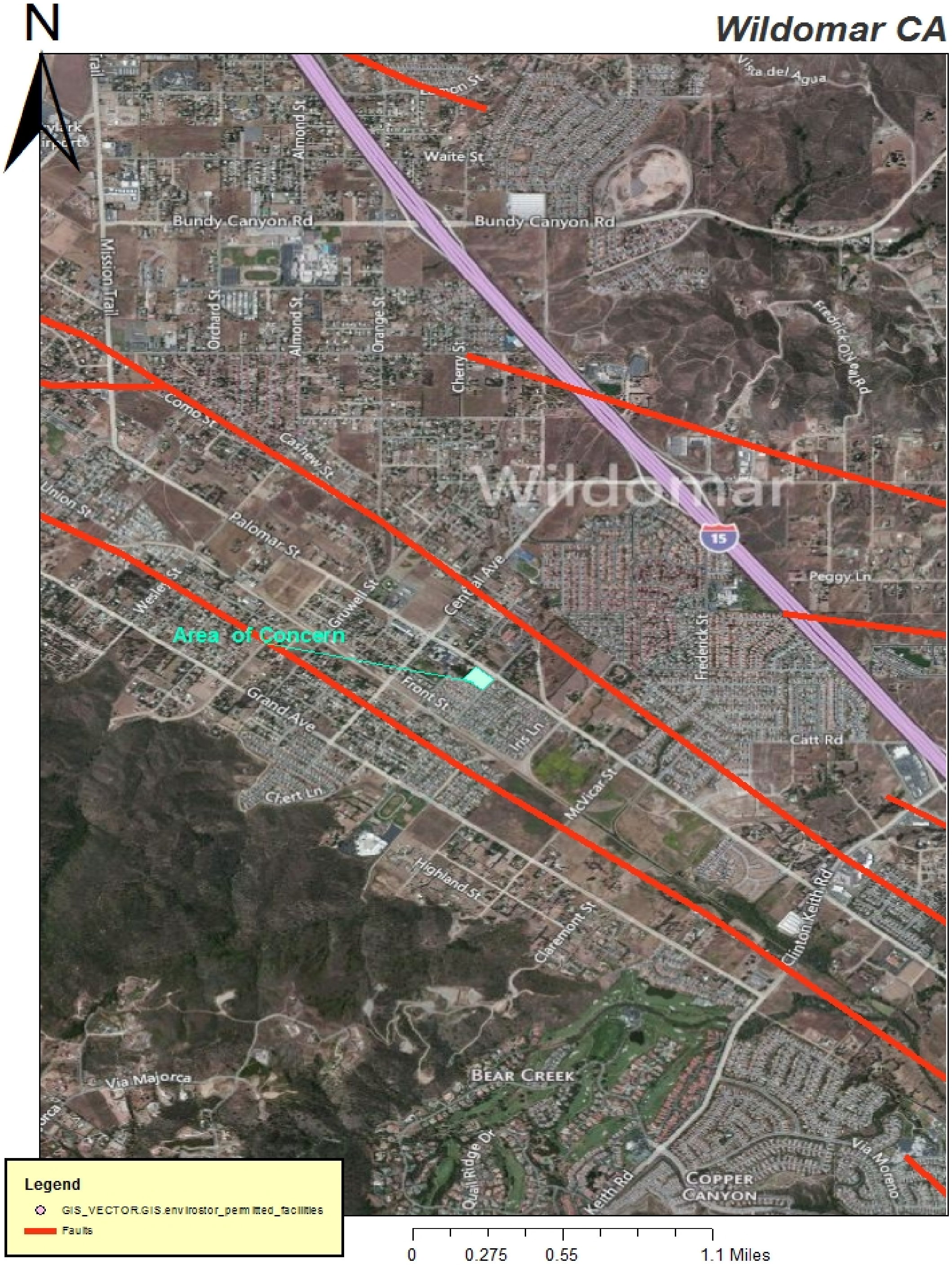
Weisel, C.P., Zhang, J., Turpin, B.J., Morandi, M.T., Colome, S., Stock, T.H., 2005. Relationships of Indoor, Outdoor, and Personal Air (RIOPA). Part I. Collection Methods and Descriptive Analyses. Research Report (Health Effects Institute). Nov; 130 Pt 1:1-107; 109-27.

