

**TARGETED SITE INVESTIGATION REPORT
CHESTNUT STREET SITE
1625 AND 1635 CHESTNUT STREET
LIVERMORE, CALIFORNIA**

PREPARED FOR:

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1625 AND 1635 CHESTNUT STREET
LIVERMORE, CALIFORNIA

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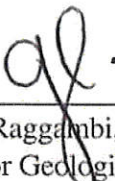



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LIST OF ACRONYMS

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
°C	degrees Celsius
Cal/EPA	California Environmental Protection Agency
CAM	California Assessment Manual
CDPH	California Department of Public Health
CHHSL	California Human Health Screening Level
CPT	Cone Penetration Test
DOE	Department of Energy
DPT	Direct-Push Technology
DQO	Data Quality Objective
DWR	Department of Water Resources
DTSC	Department of Toxic Substances Control
Enercon	Enercon Services, Inc.
EPH	extractable petroleum hydrocarbons
ESA	Environmental Site Assessment
ESL	Environmental Screening Level
GPR	ground penetrating radar
LASC/MOSC	Livermore Arcade Shopping Center/Millers Outpost Shopping Center
LBNL	Lawrence Berkeley National Laboratory
LCS	laboratory control spike
µg/kg	microgram per kilogram
µg/L	microgram per liter
mg/kg	milligram per kilogram
mL/min	milliliter per minute
MCL	Maximum Contaminant Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
OCP	organochlorine pesticide
OEHHA	Office of Environmental Health Hazard Assessment
NorCal	NorCal Geophysical Consultants
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
PG&E	Pacific Gas and Electric
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RWQCB	Regional Water Quality Control Board
RSL	Regional Screening Level
SBE	Small Business Enterprise
TCE	trichloroethylene
TestAmerica	Test America Laboratories
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons as diesel
TPH-g	total petroleum hydrocarbons as gasoline

LIST OF ACRONYMS

TPH-mo	total petroleum hydrocarbons as motor oil
TSI	Targeted Site Investigation
URS	URS Corporation
USA	Underground Services Alert
U.S. EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
YSI	YSI Incorporated

1.0 INTRODUCTION

Pursuant to Contract No. 10-T1074, the California Environmental Protection Agency (Cal-EPA), Department of Toxic Substances Control (DTSC), retained URS Corporation (URS) to conduct a soil, soil gas, and groundwater investigation at the Chestnut Street Site (Site), located at 1625 and 1635 Chestnut Street, Livermore, California (Figure 1).

1.1 Project Objective

The objective of this investigation was to gather data as part of a Targeted Site Investigation (TSI). A TSI is performed to determine whether current or historical activities have resulted in environmental conditions that will need to be evaluated and/or addressed in order to move forward with redevelopment planning, or with the implementation of proposed redevelopment plans. The overall objective of the TSI is to evaluate whether hazardous materials are present at the Site that may pose unacceptable human health and environmental risks in the context of future unrestricted land re-use.

Specific objectives included:

- Determining whether hazardous waste/substances exist at the Site;
- Assessing the nature and extent of potential contamination at the Site; and
- Providing an order-of-magnitude cost estimate to clean up the property for unrestricted land use.

The TSI Work Plan was developed by DTSC (DTSC, 2011) and provided to URS to execute the work. The DTSC work plan included the Site history and a review of the results of prior Site investigations.

1.2 Site Description and Background

The Site is located at 1625 and 1635 Chestnut Street in the City of Livermore, Alameda County. It is at the southeastern intersection of Chestnut Street and North P Street. Across Chestnut Street to the north are single-family residences; to the east is a strip mall; to the south is Western Pacific Railroad, with businesses beyond that; and to the west is a strip mall. The Site includes two parcels (Assessor's Parcel Number 098 029001101 and 098 029000607) totaling approximately 2.45 acres in a commercial area of Livermore, California. A Site Plan, including sample locations, is presented as Figure 2.

Current use of the Site includes Jo-Ann Fabric and Craft, the Livermore School of Dance, and a tax preparation business. Although the Site currently consists of retail shopping/small

businesses, it is now part of the Downtown Specific Plan, and is within the Redevelopment Project Area. The area is now a designated Downtown Neighborhood, and development is limited to residential.

Historically, it is believed that the Site may have been used as a livestock staging area, possibly associated with the railroad, from at least 1940 until the mid-1950s. From the mid-1960s, a gasoline service station occupied the northwestern corner of the Site. The gas station and all associated fueling infrastructure was removed from the Site sometime in the early- to mid-1970s. Since 1978, the current retail and office building has occupied the Site.

1.3 Summary of Previous Investigations

Previous environmental investigations have been conducted at the Site, as listed below:

- Phase II Environmental Site Assessment (ESA) by Enercon Services, September 15, 2009 (Enercon, 2009b)
- Phase I ESA by Enercon Services, July 24, 2009 (Enercon, 2009a)
- Phase I ESA by M.J. Klobberdanz & Associates, 2000 (Klobberdanz, 2000)
- Phase I ESA Update by AEI Consultants, 2004 (AEI, 2004)
- Phase II Subsurface Investigation by Kleinfelder, 1989 (Kleinfelder, 1989).

The Phase II Subsurface Investigation conducted by Kleinfelder in 1989 included soil sampling. Seven soil samples were collected at three locations within the boundary of the gas station. Samples were analyzed for total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX). One soil sample, collected at 10 feet below ground surface (bgs) from the vicinity of the previous underground storage tank (UST), had a concentration of 20 milligrams per kilogram (mg/kg) of TPH as waste oil. No other analytes were detected above laboratory reporting limits.

The Phase II Subsurface Investigation conducted by Enercon Services in 2009 included soil sampling from the northeastern corner of the Site. Six soil samples were collected at three locations within the boundary of the former gas station. Samples were collected at the assumed approximate locations of the USTs—which had been removed—and the fuel-dispenser islands. Samples were analyzed for total extractable petroleum hydrocarbons (EPH) and volatile organic compounds (VOCs). Samples were collected at 15 feet, and at 35 or 49 feet bgs. No EPH or VOCs were detected in any of the samples above the laboratory reporting limits.

Previous ESAs indicated that soil samples were analyzed for TPH as gasoline (TPH-g); TPH as diesel (TPH-d); TPH as motor oil (TPH-mo); and VOCs at three locations on the Site, as well as

one additional location just outside of the Site boundary to the west. Soil samples for TPH and VOC analyses were collected at depth intervals from 6 to 13.5 feet bgs. Of the soil samples collected, one sample collected at a depth of 6 feet bgs had reported concentrations of TPH-g, TPH-d, and TPH-mo below the Regional Water Quality Control Board (RWQCB) Environmental Screening Levels (ESLs) for residential land use, where groundwater is a source of drinking water. Detections of VOCs in soil samples included acetone, benzene, toluene, methylene chloride, and xylenes, all at concentrations less than their respective residential ESLs.

1.4 Regulatory Involvement

The Site is not listed in any of the regulatory databases reviewed.

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2.0 SITE GEOLOGY/HYDROLOGY

The Site lies within the Livermore Valley, which is comprised of continental deposits derived from alluvial fans, outwash plains, and lakes. Valley fill materials range in thickness from a few tens of feet to nearly 400 feet. Lithologies at the Site consist of Quaternary Alluvium overlying Franciscan bedrock (CDMG, 1980).

The aquifer system for the area is a multi-layered system with an unconfined upper aquifer overlying a sequence of semi-confined aquifers. Faults located to the north, east, and west, and variations in lateral continuity, thickness, and permeability of water-bearing formations cause local restrictions in the movement of groundwater within the groundwater basin.

The following geology and hydrogeology information was obtained from the Treadwell and Rollo Groundwater Investigation Report for the Livermore Arcade Shopping Center/Millers Outpost Shopping Center (LASC/MOSC) 2008 Trust Site, which is under the oversight of the San Francisco RWQCB (Treadwell and Rollo, 2009). This Site is within one-quarter mile of the Chestnut Site.

The Livermore Valley is bounded by the Calaveras Fault on the west, by the Greenville Fault on the east, and by the Mount Diablo Complex on the north. The Calaveras and Greenville faults are active strike-slip faults related to the San Andreas Fault system. The Livermore Valley includes down-dropped blocks and subsidiary northwest-trending faults. These blocks form sub-basins, and the Site lies in the Mocho Sub-basin, which is bounded on the southwest by the Mocho and Livermore faults, and on the northeast by the Tesla Fault. The Site lies in the southwestern portion of the sub-basin.

Previous investigations conducted in 1989 indicated the soils beneath the shopping center site are a heterogeneous mix of clayey silt, sandy gravel, and coarse gravels belonging to the Livermore Formation. These soils have moderate infiltration rates, high hydraulic conductivity, and low water-holding capacity. Soils encountered during previous investigations were primarily clays with varying percentages of silt, sand, and gravel.