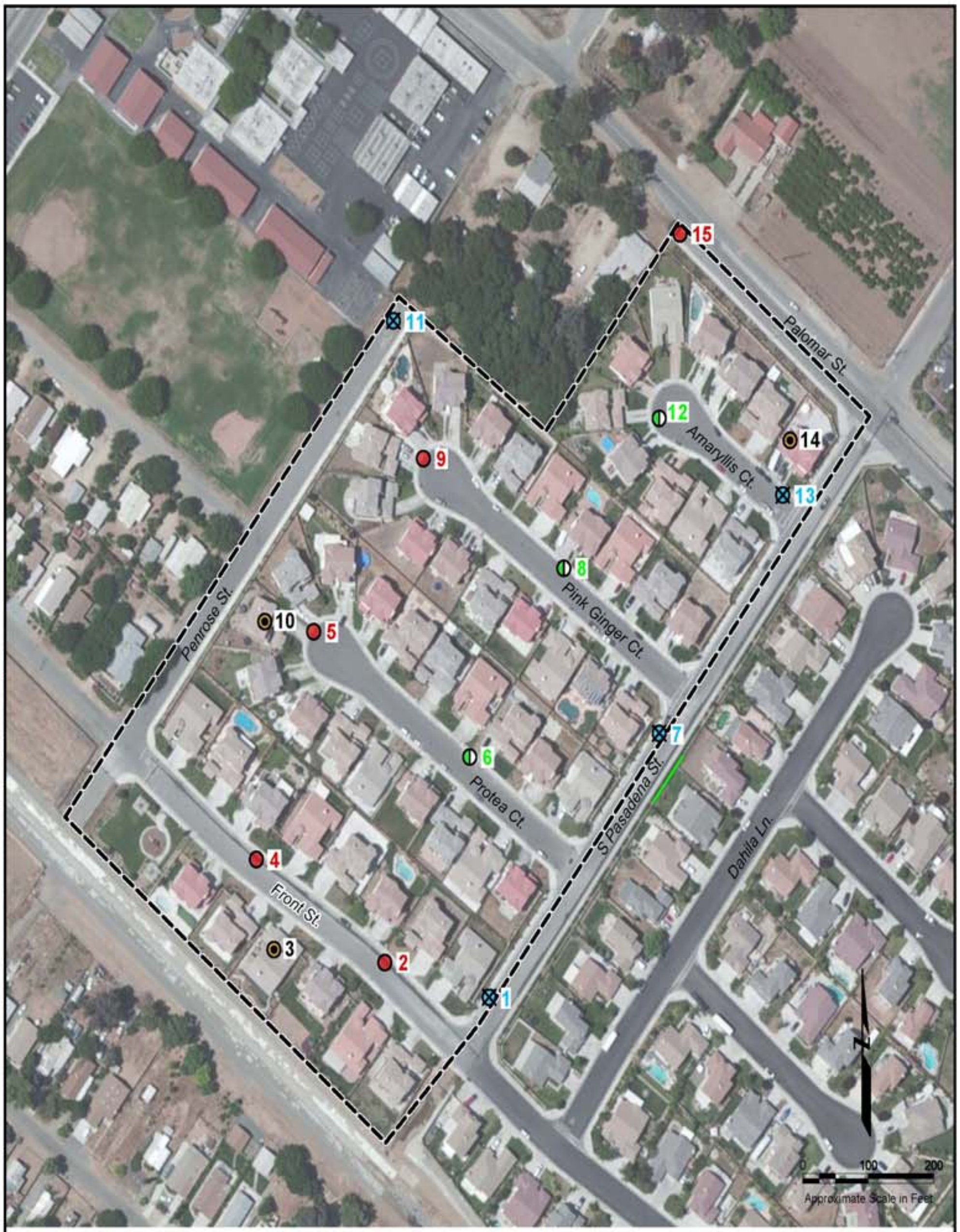
U.S. Environmental Protection Agency, 2000. Guidance for Data Quality Assessment: Practical Methods for Data Analysis (QA/G-9), EPA/600/R-96/084, Office of Environmental Information. (http://www.epa.gov/region6/qa/qadevtools/mod4references/secondaryguidance/g9-final.pdf)

US EPA, 2011. Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990 – 2005): A Compilation of Statistics for Assessing Vapor Intrusion. Office of Solid Waste and Emergency Response, EPA 530-R-10-001, June 2011. (http://www.epa.gov/oswer/vaporintrusion/documents/oswer-vapor-intrusion-background-Report-062411.pdf)

US EPA, 2013. EPA Region 9 Regional Screening Levels (RSLs) (Formerly PRGs). www.epa.gov/region9/superfund/prg/, November 2013.

FIGURES


N
Wildomar CA
Wildomar
Area of Concern
Bundy Canyon Rd
Mission Trail
Orchard St
Almond St
Orange St
Cherry St
Waite St
Lemon St
Vista del Agua
Fredrick Olea Rd
Como St
Cashew St
Union St
Palomar St
Central Ave
Wesley St
Gruwell St
Front St
Grand Ave
Iris Ln
Frederick St
Catt Rd
Peggy Ln
15
McVicar St
Chert Ln
Highland St
Claremont St
Clinton Keith Rd
Via Majorca
Bear Creek
Quail Ridge Dr
Keith Rd
Copper Canyon
Via Moreno
Legend
○ GIS_VECTOR.GIS.envirostor_permitted_facilities
▬ Faults
0
0.275
0.55
1.1 Miles



Explanation:

● Soil Gas sample location

● Sub-slab sample location

◐ Soil/Soil Gas sample location

☒ Soil/Soil Gas/Groundwater sample location

– – – – – – – Limits of project area

All locations are approximate

Basemap modified from ESRI World Imagery 2013

SAMPLE LOCATIONS
Autumnwood Development
Wildomar, California

By: jbd	Date: 11/25/2013	Project No.	NB1016075P
amec		Figure	2

Plot Date: 11/27/2013 11:42:59 AM, Plotted by: pat.herring   Drawing Path: Y:\NB1016075P\ACAD_TB-003_SAMPLING LOCATIONS.DWG, Figure 2_Proposed Sample Locations


A
11
15
9
8
12
14
B'
13
10
5
6
7
A'
4
3
2
1
B
Palomar St
Ginger Ct
Front St
S Pasadena St
Dahlia Ln
N
0
100
200
Approximate Scale in Feet
Explanation:
● Soil Gas sample location
● Sub-Slab sample location
◐ Soil/Soil Gas sample location
☒ Soil/Soil Gas/Groundwater sample location
Limits of Study Area
All locations are approximate
Basemap modified from ESRI World Imagery 2013
SAMPLE LOCATIONS
Autumnwood Development
Wildomar, California
(Cross Section Locations Added by DTSC)
By: jbd
Date: 12/02/2013
Project No. NB1016075P
amec
Figure 3