The Livermore Formation is generally composed of unconsolidated to semi-consolidated beds of gravel, sand, silt, and clay (DWR, 2007). A lower member in the eastern portion of the valley is composed of gray silt and clay, with lenses of sand and gravel. The Livermore Formation is estimated to be at least 500 feet thick in the vicinity of the Site, and ranges up to 4,000 feet thick in the Livermore Valley. The Quaternary alluvial fan deposits make up the valley floor and are composed of semi-consolidated sand and gravel in a matrix of clayey sand. These deposits are on the order of 100 feet thick in the vicinity of the Site, and lie on an erosional unconformity on

top of the Livermore Formation. The axis of the erosional surface is northeast of the Site, where the Quaternary deposits may range in thickness up to between 300 and 400 feet.

The Mocho Sub-basin is one of the groundwater sub-basins in Livermore Valley, where faulting and variations in the thickness of permeable sediments restrict horizontal and vertical groundwater flow. Groundwater in the Mocho Sub-basin occurs in Shallow and Deep Zones. In the vicinity of the Site, the Shallow Zone is unconfined and ranges from about 30 to as much as 85 feet bgs (or an elevation of 440 to 385 feet above mean sea level) (Alameda County Zone 7, 2007). The groundwater surface in the Livermore Valley slopes generally westward, but in the Mocho Sub-basin it is predominantly to the northwest. The Deep Zone ranges from about 100 to at least 500 feet bgs, and flows generally towards the northwest.

The Site and its immediate vicinity to the north and northwest are underlain by the following hydrostratigraphic units, listed in order of increasing depth bgs (Treadwell and Rollo, 2009):

- **Vadose Zone** – The vadose zone comprises the unsaturated strata above the water table. Its thickness varies as the water table elevation fluctuates from approximately 25 to 40 feet depth bgs. The lithology of the vadose zone generally resembles that of the Shallow Groundwater Zone.
- **Shallow Groundwater Zone** – The Shallow Groundwater Zone (Shallow Zone) is the uppermost, unconfined saturated zone, and consists of variably interbedded gravel, sand, silt, and clay layers. Groundwater is typically encountered between 25 and 75 feet bgs. Coarser-grained units are generally more transmissive, except those with more poorly sorted layers whose matrices are comprised of silt and clay materials (fine-grained units). Vertical and horizontal transmissivity in silty and clayey layers is low.
- **Clay Aquitard** – Underlying the Shallow Zone is an aquitard unit dominated by silty clay lithology. This includes well-sorted plastic clay layers, occasionally interbedded with discontinuous sandy lenses, and poorly sorted strata containing cobbles and gravel in a fine-grained matrix. Taken together, the unit is termed the “clay aquitard” in recognition of its function as a barrier to significant vertical hydrologic communication.
- **Deep Groundwater Zone** – The Deep Groundwater Zone (Deep Zone) consists of interbedded gravel, sand, and fine-grained strata. The main difference between this unit and the Shallow Zone, which exhibits similar lithologies, is that the gravel and sand layers in the Deep Zone are better sorted, thicker, and more continuous.

3.0 DESCRIPTION OF FIELD ACTIVITIES

3.1 Pre-Mobilization Activities

Before the start of field operations, URS prepared a DTSC-approved Health and Safety Plan for the sampling investigation at the Site.

On January 17, 2011, URS contacted the Zone 7 Water Agency (Zone 7) to determine permit requirements for the proposed project work. On February 4, 2011, URS submitted an application for permitting to Mr. Wyman Hong, and subsequently received a drilling permit for the required scope of work.

URS marked all the drilling locations in white paint and notified Underground Services Alert (USA). A utility clearance was conducted at each of the borehole locations, including clearance of public property by USA, and additional clearance by a private utility clearance company, Sierra Nevada Ground Scan Imaging, a California-certified Disabled Veteran Business Enterprise.

3.2 Soil Sampling

Soil samples were collected by Gregg Drilling and Testing, Inc., of Martinez, California, using direct-push technology (DPT) at fourteen sample locations, C-1 to C-14 (Figure 2). During advancement of the boreholes, a continuous core was collected at each location using 4-foot-long acetate sleeves that were cut at the desired sampling interval and sealed with Teflon™ sheeting and end caps. Samples collected for TPH-g were collected using gas-tight EnCore™ samplers. All borings were logged according to the Unified Soil Classification System. Laboratory Reports, Data Validation Reports, and Chain-of-Custody forms are provided in Appendix A. Boring logs are included as Appendix B.

Samples were analyzed according to the California Assessment Manual (CAM) 17 metals; BTEX; TPH-g, TPH-d and TPH-mo; polyaromatic hydrocarbons (PAHs); and organochlorine pesticides (OCPs). All samples were delivered under chain of custody to TestAmerica Analytical Laboratories of Pleasanton (TestAmerica), California for analysis. Sample analytical methods and locations are summarized in Table 1.

Duplicate samples were collected at a minimum frequency of 10 percent of the primary samples. A total of 28 soil samples and 5 duplicate samples was analyzed for metals. Twenty-three soil samples and three duplicate samples were analyzed for TPH-g with BTEX; 23 soil samples and four duplicates were analyzed for TPH-d and TPH-mo; 19 soil samples and four duplicates were analyzed for PAHs; and nine soil samples and two duplicate samples were analyzed for OCPs.

3.3 Groundwater Sampling

URS contracted with Gregg Drilling and Testing, Inc., to collect groundwater samples using a Cone Penetration Test (CPT) drill rig equipped with a Hydropunch™ sampler. Groundwater samples were collected between 43 and 49 feet bgs using a stainless-steel bailer that was decontaminated between sample locations, in accordance with the work plan.

URS used CPT technology in order to collect the groundwater samples, to assess the nature of the underlying geology, and to identify the depth to groundwater for grab groundwater collection. During advancement of the CPT cone, real-time data was monitored to identify the first groundwater-bearing zone, which was identified by coarse-grained lithologies and variations in pore pressure. In addition, pore-water dissipation tests, which record the pore-water pressure against time as it decays, were performed. Stabilization of dynamic pore pressure in a short period of time typically indicates favorable conditions for the presence of a groundwater-bearing zone. The methodology described above allowed groundwater samples to be collected from the specific groundwater-bearing zones identified using the CPT data. CPT probes were completed to a maximum depth of 49 feet bgs. Following collection of CPT and pore-water data, the probe locations were tremmie-grouted with neat cement.

Groundwater samples were analyzed for VOCs using U.S. Environmental Protection Agency (U.S. EPA) Method 8260B; TPH using U.S. EPA Methods 8015M/8020; and for CAM 17 metals using U.S. EPA Method 6010B. Five groundwater samples and one duplicate sample were collected from five onsite locations. Sample analyses are summarized in Table 1. Field parameters (temperature, conductivity, dissolved oxygen, pH, and oxidation reduction potential) were also measured for each groundwater sample using a YSI Incorporated (YSI) meter, and are summarized in Table 6. The CPT report from Gregg Drilling and Testing, Inc., is included as Appendix C.

3.4 Soil Gas Sampling

URS contracted with Gregg Drilling and Testing, Inc., to advance the soil gas borings using DPT. Soil gas samples were collected at five locations (C1 to C5), and analyzed for VOCs following the U.S. EPA Method for Toxic Organics – 15 (U.S. EPA TO-15). Soil gas samples were collected at 5 feet bgs at each of these locations. One field duplicate quality control (QC) sample was collected from location C-3.

Soil gas samples were collected in general accordance with the DTSC/Los Angeles RWQCB guidance titled “*Advisory – Active Soil Gas Investigations*,” dated January 28, 2003 (DTSC and LARWQCB, 2003). Soil gas sampling was also completed in general accordance with the draft 2009 Active Soil Gas Advisory presented in June 2009, by the San Francisco Bay RWQCB

(RWQCB, 2009). Although this guidance has not yet been formally adopted, it is expected to be adopted imminently, and presents the most up-to-date methodologies. Following this guidance, soil gas samples were collected from semi-permanent soil vapor monitoring points. At each location, a boring was advanced to 5 feet bgs using direct-push equipment. Tubing with a screen attached to the end was then lowered to the base of the boring, and a sand pack poured around it. When the sand was above the screened interval, 1 foot of dry bentonite was placed on top of the sand pack. Hydrated bentonite was then added to complete the well to the ground surface. Samples were collected directly from the tubing into a 1.4-liter SUMMA™ canister using helium as a leak-check compound. This method required use of a shroud over the sampling train and boring surface, and a continuous flow of helium into the shroud. A helium meter was used to monitor helium concentrations within the shroud, and laboratory analysis for helium was subsequently conducted to assess whether any leaks had occurred.