Figure 3

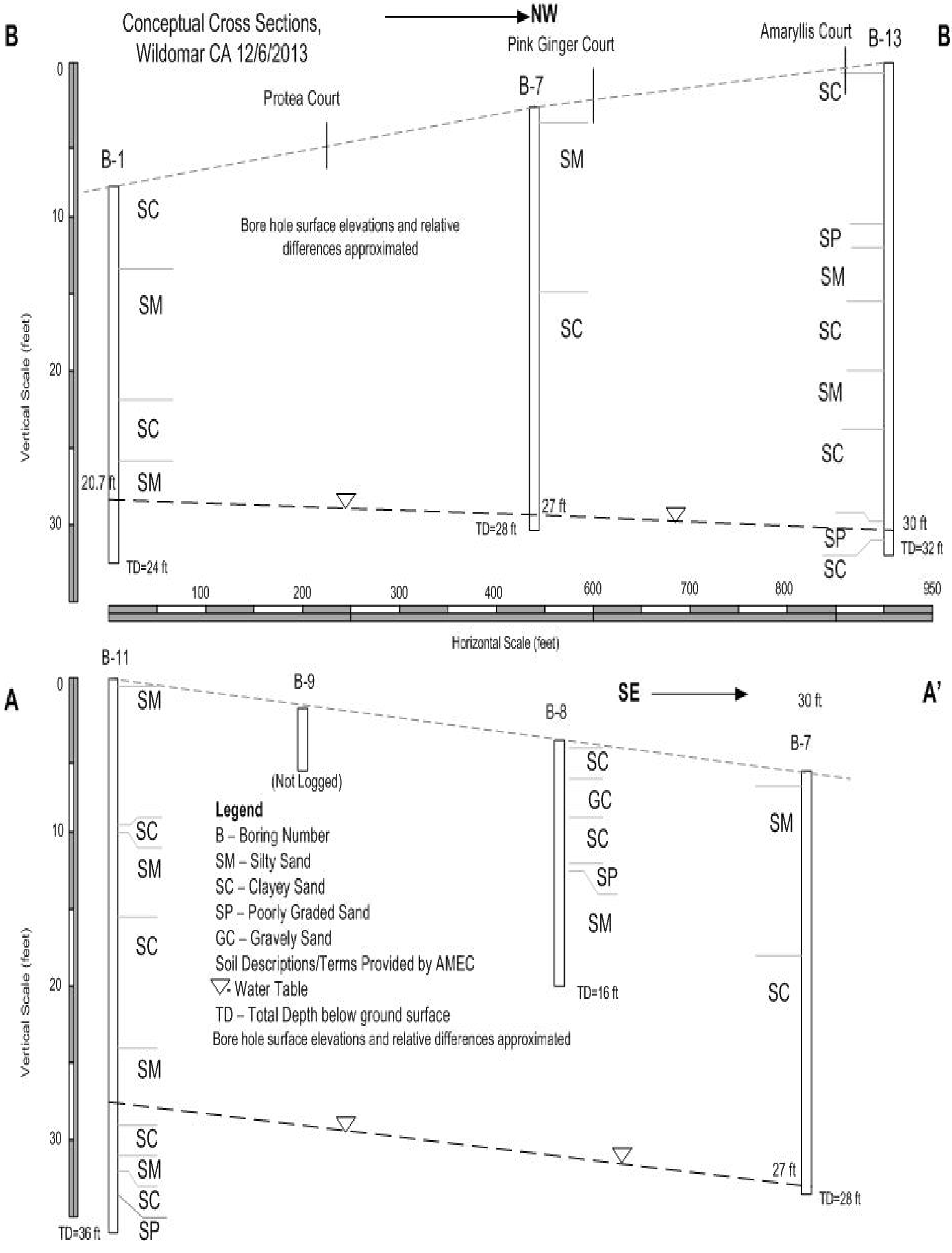

B
Conceptual Cross Sections,
Wildomar CA 12/6/2013
NW
Pink Ginger Court
Amaryllis Court
B-13
B'
Protea Court
B-7
B-1
SC
SM
Bore hole surface elevations and relative differences approximated
SC
SM
SC
SP
SM
SC
SM
SC
20.7 ft
SM
27 ft
TD=28 ft
30 ft
SP
TD=32 ft
SC
TD=24 ft
Vertical Scale (feet)
0
10
20
30
100
200
300
400
600
700
800
950
Horizontal Scale (feet)
B-11
A
B-9
SE
30 ft
A'
B-8
B-7
SM
SC
GC
SC
SP
SM
(Not Logged)
SM
SC
SM
SC
SC
SM
SC
SM
SC
SP
TD=16 ft
27 ft
TD=28 ft
TD=36 ft
Legend
B – Boring Number
SM – Silty Sand
SC – Clayey Sand
SP – Poorly Graded Sand
GC – Gravely Sand
Soil Descriptions/Terms Provided by AMEC
▽ Water Table
TD – Total Depth below ground surface
Bore hole surface elevations and relative differences approximated

Figure 4

TABLES

TABLE 1

SOIL SAMPLE ANALYTICAL RESULTS

Autumnwood Development
Wildomar, California

Concentrations reported in milligrams per kilogram (mg/kg)

Sample Location	Sample Depth (feet bgs)	Sample Identification	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury	Semi-volatile organic compounds	Polychlorinated Biphenyls	Pesticides
6-SS	5-6	6-SS-5-6	11/8/2013	ND	**1.67**	**75.4**	ND	ND	**11.5**	**11.2**	**12.7**	**1.05**	ND	**5.70**	ND	ND	ND	**58.0**	**42.1**	ND	ND	ND	ND
	9-11	6-SS-9-11	11/8/2013	ND	**0.815**	**93.0**	**0.308**	ND	**13.5**	**13.7**	**13.9**	**1.51**	ND	**6.39**	ND	ND	ND	**64.3**	**43.6**	ND	ND	ND	ND
	9-11 DUP	60-SS-9-11	11/8/2013	ND	**0.822**	**101**	**0.326**	ND	**13.7**	**14.3**	**15.1**	**1.46**	ND	**6.95**	ND	ND	ND	**66.4**	**46.6**	ND	ND	ND	ND
	13.75-14.75	6-SS-13.75-14.75	11/8/2013	ND	ND	**34.4**	ND	ND	**5.43**	**4.61**	**2.62**	ND	ND	**1.51**	ND	ND	ND	**40.6**	**13.1**	ND	ND	ND	ND
8-SS	5-6	8-SS-5-6	11/8/2013	ND	**1.28**	**66.8**	ND	ND	**9.77**	**9.93**	**10.2**	**1.22**	ND	**5.12**	ND	ND	ND	**48.6**	**36.4**	ND	ND	ND	ND
	9.5-10.5	8-SS-9.5-10.5	11/8/2013	ND	ND	**68.8**	ND	ND	**9.17**	**9.79**	**9.81**	**0.566**	ND	**4.99**	ND	ND	ND	**45.9**	**37.0**	ND	ND	ND	ND
	14.25-15.25	8-SS-14.25-15.25	11/8/2013	ND	ND	**94.7**	**0.297**	ND	**12.6**	**12.9**	**13.4**	**1.41**	ND	**6.61**	ND	ND	ND	**63.0**	**44.1**	ND	ND	ND	ND
12-SS	5-6	12-SS-5-6	11/8/2013	ND	ND	**108**	**0.256**	ND	**9.69**	**6.23**	**4.95**	**0.839**	ND	**4.33**	ND	ND	ND	**29.4**	**34.7**	ND	Bis(2-Ethylhexyl) phthalate= **2.6**	ND	ND
	9.5-10.5	12-SS-9.5-10.5	11/8/2013	ND	**0.855**	**60.5**	ND	ND	**9.36**	**8.91**	**8.76**	ND	ND	**4.51**	ND	ND	ND	**51.1**	**32.4**	ND	ND	ND	ND
	13.25-15.25	12-SS-13.25-15.25	11/8/2013	ND	ND	**102**	**0.316**	ND	**12.0**	**13.4**	**13.4**	**1.48**	ND	**6.98**	ND	ND	ND	**62.0**	**48.0**	ND	ND	ND	ND
Range of Background Concentrations (Kearney 1996)				0.15 - 1.95	0.6 - 11.0	133 - 1400	0.25 - 2.7	0.05 - 1.7	23 - 1579	2.7 - 46.9	9.1 - 96.4	12.4 - 97.1	0.1 - 9.6	9 - 509	0.015 - 0.43	0.1 - 8.3	0.17 - 1.10	39 - 288	88 - 236	0.05 - 0.9			

Notes:

1. Title 22 Metals were analyzed using EPA Method 6010B/7470A. Polychlorinated biphenyls, semi-volatile organic compounds, and pesticides were analyzed using EPA Method 8082, EPA Method 8270C, and EPA Method 8081A, respectively.
2. bgs = below ground surface.
3. ND = Not detected at or above laboratory reporting limit.
4. DUP = duplicate sample.
5. Detections at or above the laboratory reporting limit are shown in **bold**.

Kearney, 1996, Kearney Foundation Special Report, Background Concentrations of Trace and Major Elements in California Soils, Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996.

TABLE 2

GROUNDWATER SAMPLE ANALYTICAL RESULTS

Autumnwood Development
Wildomar, California

Concentrations reported in micrograms per liter (µg/L)

Sample Location	Sample Depth (feet bgs)	Sample Identification	Sample Date	Volatile Organic Compounds (VOCs)	Formaldehyde
1-GW	19-24	1-GW-19-24	11/7/2013	ND	ND
7-GW	23-28	7-GW-23-28	11/8/2013	ND	ND
11-GW	31-36	11-GW-31-36	11/7/2013	ND	ND
11-GW (DUP)	31-36	110-GW-31-36	11/7/2013	ND	--
13-GW	27-32	13-GW-27-32	11/7/2013	ND	ND
13-GW (DUP)	27-32	130-GW-27-32	11/7/2013	--	ND

Notes:

1. VOCs and formaldehyde were analyzed using EPA Method 8260B and EPA Method 8315A, respectively.
2. ND = Not detected at or above laboratory reporting limit; reporting limitis for the individual VOCs can be found in the analytical reports in Attachment F.
3. DUP = duplicate sample.
4. bgs = below ground surface.
5. -- = Not analyzed.

TABLE 3

SOIL GAS SAMPLE ANALYTICAL RESULTS

Autumnwood Development
Wildomar, California

Concentrations reported in micrograms per liter (µg/L)