Soil gas sampling was not conducted for at least 20 minutes after the semi-permanent probe was installed, to allow subsurface conditions to equilibrate. To ensure that stagnant or ambient air was removed from the sampling system and to ensure samples were representative of subsurface conditions, three purge volumes (or “dead space volumes”) were removed from the sampling system. This included air from the dedicated polyethylene tubing and the annular space around the probe tip. Six-liter SUMMA™ canisters were used to remove the purge volumes. Purging of the sampling system and sampling was performed at flow rates between 100 milliliters per minute (mL/min) and 200 mL/min to limit stripping, prevent ambient air infiltration, and reduce the variability of purging and sampling rates. After the purge volumes were removed, a 1.4-liter SUMMA™ canister was connected to the tubing within the helium shroud, and a soil gas sample was collected.

Soil gas samples were submitted under chain-of-custody to Curtis and Tompkins Laboratory (a California Small Business Enterprise (SBE) in Berkeley, California, for VOC analysis by U.S. EPA Method TO-15. Vacuum readings before and after shipping were recorded to ensure that no leakage had occurred during shipping. In addition to analysis, each canister was analyzed for helium using American Society for Testing and Materials Method D1946 to determine whether any leakage from the shroud had occurred.

3.5 Geophysical Investigation

URS contracted with NorCal Geophysical Consultants, Inc. (NorCal), of Cotati, California, a California SBE, to conduct a geophysical investigation of the northwestern corner of the Site, the location of the former gas station. The objective of the investigation was to assess whether any USTs remained following the closure of the gas station in the 1970s. NorCal used vertical magnetic gradient, metal detection, and ground-penetrating radar (GPR) methodologies to map

the subsurface of the Site within the approximate boundary of the former gas station, as shown on Figure 2. The Norcal report is included as Appendix D.

The investigation showed no anomalies in the northwestern area of the former gas station footprint, where the USTs were believed to have been located (Enercon 2009b). However, an approximately 8-foot by 8-foot anomaly was identified in the planter area on the eastern side of the gas station footprint (Figure 2). A larger-scale map of this area is included as Plate 1 in the NorCal report in Appendix D. The anomaly is consistent with a small UST, utility vault, and/or other metal debris but may also reflect the presence of rebar in the surrounding planter curb. GPR could not be used to confirm this anomaly because of the vegetation and saturated soil in the planter area. Because of the location of the anomaly with respect to prior site operations, it is believed that it is consistent with buried metal debris and/or curbing rebar rather than a UST.

3.6 Investigation-Derived Waste

A minimal amount of investigation-derived waste (soil cuttings) was generated during the drilling and sampling activities, and placed in a 55-gallon drum. Soil cuttings were characterized for profiling and will be disposed of at the South Yuma Landfill in Yuma, Arizona.

4.0 Deviations from the Work Plan

The DTSC TSI work plan was followed for the collection of soil and soil gas samples across the Site, with the deviations described below.

The TSI work plan indicated that soil gas samples would not be collected within a 7-day period of a major rain event. However, due to the expedited schedule for completion of the TSI project, soil gas samples were collected on the day of a rain event. Soil gas samples C1-SG, C3-SG, C4-SG, and C5-SG were collected from the paved parking lot; and sample C2-SG was collected from a vegetated area (Figure 2). In addition, one groundwater sample was collected from location C-1 rather than C-3, as was specified in the work plan. This change was made because C-1 was located in the approximate area occupied by one of the prior USTs, and also to give better spatial representation of groundwater conditions. Variations from the TSI work plan were completed with prior concurrence from the DTSC Project Manager.

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5.0 ANALYTICAL RESULTS

This section presents the analytical results of the soil, groundwater, and soil gas sampling and analysis conducted during this investigation. Soil samples were submitted to TestAmerica for analysis of TPH-g and BTEX, TPH-d, TPH-mo, CAM 17 Metals, PAHs, and OCPs. Groundwater samples were submitted to TestAmerica for analysis of VOCs, CAM 17 Metals, TPH-g with BTEX, TPH-d, and TPH-mo. Soil gas samples were submitted to Curtis and Tompkins, Ltd. for VOC analysis. The results were used to determine whether hazardous wastes/substances were present at the Site, to evaluate the nature and extent of contamination and to estimate the potential threat to public health and/or the environment posed by existing Site conditions. Copies of the analytical data packages and data validation reports are included in Appendix A.

5.1 Data Quality

The DTSC TSI work plan included a Quality Assurance Project Plan (QAPP) to serve as the primary guide for the integration of Quality Assurance (QA) and Quality Control (QC) functions into field activities at the Site. The QAPP identified the procedures, objectives, and specific QA/QC activities designed to achieve data quality objectives (DQOs) established for this TSI. The project file contains documentation of the QAPP protocols followed in the field, in the laboratory and in the data validation process.

Environmental measurements were conducted throughout the course of the project to produce data that are scientifically valid, are of known and acceptable quality, meet established project objectives, and are legally defensible.

Analytical data were evaluated to achieve an acceptable level of confidence in the decisions derived from the data based on methods and procedures described throughout the QAPP. The precision, accuracy, completeness, comparability, representativeness and required levels of sensitivity for all data generated were evaluated against the specified DQOs, and to provide the documentation necessary to support the investigation.

The following sections discuss the results of the data validation performed by URS chemists.

5.1.1 Soil Data

5.1.1.1 CAM 17 Metals

Holding Time and Sample Conditions

The concentration of an analyte in a sample can change with time due to chemical instability, biological degradation, and volatilization. All samples were analyzed and extracted within required holding times and within the temperature range of 4 degrees Celsius (°C) ±2°C.

Blank Contamination

No detections of any analytes were found in any of the method blanks. No field blanks were submitted.

Field Duplicates and Laboratory Duplicates

Six pairs of field duplicates were submitted to TestAmerica. The relative percent difference (RPD) between concentrations of mercury in the duplicate pair C14-5 (0.098 micrograms per kilogram [µg/kg]) and C14-60 (0.037 µg/kg) of 90.4 percent exceeded the QC limit of 50 percent. Reported concentrations of mercury are flagged “J,” estimated in both samples. Significant discrepancies were found in the duplicate pair C2-2 and C2-60. The RPD between concentrations of arsenic, chromium, nickel, mercury, and zinc, in the duplicate pair exceeded the QC limit of 50 percent. In each case, positive detections in either sample of the listed metals, not previously qualified, were flagged “J,” estimated. The details, including concentrations in duplicate pair members as well RPDs, are shown in the tables in the validation report. The relatively poor precision shown by the field duplicates is most likely due to soil heterogeneity. No other significant discrepancies were found between duplicate pairs.

Laboratory Control Samples

All metals spiked for laboratory control samples (LCS) were recovered within their QC acceptance range of 80 to 120 percent.

Matrix Spikes and Duplicates

Four samples from this project were spiked for the matrix spike (MS)/matrix spike duplicate (MSD). A number of metals from samples C2-5, C5-2, C10-5, and C14-5 had recoveries outside the 75 to 125 percent QC limit, or had RPDs between the reported concentrations that exceeded 20 percent. In the appropriate analytical batch, for all metals where the mean percent recovery was low, the reporting limit for non-detects were flagged “UJ,” estimated, and reported concentrations were flagged “J,” estimated. When the mean percent recovery was high, the

reported concentrations were flagged “J,” estimated. The tables in the data validation reports identify the sample that was spiked, the associated analytical batch, the mean percent recovery (for the MS and MSD), and the RPD. The flagging protocol followed is listed at the end of each table. It is likely that both the RPD failures and the recovery failures are due to soil heterogeneity.

Reporting Limits and Dilutions

All samples were diluted by a factor of four for the 6010B analysis (for all metals except mercury), and reporting limits were correspondingly increased by a factor of four. The mercury analyses by U.S. EPA Method 7470 were not diluted.

5.1.1.2 Gasoline-Range Organics

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analyte were found in any of the method blanks analyzed.

Field Duplicates and Laboratory Duplicates

Four field duplicate soil samples were submitted for gasoline-range organics analysis. There was no significant discrepancy between the results of the pair members.

Surrogates

For all samples, the surrogate was recovered within its QC acceptance limits.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

MS/MSD recoveries were within their QC acceptance ranges.

Reporting Limits and Dilutions

No dilutions were required.

5.1.1.3 Diesel and Motor-Oil Range Organics

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of 4°C +/- 2°C degrees. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analyte were found in any of the method blanks or trip blanks analyzed.

Field Duplicates and Laboratory Duplicates

Four field duplicate soil samples were submitted for diesel and motor-oil range organics analysis. In duplicate pair C3-5 and C3-60, both diesel and motor oil were reported non-detect in sample C3-60, but at concentrations of 100 mg/kg and 470 mg/kg, respectively, in sample C3-5. Reported concentrations in sample C3-5 were flagged “J,” estimated. The relatively poor precision shown by these duplicates is most likely due to soil heterogeneity. No significant discrepancy was found between the results of the other duplicate pair members.