Sample Location	Sample Depth (feet bgs)	Sample Identification	Sample Date	Tetrachloroethene	Chloroform[1]	Benzene	Toluene	Ethylbenzene	m, p-Xylene	O-Xylene	1,2,4-Trimethylbenzene[2]	1,3,5- Trimethylbenzene[3]	Naphthalene	p-Isopropyltoluene[4]	Methanol	Tracer 1,1 Difluoroethane (LCC)	Max Screening IA Risk	Max Screening IA Hazard
		CHHSL	**(µg/L)**	**0.47**	0.42	**0.085**	**320**	**1.1**	**800**	**740**	3.65	3.65	**0.093**	210				
1-SV	5	1-SV-5	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	5-Rep	1-SV-5-Rep	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	10	1-SV-10	11/15/13	ND (<0.02)	ND (<0.02)	**0.03**	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	3.E-07	1.E-03
2-SV-1PV	5	2-SV-5	11/14/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	**0.19**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
2-SV-3PV				ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	**0.21**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	2.E-07	9.E-04
2-SV-10PV				ND (<0.02)	**0.04**	**0.02**	ND (<0.2)	ND (<0.1)	**0.27**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
2SV	15	2-SV-15	11/14/13	ND (<0.02)	ND (<0.02)	**0.08**	**0.25**	ND (<0.1)	**0.26**	ND (<0.1)	**0.10**	ND (<0.1)	**0.20**	ND (<0.1)	–	ND (<0.1)	3.E-06	8.E-02
4-SV	15	4-SV-15	11/15/13	ND (<0.02)	ND (<0.02)	**0.10**	**0.29**	ND (<0.1)	**0.30**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	1.E-06	5.E-03
	5	4-SV-5	11/15/13	ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	**1.1**	2.E-07	6.E-04
5-SV	15	5-SV-15	11/14/13	ND (<0.02)	ND (<0.02)	**0.03**	ND (<0.2)	ND (<0.1)	**0.27**	ND (<0.1)	**0.17**	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	**0.27**	3.E-07	5.E-02
	5	5-SV-5	11/14/13	ND (<0.02)	**0.04**	ND (<0.02)	ND (<0.2)	ND (<0.1)	**0.14**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	1.E-07	4.E-04
6-SV	15	6-SV-15	11/14/13	ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	2.E-07	6.E-04
	15-Rep	6-SV-15-Rep	11/14/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	3	6-SV-3	11/15/13	ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	**0.18**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	2.E-07	9.E-04
7-SV	5	7-SV-5	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	15	7-SV-15	11/15/13	ND (<0.02)	ND (<0.02)	**0.08**	**0.23**	**0.25**	**1.5**	**0.42**	**0.13**	ND (<0.1)	ND (<0.02)	**0.15**	–	ND (<0.1)	1.E-06	4.E-02
8-SV	3	8-SV-3	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	15	8-SV-15	11/15/13	ND (<0.02)	ND (<0.02)	**0.08**	ND (<0.2)	**0.13**	**0.71**	**0.20**	**0.14**	ND (<0.1)	ND (<0.02)	**0.22**	–	ND (<0.1)	1.E-06	4.E-02
9-SV	15	9-SV-15	11/15/13	ND (<0.02)	ND (<0.02)	**0.03**	ND (<0.2)	ND (<0.1)	**0.24**	ND (<0.1)	**0.37**	**0.14**	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	3.E-07	1.E-01
	5	9-SV-5	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
11-SV	15	11-SV-15	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	5	11-SV-5	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
12-SV-1PV	15	12-SV-15	11/13/13	ND (<0.02)	ND (<0.02)	**0.06**	**0.26**	ND (<0.1)	**0.33**	**0.12**	ND (<0.1)	ND (<0.1)	**0.02**	ND (<0.1)	–	**0.70**	9.E-07	8.E-03
12-SV-3PV				ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
12-SV-10PV				ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	**0.13**	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
12-SV	5	12-SV-5	11/14/13	ND (<0.02)	ND (<0.02)	**0.02**	ND (<0.2)	ND (<0.1)	**0.11**	ND (<0.1)	**0.11**	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	**0.89**	2.E-07	3.E-02
13-SV	15	13-SV-15	11/14/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	5	13-SV-5	11/14/13	ND (<0.02)	**0.02**	**0.06**	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	7.E-07	2.E-03
15-SV	15	15-SV-15	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A
	5	15-SV-5	11/15/13	ND (<0.02)	ND (<0.02)	ND (<0.02)	ND (<0.2)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.1)	ND (<0.02)	ND (<0.1)	–	ND (<0.1)	N/A	N/A

[1] For Chloroform, the soil gas CHHSL of 420 µg/L was provided by Dr. David Siegel of OEHHA.

[2] For 1,2,4-trimethylbenzene, the soil gas screening level was calculated using the EPA indoor air RSL (7.3 µg/m^3) and a default soil gas attenuation factor of 0.002, per the DTSC Vapor Intrusion Guidance (DTSC 2011).

[3] For 1,3,5-trimethylbenzene, the soil gas screening level for 1,2,4-trimethylbenzene was used as a surrogate.

[4] For isopropyltoluene, the soil gas screening level was calculated using the indoor air RSL for cumene (420 µg/m^3) as a surrogate and a default soil gas attenuation factor of 0.002, per the DTSC Vapor Intrusion Guidance (2011).

Notes:

1. Soil gas samples analyzed by mobile laboratory for volatile organic compounds using EPA Method 8260SV (see laboratory sheets for complete list of compounds).
2. Detections at or above the laboratory reporting limit are shown in **bold**.
3. Purge volume tests were conducted at 2-SV-5 and 12-SV-15. A numeric and "PV" following the probe ID indicate the purge volume applied prior to collecting the soil gas sample. Shallow (3 and 5-foot depth) soil gas samples were collected after 3 purge volume and deeper (10- and 15-foot depths) were collected after 1 purge volume.
4. bgs = below ground surface.
5. -- = Not analyzed.
6. Rep = duplicate sample.

TABLE 4

SUB-SLAB SAMPLE ANALYTICAL RESULTS

Autumnwood Development
Wildomar, California

Concentrations reported in micrograms per cubic meter (µg/m3)

Sample Location	Sample Identification	Sample Date	Tetrachloroethene	Chloroform	Benzene	Toluene	Ethylbenzene	m, p-Xylene	O-Xylene	1,2,4-Trimethylbenzene	1,3,5- Trimethylbenzene	Naphthalene	p-Isopropyltoluene	Methyl tert-butyl ether	Methylene Chloride	Methanol	Tracer 1,1 Difluoroethane (LCC)
3B (bedroom)	3B-SV	11/14/2013	ND	ND	**24**	**60**	**19**	**48**	**20**	**15**	ND	ND	ND	ND	ND	**540**	**7.5**
3G (garage)	3G-SV	11/14/2013	**15**	**11**	**55**	**140**	**26**	**66**	**22**	**14**	ND	ND	ND	ND	**6.2**	**95**	**8.2**
10L (living room)	10L-SV	11/14/2013	**16**	ND	**23**	**76**	**21**	**34**	**10**	**12**	ND	ND	ND	ND	ND	ND	**19**
10B (bedroom)	10B-SV	11/14/2013	ND	ND	**7.6**	**16**	ND	**16**	**5.2**	**14**	ND	ND	ND	ND	**3.7**	**230**	**1000**
10B duplicate	10B-SV Rep	11/14/2013	ND	ND	**5.8**	**11**	ND	**12**	**5.4**	**13**	ND	ND	ND	ND	ND	**190**	**120**
14G (garage)	14G-SV	11/14/2013	ND	ND	**26**	**59**	**11**	**30**	**12**	**17**	ND	ND	ND	ND	ND	**100**	**20**
14B (bedroom)	14B-SV	11/14/2013	**12**	ND	**110**	**160**	**35**	**79**	**29**	**15**	ND	ND	ND	**8.7**	ND	**41**	**12**

Notes:

1. Sub-slab samples analyzed for volatile organic compounds using EPA Method TO-15 (see laboratory sheets for complete list of compounds).
2. Detections at or above the laboratory reporting limit are shown in **bold**.
3. ND = Not detected at or above laboratory reporting limit.
4. Rep = duplicate sample.

TABLE 5

FORMALDEHYDE SOIL GAS SAMPLE RESULTS

Autumnwood Development
Wildomar, California

Concentrations reported in micrograms per cubic meter (µg/m3)

Sample Location	Sample Depth (feet bgs)	Sample Identification	Sample Date	Formaldehyde
2-SV	5	2-SV-5	11/14/13	ND
6-SV	15	6-SV-15	11/14/13	ND
6-SV Dup	15	60-SV-15	11/14/13	ND
8-SV	3	8-SV-3	11/14/13	ND
12-SV	15	12-SV-15	11/14/13	ND
13-SV	15	13-SV-15	11/14/13	ND
3B-SV	sub-slab	3B-SV	11/14/13	**6.53**
10L-SV	sub-slab	10L-SV	11/14/13	**6.64**
14B-SV	sub-slab	14B-SV	11/14/13	**8.10**
Blank	--	Blank	11/14/13	ND

Notes:

1. Formaldehyde was analyzed using EPA Method TO-11A.
2. ND = Not detected at or above laboratory reporting limit.
3. Dup = duplicate sample.
4. Detections at or above the laboratory reporting limit are shown in **bold**.
5. bgs = below ground surface.
6. -- = not applicable.

TABLE 6

QUALITY CONTROL SAMPLE RESULTS

Autumnwood Development
Wildomar, California

Soil Samples

Soil Sample ID		**6-SS-9-11**	**60-SS-9-11**	**RPD**
Analyte	**Reporting Limits (mg/kg)**	**(primary)**	**(duplicate)**	
Title 22 Metals				
Antimony	0.750	<0.750	<0.750	--
Arsenic	0.750	**0.815**	**0.822**	**1**
Barium	0.500	**93.0**	**101**	**8**
Beryllium	0.250	**0.308**	**0.326**	**6**
Cadmium	0.500	<0.500	<0.500	--
Chromium	0.250	**13.5**	**13.7**	**1**
Cobalt	0.250	**13.7**	**14.3**	**4**
Copper	0.500	**13.9**	**15.1**	**8**
Lead	0.500	**1.51**	**1.46**	**3**
Molybdenum	0.250	<0.250	<0.250	--
Nickel	0.250	**6.39**	**6.95**	**8**
Selenium	0.750	<0.750	<0.750	--
Silver	0.250	<0.250	<0.250	--
Thallium	0.750	<0.750	<0.750	--
Vanadium	0.250	**64.3**	**66.4**	**3**
Zinc	1.000	**43.6**	**46.6**	**7**
Mercury	0.0835	<0.0835	<0.0835	--
Pesticides	RL	ND	ND	--
Polychlorinated biphenyls (PCBs)	50	<50	<50	--
Semi-volatile organic compounds (SVOCs)	RL	ND	ND	--

Groundwater Samples

Groundwater Sample ID		**11-GW-31-36**	**110-GW-31-36**	**RPD**
Analyte	**Reporting Limits (µg/L)**	**(primary)**	**(duplicate)**	
Volatile Organic compounds (VOCs)	RL	ND	ND	--
Groundwater Sample ID		**13-GW-27-32**	**130-GW-27-32**	**RPD**
Analyte	**Reporting Limits (µg/L)**	**(primary)**	**(duplicate)**	
Formaldehyde	100	<100	<100	--

Soil Gas Samples

Soil Gas Sample ID		**1-SV-5**	**1-SV-5-Rep**	**RPD**	**6-SV-15**	**6-SV-15-Rep**	**RPD**
Analyte	**Reporting Limits**	**(primary)**	**(duplicate)**		**(primary)**	**(duplicate)**	
Volatile Organic Compounds (VOCs)	RL	ND	ND	--	ND	ND	--