Surrogates

There was no recovery (0 percent) of the surrogate p-terphanyl in sample C7-2. The reported concentrations of both diesel and motor-oil range organics were flagged “J,” estimated, and could be biased low due to the failed surrogate recovery. However, there was no MS/MSD recovery issue with the sample batch containing C7-2, indicating that there was no matrix problem with the analytes of concern.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

The RPD between the percent recoveries of the MS and MSD (45 percent) exceeded the QC limit of 30 percent for the spiked sample C3-60. The reporting limits for both diesel and motor oil were therefore flagged “UJ,” estimated for this sample. The MS/MSD exceedence for the non-detect sample C3-60 was not considered to affect the results of the other samples within this

batch, in accordance with the professional judgment of the URS chemist, consistent with U.S. EPA data validation protocol.

Reporting Limits and Dilutions

Dilutions between two and five were required to quantitate these analytes in samples C5-5, C2-60, C4-5, C3-2, C6-2, C7-2, and C3-5. In each case, the reporting limit was raised by the same factor as the dilution. Reported concentrations exceeded the elevated reporting limits. The details of which samples were diluted, and their corresponding factors, are presented in the validation report in Appendix A.

5.1.1.4 Organochlorine Pesticides

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of 4°C +/- 2°C degrees. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analytes were found in any of the method blanks analyzed.

Field Duplicates and Laboratory Duplicates

Two field duplicates were submitted for pesticide analysis. There were no significant discrepancies between the results of the pair members.

Surrogates

For all samples, the surrogate was recovered within its QC acceptance limits.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

No MS/MSD sample was submitted for organochlorine pesticide analysis. However, surrogate (tetrachloro-m-xylene and DCB decachlorobiphenyl) recoveries were within the prescribed ranges, suggesting that no significant matrix affect was present.

Reporting Limits and Dilutions

No dilutions were required.

5.1.1.5 PAHs

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of 4°C +/- 2°C degrees. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analytes were found in any of the method blanks analyzed.

Field Duplicates and Laboratory Duplicates

Four field duplicates were submitted for PAH analysis. The following compounds in sample C10-60 had reported concentrations greater than 3 times the reporting limits for the non-detects in the duplicate sample C10-2: benzo(a)anthracene, chrysene, benzo(a)pyrene, benzo(b)fluoranthene, fluoranthene, and pyrene. Reported concentrations in sample C10-60 were flagged “J,” estimated. Results in sample C10-2 were all non-detect. All other duplicate pairs had no significant discrepancies.

Surrogates

For all samples, the surrogate was recovered within its QC acceptance limits.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

MS/MSD recoveries were all within their QC acceptance ranges.

Reporting Limits and Dilutions

Dilutions between two and ten were required to quantitate these analytes in samples C1-2, C2-60, C5-5, C1-5, C4-5, C3-2, C3-5, C7-2, and C6-2. In each case, the reporting limit was raised by the same factor as the dilution. Reported concentrations exceeded the elevated reporting

limits. The details of which samples were diluted and their corresponding factors are presented in the validation report in Appendix A.

5.1.2 Groundwater Data

5.1.2.1 CAM 17 Metals

Holding Time and Sample Conditions

The concentration of an analyte in a sample can change with time due to chemical instability, biological degradation, and volatilization. All samples were analyzed and extracted within required holding times and within the temperature range of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

Blank Contamination

No detections of any analytes were found in any of the method blanks.

Field Duplicates and Laboratory Duplicates

One pair of field duplicates was submitted to Test America. No significant discrepancy was found between the results of the pair members.

Laboratory Control Samples

All metals spiked for LCS were recovered within their QC acceptance range of 80 to 120 percent.

Matrix Spikes and Duplicates

One sample from this project was spiked for the MS/MSD. MS/MSD recoveries were within their QC acceptance ranges. In the second batch of samples (C2GW, C20GW, and C9GW), the sample spiked for the MS/MSD for mercury was not from this project and does not reflect the matrix of these samples. All of the 6010B metals met QC acceptance criteria.

Reporting Limits and Dilutions

No dilutions were required.

5.1.2.2 Gasoline-Range Organics

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analytes were found in any of the method blanks analyzed.

Field Duplicates and Laboratory Duplicates

One field duplicate groundwater sample was submitted for gasoline-range organics analysis. There was no significant discrepancy between the results of the pair members.

Surrogates

For all samples, the surrogate was recovered within its QC acceptance limits.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

MS/MSD recoveries were within their QC acceptance ranges.

Reporting Limits and Dilutions

No dilutions were required.

5.1.2.3 Diesel and Motor-Oil Range Organics

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ degrees. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analytes were found in any of the method blanks or trip blanks analyzed.

Field Duplicates and Laboratory Duplicates

One field duplicate was submitted for TPH-d and TPH-mo analysis. There was no significant discrepancy between the results of the pair members.

Surrogates

For all samples, the surrogate was recovered within its QC acceptance limits.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

One sample from this project was spiked for the MS/MSD. MS/MSD recoveries were within their QC acceptance ranges.

Reporting Limits and Dilutions

No dilutions were required.

5.1.2.4 Volatile Organic Compounds

Holding Time and Sample Conditions

All samples were analyzed and extracted within required holding times and within the temperature range of 4°C +/- 2°C degrees. All of the samples were analyzed within the holding time. No problems were encountered with sample temperature at log-in at the laboratory.

Blank Contamination

No detections of any analytes were found in any of the method blanks or trip blanks analyzed.

Field Duplicates and Laboratory Duplicates

One field duplicate was submitted for VOC analysis. There was no significant discrepancy between the results of the pair members.

Surrogates

For all samples, the surrogate was recovered within its QC acceptance limits.

Laboratory Control Samples

LCS recoveries were within their QC acceptance ranges.

Matrix Spikes and Duplicates

One sample from this project was spiked for the MS/MSD. The mean percent recovery of acetone of 59 percent was below the QC acceptance range of 60 percent to 140 percent. The reporting limit of acetone in sample C12-GW was flagged “UJ,” estimated. However, this result does not indicate significant matrix effects for precision.

Reporting Limits and Dilutions

No dilutions were required.

5.1.3 Data Quality Review

5.1.3.1 Soil Gas Data

Holding Times and Sample Condition

Holding time for soil gas samples in SUMMA canisters is generally considered to be 30 days, although it is not specified in the TO-15 method. Curtis and Tompkins performed the analysis within 3 days of sampling. There were no instances of problems with sample conditions noted by the laboratory during log-in.

Blank Contamination

No detections of target compounds were reported in any of the method blanks.

Field Duplicates

URS sent one pair of field duplicates (C3-SG and C6-SG) for analysis. The duplicates were collected sequentially. There were no significant discrepancies between results of the duplicate pair. The duplicate sample C6-SG was the only sample that had helium leakage from the shroud, at 1.3 percent by volume. However, the analytical results for this duplicate sample were consistent with the parent sample.

Surrogates

All surrogate recoveries fell within the QC acceptance range of 70 to 130 percent LCS except 2-hexanone, which was recovered at 134 percent. Because this compound was not reported in any samples, results were not qualified.

Matrix Spikes and Duplicates

Matrix spikes are not used in air and gas analyses.

Reporting Limits and Dilutions

Some samples required additional dilutions in order to quantitate target compounds (usually tetrachloroethene [PCE]). These dilutions are shown on the laboratory reports and on the validation reports in Appendix A.

5.1.4 Overall Summary of Data Quality

Based on this level of data validation, the associated data are all usable for this project. None of the results were rejected, and the data that were qualified were almost all from the soil samples, where heterogeneity is the likely cause.

5.2 Comparison Criteria

Soil analytical results were compared to the Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels (CHHSLs) and the U.S. EPA Region IX Regional Screening Levels (RSLs) for residential soil. RSLs are intended to address human health concerns regarding direct exposure to affected soils, and are generally consistent with human health risk assessment guidance prepared by the DTSC. The most recent update to the RSLs was in December 2009. The OEHHA CHHSLs are soil-screening levels developed by OEHHA and released in January 2005 (a revision of the November 2004 draft publication), with subsequent revisions on September 17, 2009. The OEHHA CHHSLs are not intended to be prescriptive cleanup levels; however, they are useful as an initial human-health-based screening tool.

Because no CHHSL or RSL values have been assigned for TPH compounds, these results were compared to the San Francisco Bay RWQCB ESLs for shallow soils where groundwater is a potential drinking-water source for residential land use. ESLs are conservative risk-based screening levels; they are not regulatory cleanup levels, but are useful as an initial screening level to be protective of human health and the environment. The most recent version of the ESLs was released in May 2008.

Groundwater analytical results were compared to the California Department of Public Health (CDPH) Maximum Contaminant Levels (MCLs), updated November 28, 2008, which are regulatory standards that limit contaminant concentrations in drinking water.

Soil gas analytical results were compared to the OEHHA CHHSLs for volatile chemicals below buildings constructed without engineered fill below sub-slab gravel, a residential scenario to provide the most conservative comparison standard. The OEHHA CHHSLs are soil-gas screening levels developed by OEHHA and released in January 2005 (a revision of the November 2004 draft publication), with subsequent revisions on September 17, 2009. The OEHHA CHHSLs are not intended to be prescriptive cleanup levels, but they are useful as an initial human-health-based screening tool.