Sub-Slab Soil Gas Sample

Sample ID		**10B-SV**	**10B-SV Rep**	**RPD**
Analyte	**Reporting Limits (ug/m3)**	**(primary)**	**(duplicate)**	
Methanol	27	**230**	**190**	**19**
Methylene chloride (Dichloromethane)	3.5	**3.7**	<3.5	**--**
Benzene	3.2	**7.6**	**5.8**	**27**
Toluene	3.8	**16**	**11**	**37**
m,p-Xylene	8.8	**16**	**12**	**29**
o-Xylene	4.4	**5.2**	**5.4**	**4**
1,2,4-Trimethylbenzene	5.0	**14**	**13**	**7**

Formaldehyde in Soil Vapor

Sample ID		**6-SV-15**	**60-SV-15**	**RPD**
Analyte	**Reporting Limits (ug/m3)**	**(primary)**	**(duplicate)**	
Formaldehyde	75	<75	<75	--

Notes:

1. RPDs = Relative Percent Different calculated using:

$$RPD = 2 \times \left[\frac{primary - duplicate}{primary + duplicate} \right] \times 100$$

2. RPD was not calculated when either primary or duplicate sample, or both samples were not detected above the reporting limits, or detected at concentrations less than five times the reporting limit.
3. Detections at or above the laboratory reporting limit are shown in **bold**.
4. RL= reporting limit
5. ND = Not detected at or above laboratory reporting limit.

Table 7

Summary of Soil Gas Risks and Hazards

Autumnwood Development
Wildomar, California

Volatile Organic Compound	Maximum Soil Gas Concentration ($\mu g/m^3$)	Soil Gas Depth (feet)	Maximum Indoor Air Risk	Maximum Indoor Air Hazard
Benzene	100	15	3.5E-07	9.4E-04
Chloroform	40	5	7.3E-08	1.1E-04
Ethylbenzene	250	15	6.6E-08	6.1E-05
p-Isopropyltoluene	220	15	NC	1.2E-04
Naphthalene	200	15	5.7E-07	1.3E-02
Toluene	290	15	NC	2.7E-04
1,2,4-Trimethylbenzene	370	15	NC	1.1E-02
1,3,5-Trimethylbenzene	140	15	NC	4.7E-03
m,p-Xylene	1,500	15	NC	3.8E-03
o-Xylene	420	15	NC	1.2E-03
		Total	**1.E-06**	**0.04**

Table 8

Comparison of Predicted Indoor Air Levels to Background Indoor Air Levels

Autumnwood Development
Wildomar, California

Volatile Organic Compound	Range of Sub-Slab Concentrations (μg/m^3)	Range of Predicted Maximum Indoor Air Concentrations [1] (μg/m^3)	Indoor Air Screening Concentration (μg/m^3)	Range of Median Background Indoor Air[2] (μg/m^3)	Range of 95th Percentile Background Indoor Air[2] (μg/m^3)
Benzene	5.8 - 110	0.3 - 5	0.084	<0.8 - 4.7	9.9 - 29
Chloroform	11	0.5	0.46	<1.2 - 2.4	4.1 - 7.5
Ethylbenzene	11 - 35	0.5 - 1.7	0.97	1 - 3.7	12 - 17
Methanol	41 - 540	2 - 27	4000	NA	NA
Methylene chloride	3.7 - 6.2	0.2 - 0.3	96	0.68 - 61	2.9 - 45
Methy tert-butyl ether	8.7	0.4	9.4	0.03 - 3.5	71 - 72
Tetrachloroethene	12 - 16	0.6 - 0.8	0.41	<1.7 - 2.2	4.1 - 9.5
Toluene	11 - 160	0.5 - 8	313	4.8 - 24	79 - 144
1,2,4-Trimethylbenzene	12 - 17	0.6 - 0.8	7.3	NA	NA
m,p-Xylene	12 - 79	0.6 - 4	730	1.5 - 14	21 - 63.5
o-Xylene	5.2 - 29	0.3 - 1.4	730	1.1 - 3.6	13 - 20

Highlighted VOCs exceed the indoor air screening level

[1] Maximum predicted indoor air concentration derived from the sub-slab concentrations using a default attenuation factor of 0.05, per the DTSC Vapor Intrusion Guidance (DTSC 2011).

[2] Background indoor air concentrations measured in homes having no vapor intrusion (EPA 2011)

NA Not available.

Table 9

Soil Gas Analytical Results
Tentatively Identified Compounds (TICs)
Autumnwood Development
Wildomar, California

	Sample 12-SV-5-3PV			Sample 13-SV-5			Sample 7-SV-15		
Tentatively Identified Compounds (TICs) [a]	Soil Gas Concentration (µg/L)	Soil Gas Screening Level (µg/L)	Hazard Quotient (HQ)	Soil Gas Concentration (µg/L)	Soil Gas Screening Level (µg/L)	Hazard Quotient (HQ)	Soil Gas Concentration (µg/L)	Soil Gas Screening Level (µg/L)	Hazard Quotient (HQ)
C_5-C_8 Aliphatics	7.2	350 [b]	0.02	40.1	350 [b]	0.1	10.6	350 [b]	0.03
C_9-C_{18} Aliphatics	1.18	150 [b]	0.01	ND	N/A	N/A	0.26	150 [b]	1.7E-03
Decahydro-2-metylnaphthalene (C_9-C_{16} Aromatic surrogate)	0.21	25 [b]	0.01	ND	N/A	N/A	ND	N/A	N/A
1-Ethyl-3-methylbenzene (xylene surrogate)	0.26	740 [c]	3.5E-04	ND	N/A	N/A	ND	N/A	N/A
1,3,5-Trimethylcyclohexane (cyclohexane surrogate)	0.11	3,150 [c]	3.5E-05	ND	N/A	N/A	ND	N/A	N/A
1,2,4-Trimethylcyclohexane (cyclohexane surrogate)	ND	N/A	N/A	ND	N/A	N/A	0.11	3,150 [c]	3.5E-05
		Hazard Index	0.04		Hazard Index	0.1		Hazard Index	0.03

[a] All alkanes and alkenes were conservatively summed for each fraction; no toxicity data were available for 3-ethyl-oxirane, camphene and trans-1,2-dimethylcyclopropane, which were not included.