5.3 Soil Analytical Results

Soil analytical results for TPH are summarized in Table 2, results for metals are summarized in Table 3, results for PAHs are summarized in Table 4, and results for organochlorine pesticides are summarized in Table 5. Laboratory analytical reports are included in Appendix A.

5.3.1 TPH-g, TPH-d, and TPH-mo

The analytical laboratory results for TPH-g, BTEX, TPH-d, and TPH-mo analyses are summarized in Table 2. Samples were analyzed for these compounds at 14 locations in samples collected at 2 feet bgs; at five locations in samples collected at 5 feet bgs; and at two locations in samples collected at 20 and 30 feet bgs. TPH-g and BTEX compounds were not detected in any of the samples analyzed above laboratory reporting limits. TPH-d was not detected in concentrations exceeding the residential ESL for TPH-d of 83 mg/kg in any samples collected at 2 feet bgs, 20 feet bgs, or 30 feet bgs. However, THP-d was detected at concentrations exceeding the ESL in three of the five samples collected at 5 feet bgs. Concentrations detected above the ESL were 100 mg/kg in sample C1-5, 110 J mg/kg in sample C3-5, and 140 mg/kg in sample C4-5. The result for sample C3-5 was “J” flagged as estimated, as discussed in Section 5.1.1.3. TPH-d detections were also found at levels less than the ESL at locations C5 (5 feet bgs) and C1, C5, C6, C7, and C8 (2 feet bgs). TPH detections are shown on Figure 3.

TPH-mo was not detected in concentrations exceeding its ESL of 370 mg/kg in any samples collected at 2 feet bgs, 20 feet bgs, or 30 feet bgs. TPH-mo was detected at concentrations exceeding the ESL in three of the five samples collected at 5 feet bgs. The results were 470 J mg/kg in sample C3-5, 570 mg/kg in sample C1-5, and 670 mg/kg in sample C4-5. The TPH-mo result for C3-5 was J-flagged as estimated, as discussed in Section 5.1.1.3. TPH-mo detections were also found at concentrations less than the ESL at locations C5 (5 feet bgs), C6, C7, and C8 (all at 2 feet bgs), all locations at which TPH-d was detected.

5.3.2 CAM 17 Metals

The metals analytical results are summarized in Table 3. Samples collected from 2 feet bgs and 5 feet bgs at all 14 borings were analyzed for metals. Multiple metals were detected at all of the

locations and at all depths; however, only arsenic was detected at concentrations exceeding comparison criteria.

Arsenic was detected in 25 out of 34 samples collected at the Site. All of the detected concentrations of arsenic were above the CHHSL concentration of 0.07 mg/kg, and the RSL concentration of 0.39 mg/kg. Concentrations ranged from 4.1 mg/kg in sample C1-2 to 14 mg/kg in sample C2-2. The detected arsenic concentrations, while above risk-based comparison criteria, are less than the 95th percentile for background levels of 17 mg/kg, developed by Lawrence Berkeley National Laboratory (LBNL, 2009). The LBNL 95th percentile background level is a value that has commonly been accepted as a background concentration for arsenic in San Francisco Bay Area soils.

Other metals detected above the laboratory reporting limits were barium, chromium, cobalt, copper, lead, nickel, vanadium, zinc, and mercury, as listed Table 3. These metals were all detected at concentrations below the applicable residential CHHSLs and RSLs.

5.3.3 Polynuclear Aromatic Hydrocarbons

The analytical laboratory results for PAH analyses are summarized in Table 4. Samples were analyzed for these compounds at fourteen locations in samples collected at 2 feet bgs, and at five locations in samples collected at 5 feet bgs. Multiple PAH compounds were detected in two samples: C10-60 (duplicate of C10-2) and C2-2. Naphthalene was detected in sample C3-2 at 36 µg/kg. Only benzo[a]pyrene exceeded the RSL concentration of 15 µg/kg in sample C10-60, with a reported concentration of 21 J µg/kg, but this was below the CHHSL of 38 micrograms per liter (µg/L). This result was J-flagged as estimated, as discussed in Section 5.1.1.5. All other detections were below their respective RSLs and CHHSLs.

5.3.4 Organochlorine Pesticides

The analytical laboratory results for pesticide analyses are summarized in Table 5. Samples collected at 2 feet bgs were analyzed for these compounds at nine locations. No pesticides were detected above laboratory reporting limits in any samples collected. Reporting limits are included in Table 5.

5.4 Groundwater Analytical Results

Groundwater field parameters are summarized in Table 6. Analytical results for TPH are presented in Table 7; results for metals are presented in Table 8; results for VOCs are presented in Table 9. Laboratory analytical reports and validation reports are included in Appendix A.

5.4.1 Groundwater Field Parameters

The groundwater field parameters temperature, conductivity, dissolved oxygen, pH, and Oxidation Reduction Potential were measured using a YSI multi-parameter meter. Field parameters and depths to groundwater for each sample location are summarized in Table 6.

5.4.2 TPH-g, TPH-d, and TPH-mo

The analytical laboratory results for TPH-g, TPH-d, and TPH-mo analyses are summarized in Table 7. BTEX results are included in Table 8 (VOC results). Samples collected from groundwater varying in depth from 43 to 49 feet bgs were analyzed for these compounds at five locations. In each case, the first groundwater encountered was sampled. TPH-g and BTEX were not detected in any of the samples analyzed above laboratory reporting limits. TPH-d was detected above the laboratory reporting limits in samples C14-GW, C2-GW, C20-GW, and C9-GW. However, TPH-d was only detected at concentrations exceeding the ESL of 100 µg/L in one sample, C2-GW, at a concentration of 130 µg/L. It should be noted that the TPH-d concentration in C20-GW (the duplicate of the C2-GW) was less than the ESL, at 82 µg/L. TPH-mo was detected at concentrations exceeding the laboratory reporting limit in all samples except C1-GW. However, the only concentration detected above the ESL was in sample C2-GW, at 400 µg/L. The TPH-mo concentration detected in the duplicate sample for this location (C20-GW) was 200 µg/L, which is less than the ESL. TPH results are shown on Figure 4.

5.4.3 CAM 17 Metals

The metals analytical results are summarized in Table 8. Metals were analyzed from five locations from groundwater ranging in depth from 43 to 49 feet bgs. Multiple metals were detected in all of the samples; however, only three metals were detected at concentrations exceeding comparison criteria. Metals for which concentrations exceeded the CDPH MCL criteria were barium, chromium, and nickel.

Only sample C9-GW exceeded the barium CDPH MCL of 1 µg/L, with a detected concentration of 1.2 µg/L.

Chromium was detected in four of the six samples collected; however, it was detected in only one sample (and its duplicate) at a concentration exceeding the CDPH MCL of 0.05 µg/L. The concentrations exceeding the CDPH MCL were detected in samples C2-GW and C20-GW (the duplicate sample of C2-GW) at 0.086 µg/L and 0.1 µg/L, respectively.

Nickel was detected in all of the samples collected, but only two samples (and one duplicate) exceeded the CDPH MCL of 0.1 µg/L. Nickel samples exceeding the CDPH MCL included C9-GW at 0.15 µg/L, C2-GW at 0.27 µg/L, and C20-GW at 0.39 µg/L (duplicate of C2-GW).

5.4.4 Volatile Organic Compounds

The analytical laboratory results for VOC analyses are summarized in Table 9. Samples were analyzed for these compounds at six locations in groundwater, at depths ranging from 43 to 49 feet bgs. Trichloroethylene (TCE) and PCE were the only VOCs detected above laboratory reporting limits. PCE was detected in all of the samples analyzed above laboratory reporting limits. In five of the six samples, PCE was above the CDPH MCL of 5 µg/L. Concentrations above the CDPH MCL ranged from 12 µg/L in sample C20-GW (duplicate of C2-GW) to 15 µg/L in sample C9-GW. TCE was also detected above laboratory limits in three of the samples, but no samples exceeded the CDPH MCL of 5 µg/L. No other VOCs were detected in the groundwater samples. PCE concentrations in groundwater samples are shown on Figure 4.

5.5 Soil Gas Analytical Results

Soil gas samples were collected from five locations at 5 feet bgs. Soil gas samples were analyzed for VOCs. The results are presented in Table 10 and laboratory analytical and data validation reports are included in Appendix A. A total of 14 compounds was detected in soil gas samples from the Site. Benzene was the only compound detected above its CHHSL. In sample C5-SG, benzene was detected at a concentration of 0.04 µg/L, which slightly exceeds the CHHSL of 0.036 µg/L. Benzene was also detected in samples C1-SG, C2-SG, and C4-SG, but at concentrations below the CHHSL. Other compounds detected for which CHHSLs have been established were PCE, which was detected at concentrations up to 0.049 µg/L, below the residential CHHSL of 0.18 µg/L; m,p-xylenes up to 0.15 µg/L, below the residential CHHSL of 320 µg/L; o-xylene up to 0.03 µg/L, below the residential CHHSL of 320 µg/L; and toluene at up to 0.018 µg/L, below the residential CHHSL of 140 µg/L. Propylene was detected in all of the soil gas samples, except for the C6-SG (duplicate of C3SG) at concentrations between 0.056 µg/L and 0.5 µg/L. No CHHSL is established for propylene.

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6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Soil

Based on the results of the investigation conducted at the Site, soil has been impacted by low-level TPH-d and TPH-mo contamination at eight locations, within the footprint of the former gas station and across the northern part of the Site (Figure 3). TPH-d and TPH-mo concentrations at 2 feet bgs were all below the established residential ESLs. For two samples in the area of the former gas station (C1 and C3) and one sample east of this area (C4), TPH-d and TPH-mo concentrations exceeded the residential ESLs at a depth of 5 feet bgs. The maximum TPH-d concentration was 140 mg/kg (residential ESL 83 mg/kg); and the maximum TPH-mo concentration was 670 mg/kg (residential ESL 370 mg/kg). There were no TPH detections at the 20- and 30-foot bgs samples collected at C2 and C3, indicating that TPH contamination from the 5-foot bgs samples had not migrated vertically to 20 feet bgs. TPH-d and TPH-mo contamination at concentrations less than the ESL was detected at locations C5 (5 feet bgs), and at locations C6, C7, and C8 (2 feet bgs), which are outside of the former gas station footprint. These results indicate that the former gas station is likely not the only source of TPH contamination at the Site. Deeper samples were not collected at locations C6, C7, and C8 during the current investigation.

It is possible that other undocumented historical activities at the Site may have resulted in TPH contamination in areas outside of the former gas station. In addition, the 2009 Phase I ESA (Enercon, 2009a) identified a Pacific Gas and Electric (PG&E) manufactured gas plant, which operated through the 1950s, as having been adjacent to the Site. Although the PG&E site was classified as requiring no further action by the U.S. EPA and RWQCB, and was not identified as a Recognized Environmental Condition in the Phase I report (Enercon, 2009a), it is possible that TPH soil contamination, especially at the eastern boundary of the Site (C7), could be associated with historical operations at this facility.

The detected arsenic concentrations, although above risk-based comparison criteria, are within the 95th percentile for background levels of 17 mg/kg. The 95th percentile background level is a value developed by LBNL that has been accepted as a background concentration for arsenic in San Francisco Bay Area soils (LBNL, 2009). No other metals were detected at levels exceeding the residential CHHSLs or RSLs.

PAHs were detected in only three of the fourteen sample locations (C2, C3, and C10). The only detection that exceeded comparison criteria was the benzo(a)pyrene result of 21 J µg/kg, which is below the residential CHHSL of 38 µg/kg. Other detections were below comparison criteria (Table 4).

There were no detections of organochlorine pesticides in the samples collected at 2 feet bgs.

For unrestricted Site use, no contaminants were detected above comparison criteria in surficial soils to a depth of at least 2 feet bgs. In the corner of the Site, formerly occupied by the gas station, and to the east of this area, there were low-level exceedences of TPH-d and TPH-mo in the 5-foot bgs samples, but no detections in the 20- and 30-foot bgs samples. However, the areas of contamination at 5 feet bgs at C1, C3, and C4 are not vertically bounded, because there are no sample points between 5 and 20 feet bgs. Also, samples at 5 feet bgs were not collected from locations C6, C7, and C8, all of which had TPH-d and TPH-mo detections below the ESL at 2 feet bgs. TPH concentrations at 5 feet bgs are unknown at these locations. This area of the Site may warrant further investigation for TPH-d and TPH-mo to bound the vertical and lateral extent of contamination.

6.2 Groundwater

The primary groundwater contaminant of concern is PCE, which was detected above its CDPH MCL at both upgradient and downgradient borders of the Site (Figure 4). The inferred groundwater flow direction in the Site vicinity is to the northwest (Treadwell and Rollo, 2009). PCE groundwater concentrations ranged from 2.4 µg/L to 15 µg/L. The PCE concentration at location C14 (upgradient) was 13 µg/L; PCE concentrations at the downgradient corner of the Site were 13 µg/L and 14 µg/L at C1 and C2, respectively. Because the PCE concentrations do not vary across the Site, it is likely that there is an off-site, upgradient source. Although there are several dry cleaners in the upgradient area, no releases were identified in the most recent Phase I ESA (Enercon, 2009).

Review of the groundwater investigation conducted by Treadwell and Rollo (Treadwell and Rollo, 2009) at the nearby LASC/MOSC sites indicates that the Chestnut Street site is directly downgradient of the shallow groundwater PCE plumes associated with the LASC/MOSC sites. The April 2009 plume map in the Treadwell and Rollo report for shallow-zone PCE contamination (25 feet to 75 feet bgs) shows that the PCE plumes extend to the railroad tracks south of the Site. The highest concentration in the shallow PCE plumes identified by Treadwell and Rollo (2009), upgradient of the Site was 28 µg/L, which is higher than the onsite PCE concentrations found in groundwater. Additional migration of the contaminant plume would have occurred between April 2009 and the date of the current investigation (February 2011). It is likely that PCE concentrations detected in groundwater sampled during this TSI are attributable to an off-site, upgradient source.

TPH-d was detected across the Site at both the upgradient and downgradient sample locations. The only exceedence of the residential ESL (100 µg/L) was at C2-GW (120 µg/L). TPH-mo was also detected across the Site, with a low-level exceedence at C2-GW (400 µg/L). The residential ESL for TPH-mo is 370 µg/L. TPH was detected at locations C12 and C14, which are upgradient of the former gas station area, and at C9, which is cross-gradient. The former gas station was

located in the area of C1, C2, and C3; the USTs were located in the area of C2 and C3. These upgradient and cross-gradient detections indicate a potential off-site source. The PG&E manufactured gas plant identified in the 2009 Phase I ESA (Enercon, 2009a) that operated through the 1950s is described as adjacent to the Site. It is a possible source for the low-level TPH groundwater contamination, but this contamination could also be attributable to other historical operations at the Site.

Chromium was detected in sample C2-GW (0.086 µg/L), and at 0.1 µg/L in C20-GW (duplicate of C2-GW), exceeding the CDPH MCL of 0.05 µg/L. Nickel was detected in samples C2-GW (0.27 µg/L) and C9-GW (0.15 µg/L) at concentrations above the CDPH MCL of 0.1 µg/L. Barium was detected at 1.2 µg/L at location C9-GW, exceeding the CDPH MCL of 1.0 µg/L. These isolated and low-level exceedences for metals are likely attributable to background levels of metals in the groundwater.

6.3 Soil Gas

Several compounds were present in soil gas at the Site (Table 10). PCE was detected in four of the five primary samples at concentrations below the residential CHHSL of 0.18 µg/L. This indicates that PCE concentrations in groundwater do not pose a vapor intrusion threat. Benzene was detected in one sample (C5-SG) at a concentration of 0.040 µg/L, exceeding the CHHSL of 0.036 µg/L. Other benzene detections from the area of the former gas station did not exceed the CHHSL. All other compounds were detected at relatively low levels and did not exceed CHHSL concentrations. The soil gas results do not indicate the potential for vapor intrusion at the Site.

6.4 Geophysical Investigation

The investigation revealed no anomalies in the northwestern area of the former gas station footprint, where the USTs were believed to have been located. The former USTs were located in the area of C2 and C3 (Enercon, 2009a; Kleinfelder, 1989). However, an approximately 8-foot by 8-foot anomaly was identified in the planter area on the eastern side of the gas station footprint (Figure 2). The anomaly is consistent with a small UST, utility vault, or other metal debris. However, it may also reflect the presence of rebar in the surrounding planter curb. GPR could not be used to confirm this anomaly because of the vegetation and saturated soil in the planter area; therefore, the anomaly is based solely on the metal detector survey. This instrument does not differentiate between surficial metal debris and metal debris at depth. Because of the location of the anomaly with respect to prior Site operations, it is believed that it is consistent with buried metal debris and/or curbing rebar rather than a UST.

It is recommended that a GPR survey and additional electromagnetic line location/metal detection surveys of the 8-foot by 8-foot geophysical anomaly be conducted to determine whether there is

any underground structure. Depending on redevelopment plans, the survey could be performed once the planter/curb has been removed to decrease the potential for anomalies. In addition, hand-augering to a depth of 6 feet bgs at three points within the 8-foot by 8-foot area may be warranted, to further assess the origin of the anomaly.