[b] Soil gas screening levels were calculated using the TPH fraction RfC from the DTSC PEA Guidance Manual and an attenuation factor of 0.002.

[c] Soil gas screening levels were calculated using the surrogate RfC from the EPA Region 9 RSL Table and an attenuation factor of 0.002.

Table 10

Sub-Slab Soil Gas Analytical Results
Tentatively Identified Compounds (TICs)

Autumnwood Development
Wildomar, California

	Sample 14G-SV			Sample 14B-SV			Sample 10B-SV		
Tentatively Identified Compounds (TICs) [a]	Soil Gas Concentration ($\mu g/m^3$)	Soil Gas Screening Level ($\mu g/m^3$)	Hazard Quotient (HQ)	Soil Gas Concentration ($\mu g/m^3$)	Soil Gas Screening Level ($\mu g/m^3$)	Hazard Quotient (HQ)	Soil Gas Concentration ($\mu g/m^3$)	Soil Gas Screening Level ($\mu g/m^3$)	Hazard Quotient (HQ)
C_5-C_8 Aliphatics	109	14,000 [b]	0.01	246	14,000 [b]	0.02	30	14,000 [b]	2.1E-03
C9-C18 Aliphatics	345	6000 [b]	0.06	219	6,000 [b]	0.04	158	6,000 [b]	0.03
		Hazard Index	0.07		Hazard Index	0.06		Hazard Index	0.03

[a] All alkanes and alkenes were conservatively summed for each fraction; no toxicity data was available for n-butyl alcohol, which was not included.

[b] Soil gas screening levels were calculated using the TPH fraction RfC from the DTSC PEA Guidance Manual and an attenuation factor of 0.05.

ATTACHMENTS

Attachment A Previous Investigation Data

- Indoor Air Quality Investigation
- Preliminary Environmental Assessment Report

Attachment B Previous Investigation Data Evaluations

- AQMD Soil Results Recycled Water
- SCAQMD Wildomar Report
- OEHHA Wildomar Report
- CDPH Wildomar Letter

Attachment C City Encroachment Permit

- City of Wildomar Encroachment Permit

Attachment D Community Work Notice

- Community Work Notice

Attachment E Soil Boring Logs

- Soil Boring Logs

Attachment F Soil and Groundwater Sample Analytical Data Sheets

- Soil and Groundwater Sample Analytical Data Sheets

Attachment G Soil Gas Sample Analytical Data Sheets

- Soil Gas Sample Analytical Data Sheets

Attachment H Formaldehyde Soil Gas Sample Analytical Data Sheets

- Formaldehyde Soil Gas Sample Analytical Data Sheets

Attachment I Sub-Slab Soil Gas Sample Analytical Data Sheets

- Sub-Slab Soil Gas Sample Analytical Data Sheets

Attachment J Level 4 Data Validation and Data Verification Report

- ECL Level 4 Data Evaluation
  - 8260SV validation calculations AEE111313 SB1
  - Formaldehyde calculations package 13-11-0697
  - TO 15 and Methanol validation calculations AEE111513-11
  - VOC validation calculations package 13-11-0600
  - VOC validation calculations package 13-11-0697
  - Formaldehyde calculations package 13-11-0600
  - Wildomar ECL Data Review Final Version 4-17-2014

- Level 4 Data and Associated Data from Labs
  - 13-11-0600-s1
  - 13-11-0697-s1
  - 213619 Data Deliverable Package Environmental Analytical Service
  - AEE111313-SB1-REV-2-FINAL
  - AEE111513-11-REV-2-FINAL
  - AEE111513-11-TPH-DATA
  - EAS TO11 Cartridge Spike Study 041014
  - Methanol Low Standard
  - Methanol Quantitation Reports
  - Methanol Std Qedit
  - Quant Rpts 7 SV 5 and 7 SV 15
  - Spike-Study-Page-2
  - Supelco Cartridge Certificate
  - TPH DATA-11.13.13
  - TPH DATA-11.14.13
  - TPH DATA-11.15.13
  - AEE111313-SB1-LEVEL-IV-DATA-111313
  - AEE111313-SB1-LEVEL-IV/AEE111313-SB1-LEVEL-IV-DATA-111413
  - AEE111313-SB1-LEVEL-IV/AEE111313-SB1-LEVEL-IV-DATA-111513
  - AEE111313-SB1-LEVEL-IV/AEE111313-SB1-LEVEL-IV-ICAL-111213VAPOR
  - AEE111313-SB1-LEVEL-IV/AEE111313-SB1-REV-FINAL
  - AEE111513-11-LEVEL-IV-DATA-TO15-METHANOL-112013
  - AEE111513-11-LEVEL-IV-ICAL-TO15-102313PPBV-250CC
  - AEE111513-11-LEVEL-IV/AEE111513-11-LEVEL-IV-TO15-DATA-111913---112013
  - AEE111513-11-LEVEL-IV/AEE111513-11-REV-FINAL

Attachment K Screening-Level Johnson and Ettinger Model Outputs

- Johnson and Ettinger Model Outputs

Attachment L Response to Comments Wildomar meeting January 17, 2014

- Final Response to Comments

Attachment M Autumnwood Development Investigation Report review from OEHHA and CDPH

- CDPH Review of DTSC April 2014 Autumnwood Report
- OEHHA Final Report Evaluation Letter