6.5 Potential Threat to Human Health or the Environment

The TPH-d and TPH-mo concentrations detected at 5 feet bgs in the northwestern corner of the Site in the area of the former gas station do not currently pose a threat to human health or the environment because the Site is paved, and there is no exposure pathway. The deeper soil samples collected from the same area indicate that TPH contamination has not migrated to 20 feet bgs, and therefore has not impacted shallow groundwater (43 to 49 feet bgs) in this area. However, development of the Site could involve excavation and disturbance of soils in this area of the Site, where exposed TPH-contaminated soils would require remediation either before or during construction.

Analytes detected in soil gas at the Site are low in concentration and do not pose a risk to human health and environment. However, removal of the asphaltic pavement or use of the property for unrestricted development could require additional sampling, formal risk assessment, remedial actions, and/or engineering controls to ensure that potential risks are minimized.

PCE contamination at the Site exceeds the CDPH MCL of 5 µg/L, with a maximum concentration of 15 µg/L at two locations. This shallow groundwater contamination is believed to be associated with the LASC/MOSC sites (Treadwell & Rollo, 2009). The source of the LASC/MOSC shallow PCE plumes has been identified as historic releases from multiple dry-cleaning operations, located upgradient of the Site. The Treadwell and Rollo report also discusses deeper groundwater PCE contamination associated with the same sites, which has impacted two municipal drinking water supply wells. Because groundwater at the Site is not currently used for drinking water, and soil gas concentrations do not exceed risk-based levels for vapor intrusion, the presence of elevated concentrations of PCE in groundwater at the Site does not pose a threat. However, continued monitoring of groundwater and/or soil gas may be required at the Site to confirm that there is no ongoing threat to human health and the environment.

Although the Site does not currently pose a threat to human health or the environment, a limited amount of contaminated soil is present above risk-based regulatory screening levels; therefore, remediation or engineering controls prior to or during redevelopment will be required.

7.0 REMEDIATION AND DATA GAP DISCUSSION

TPH-d and TPH-mo results exceeded the RWQCB ESLs of 83 mg/kg and 370 mg/kg, respectively, for soil at three borings in the northwestern corner of the Site, within the boundary of the former gas station. Samples were collected at 2 feet bgs and 5 feet bgs; there were no exceedences found in the 2-foot bgs samples. Deeper soil samples were collected at 20 and 30 feet bgs, showing that TPH contamination had not migrated to 20 feet bgs. However, there is the potential for TPH contamination between 5 feet bgs and 20 feet bgs, so that the vertical extent of the contamination is currently unbounded. Similarly, the lateral extent of contamination is not well-defined south of C1.

Depending upon the nature of the redevelopment, it may not be necessary to excavate to 5 feet bgs in the area of the former gas station. If it is necessary to excavate to 5 feet bgs or deeper, then some remediation would be needed either prior to or during construction to address the TPH contamination. Because the extent of TPH contamination in this area is not bounded, it is not possible to estimate remediation costs without further characterization. It is suggested that additional characterization be conducted of soils between 5 feet and 20 feet bgs in order to provide a vertical boundary to the TPH contamination in the northwestern corner of the Site, and that additional samples be collected south of C1. If redevelopment included unpaved (landscaped, grass) areas in the area of the Site impacted by TPH contamination, then a migration pathway to groundwater might be established. In this case, remediation of impacted soils would be required.

If further characterization is to be conducted prior to redevelopment, then soil samples should be collected at 10 and 15 foot depth intervals at each of the locations where TPH-d and TPH-mo exceedences were observed. Soil samples should also be collected at 5, 10, and 15 foot intervals at locations C6, C7, and C8, since existing data indicate contamination at 2 feet bgs, and deeper samples were not collected during the current investigation. It is recommended that a GPR and additional electromagnetic line location/metal detection surveys be conducted of the 8-foot by 8-foot geophysical anomaly to determine whether there is any underground structure, or whether the anomaly is associated with rebar in the surrounding planter curbing. Depending upon the results of this survey, hand-augering to a depth of 6 feet bgs at three points within the 8-foot by 8-foot area may be warranted, to further assess the origin of the anomaly. Costs associated with this data gap investigation would be approximately \$10,000, which would include field sampling, drilling subcontractor costs, laboratory analytical costs, disposal of investigation derived waste and a letter report detailing the results of the additional sampling. In addition to the data gap investigation, it is recommended that the soil boring locations be surveyed, so that their locations can be referenced once the existing structures on site have been demolished.

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8.0 REFERENCES

- AEI Consultants, 2004. Phase I Environmental Site Assessment, 1625 – 1635 Chestnut Street, Livermore, California, 94551.
- Alameda County Zone 7 Water Agency, 2007. Preliminary Geologic Map of the Livermore Valley. April.
- California Division of Mines and Geology (CDMG), 2007. Well Logs for Wells Located in the Model Domain.
- California Division of Mines and Geology (CDMG), 1980. Geologic Map of California, Livermore Sheet.
- DTSC (Department of Toxic Substances Control), 2011. *Targeted Site Investigation Workplan, for the Chestnut Street, Livermore Site, 1625 and 1635 Chestnut Street*. February.
- DTSC and LARWQCB (California Environmental Protection Agency, Department of Toxic Substances Control, and Los Angeles Regional Water Quality Control Board), 2003. *Advisory— Active Soil Gas Investigations*. January.
- Department of Water Resources (DWR), 2006, California’s Groundwater Bulletin 118, Livermore Valley Groundwater Basin. January.
- Enercon (Enercon Services, Inc.), 2009a. Phase I Environmental Site Assessment Retail Office 1625-1635 Chestnut Street, Livermore, California 94551. July 24.
- Enercon (Enercon Services, Inc.), 2009b. Phase II Environmental Site Assessment Retail Office 1625-1635 Chestnut Street, Livermore, California 94551. September 15.
- Kleinfelder, 1989. Phase II Subsurface Investigation.
- LBNL (Lawrence Berkeley National Laboratory), 2009. Analysis of Background Distributions of Metals in the Soil at Lawrence Berkeley National Laboratory. April.
- M. J. Kloberdanz & Associates, 2000. Phase I Environmental Site Assessment, 1625 – 1635 Chestnut Street, Livermore, California, 94551.
- RWQCB (Regional Water Quality Control Board), 2009. *Draft 2009 Active Soil Gas Advisory*. June.

Section 7.0 – Remediation Cost Estimate

Treadwell & Rollo, 2009. Groundwater Investigation, LASC/MOSC, Livermore, California, LASC/MOSC 2008 Trust. October 29. Alameda County Zone 7 Water Agency, 2007. Preliminary Geologic Map of the Livermore Valley. April.

Table 1
Sample Locations & Analyses
Chestnut Street, Livermore, CA

Location	Sample Number	Matrix	Depth bgs (feet)	TPHg & BTEX EnCore Sampler (soil) 8015M	VOCs by US EPA Method TO-15	TPH- Diesel, Motor Oil US EPA Method 8015M	CAM 17 Metals by US EPA Method 6010B	Organo-chlorine Pesticides 8081A	PAHs 8270C	VOCs 8260B
Soil Vapor Samples										
C1	C1-SG	Soil Vapor	5		X					
C2	C2-SG	Soil Vapor	5		X					
C3	C3-SG	Soil Vapor	5		X					
C4	C4-SG	Soil Vapor	5		X					
C5	C5-SG	Soil Vapor	5		X					
Sub-Surface Soil Samples										
C1	C1-2	Soil	2	X		X	X		X	
C1	C1-5	Soil	5	X		X	X		X	
C2	C2-2	Soil	2	X		X	X		X	
C2	C2-5	Soil	5	X		X	X		X	
C2	C2-20	Soil	20	X		X				
C2	C2-30	Soil	30	X		X				
C3	C3-2	Soil	2	X		X	X		X	
C3	C3-5	Soil	5	X		X	X		X	
C3	C3-20	Soil	20	X		X				
C3	C3-30	Soil	30	X		X				
C4	C4-2	Soil	2	X		X	X		X	
C4	C4-5	Soil	5	X		X	X		X	
C5	C5-2	Soil	2	X		X	X		X	
C5	C5-5	Soil	5	X		X	X		X	
C6	C6-2	Soil	2	X		X	X	X	X	
C6	C6-5	Soil	5				X			
C7	C7-2	Soil	2	X		X	X	X	X	
C7	C7-5	Soil	5				X			
C8	C8-2	Soil	2	X		X	X	X	X	
C8	C8-5	Soil	5				X			
C9	C9-2	Soil	2	X		X	X	X	X	
C9	C9-5	Soil	5				X			
C10	C10-2	Soil	2	X		X	X	X	X	
C10	C10-5	Soil	5				X			
C11	C11-2	Soil	2	X		X	X	X	X	
C11	C11-5	Soil	5				X			
C12	C12-2	Soil	2	X		X	X	X	X	
C12	C12-5	Soil	5				X			
C13	C13-2	Soil	2	X		X	X	X	X	
C13	C13-5	Soil	5				X			
C14	C14-2	Soil	2	X		X	X	X	X	
C14	C14-5	Soil	5				X			
Groundwater Samples										
C1	C1GW	Groundwater	48	X		X	X			X
C2	C2GW	Groundwater	49	X		X	X			X
C9	C9GW	Groundwater	43	X		X	X			X
C12	C12GW	Groundwater	45	X		X	X			X
C14	C14GW	Groundwater	46	X		X	X			X

Table 2
 Soil Analytical Results - TPH and BTEX
 Chestnut Street, Livermore, CA

Chemical of Concern	Residential RSL (µg/kg)	C1-2	C1-5	C2-2	C2-5	C2-20	C2-30	C2-60	C3-2	C3-5	C3-20	C3-30	C3-60	C4-2	C4-5	C4-60	C5-2	C5-5
Benzene	1,100	< 5.1	< 4.6	< 4.3	< 4.1	< 4.9	< 4.5	< 4.1	< 4.6	< 4.4	< 4	< 6.3	< 5.3	< 4.2	< 4.3	< 4.6	< 4.3	< 4.4
Ethylbenzene	5,400	< 5.1	< 4.6	< 4.3	< 4.1	< 4.9	< 4.5	< 4.1	< 4.6	< 4.4	< 4	< 6.3	< 5.3	< 4.2	< 4.3	< 4.6	< 4.3	< 4.4
Toluene	5,000,000	< 5.1	< 4.6	< 4.3	< 4.1	< 4.9	< 4.5	< 4.1	< 4.6	< 4.4	< 4	< 6.3	< 5.3	< 4.2	< 4.3	< 4.6	< 4.3	< 4.4
Xylenes, Total	630,000	< 10	< 9.1	< 8.7	< 8.2	< 9.7	< 9	< 8.2	< 9.1	< 8.8	< 8.1	< 13	< 11	< 8.4	< 8.7	< 9.1	< 8.5	< 8.7
	ESL - Residential (mg/kg)																	
TPH-g	83	< 0.26	< 0.23	< 0.22	< 0.20	< 0.24	< 0.22	< 0.21	< 0.23	< 0.22	< 0.20	< 0.32	< 0.26	< 0.21	< 0.22	< 0.23	< 0.21	< 0.22
TPH-d	83	7.9	100	27	< 0.99	< 0.99	< 1	32	39	110 J	< 1	< 1	< 0.99 UJ	< 1	140	< 0.99	2.1	10
TPH-mo	370	< 49	570	150	< 49	< 50	< 50	210	140	470 J	< 50	< 50	< 50 UJ	< 50	670	< 49	< 50	130

Table 2
 Soil Analytical Results - TPH and BTEX
 Chestnut Street, Livermore, CA

Chemical of Concern	Residential RSL (µg/kg)	C1-2	C1-5	C2-2	C2-5	C2-20	C2-30	C2-60	C3-2	C3-5	C3-20	C3-30	C3-60	C4-2	C4-5	C4-60	C5-2	C5-5
Benzene	1,100	< 5.1	< 4.6	< 4.3	< 4.1	< 4.9	< 4.5	< 4.1	< 4.6	< 4.4	< 4	< 6.3	< 5.3	< 4.2	< 4.3	< 4.6	< 4.3	< 4.4
Ethylbenzene	5,400	< 5.1	< 4.6	< 4.3	< 4.1	< 4.9	< 4.5	< 4.1	< 4.6	< 4.4	< 4	< 6.3	< 5.3	< 4.2	< 4.3	< 4.6	< 4.3	< 4.4
Toluene	5,000,000	< 5.1	< 4.6	< 4.3	< 4.1	< 4.9	< 4.5	< 4.1	< 4.6	< 4.4	< 4	< 6.3	< 5.3	< 4.2	< 4.3	< 4.6	< 4.3	< 4.4
Xylenes, Total	630,000	< 10	< 9.1	< 8.7	< 8.2	< 9.7	< 9	< 8.2	< 9.1	< 8.8	< 8.1	< 13	< 11	< 8.4	< 8.7	< 9.1	< 8.5	< 8.7
	ESL - Residential (mg/kg)																	
TPH-g	83	< 0.26	< 0.23	< 0.22	< 0.20	< 0.24	< 0.22	< 0.21	< 0.23	< 0.22	< 0.20	< 0.32	< 0.26	< 0.21	< 0.22	< 0.23	< 0.21	< 0.22
TPH-d	83	7.9	100	27	< 0.99	< 0.99	< 1	32	39	110 J	< 1	< 1	< 0.99 UJ	< 1	140	< 0.99	2.1	10
TPH-mo	370	< 49	570	150	< 49	< 50	< 50	210	140	470 J	< 50	< 50	< 50 UJ	< 50	670	< 49	< 50	130

Table 2
Soil Analytical Results - TPH and BTEX
Chestnut Street, Livermore, CA

Chemical of Concern	Residential RSL (µg/kg)	C6-2	C7-2	C8-2	C9-2	C9-60	C10-2	C11-2	C12-2	C13-2	C14-2
Benzene	1,100	< 4.7	< 5.1	< 4.3	< 6.1	< 5.1	< 5.4	< 4.3	< 4.4	< 4.3	< 4.4
Ethylbenzene	5,400	< 4.7	< 5.1	< 4.3	< 6.1	< 5.1	< 5.4	< 4.3	< 4.4	< 4.3	< 4.4
Toluene	5,000,000	< 4.7	< 5.1	< 4.3	< 6.1	< 5.1	< 5.4	< 4.3	< 4.4	< 4.3	< 4.4
Xylenes, Total	630,000	< 9.5	< 10	< 8.7	< 12	< 10	< 11	< 8.5	< 8.8	< 8.6	< 8.7
	ESL - Residential (mg/kg)										
TPH-g	83	< 0.24	< 0.25	< 0.22	< 0.30	< 0.26	< 0.27	< 0.21	< 0.22	< 0.22	< 0.22
TPH-d	83	38	45 J	12	< 0.99	< 0.99	< 0.99	< 1	< 0.99	< 0.99	1.7
TPH-mo	370	210	280 J	53	< 49	< 50	< 49	< 50	< 50	< 49	< 50

Notes:

BTEX results in µg/kg.

TPH results in mg/kg.

C9-60 is a field duplicate of C9-2.

C2-60 is a field duplicate of C2-5.

C4-60 is a field duplicate of C4-2.

CHHSL = California Human Health Screening Level from the Office of Environmental Health Hazard Assessment (OEHHA).

RSL = Regional Screening Level from the U.S. Environmental Protection Agency (U.S. EPA).

ESL = Environmental Screening Levels, California Regional Water Quality Control Board, SF Bay Region.

mg/kg = milligrams per kilogram (parts per million).

µg/kg = micrograms per kilogram (parts per billion).

NV = No RSL, CHHSL, ESL available for this compound.

Bold concentrations indicate that the analyte was detected above the laboratory reporting limit.

Less than sign (<) indicates that the analyte was not detected above the laboratory reporting limit.

Shaded concentrations indicate that the concentration exceeds the CHSSL or RSL.

J = estimated concentration.

UJ = estimated reporting limit.

Table 3
 Soil Analytical Results - Metals (mg/kg)
 Chestnut Street, Livermore, CA

Chemical of Concern	CHHSL Residential (mg/kg)	Residential RSL (mg/kg)	C1-2	C1-5	C2-2	C2-5	C2-60	C3-2	C3-5	C3-60	C4-2	C4-5	C5-2	C5-5	C6-2	C6-5	C6-60	C7-2	C7-5
Antimony	30	31	< 2.0 UJ	< 2.1 UJ	< 1.9 UJ	< 1.9 UJ	< 2.0 UJ	< 2	< 2	< 2	< 1.9 UJ	< 2.0 UJ	< 1.9 UJ	< 1.9 UJ	< 2	< 2.1 UJ	< 2.0 UJ	< 1.9 UJ	< 2.0
Arsenic	0.07	0.39	4.1 J	4.5 J	14 J	5.6 J	< 4.1 UJ	< 4.1	< 4	< 4	4.5 J	< 4.0 UJ	5.7 J	5.0 J	< 4.1	< 4.2	5.4	4.5	5.1
Barium	5,200	15,000	160 J	140 J	120 J	130 J	110 J	110	86	92	200 J	85 J	230 J	180 J	120	140 J	180 J	200 J	190 J
Beryllium	160	160	< 0.41 UJ	< 0.42 UJ	< 0.38 UJ	< 0.38 UJ	< 0.41 UJ	< 0.41	< 0.4	< 0.4	< 0.38 UJ	< 0.4 UJ	< 0.38 UJ	< 0.38 UJ	< 0.41	< 0.42	< 0.41	< 0.39	< 0.4
Cadmium	1.7	70	< 0.51 UJ	< 0.52 UJ	< 0.48 UJ	< 0.48 UJ	< 0.51 UJ	< 0.51	< 0.5	< 0.5	< 0.48 UJ	< 0.51 UJ	< 0.48 UJ	< 0.48 UJ	< 0.51	< 0.52	< 0.51	< 0.49	< 0.5
Chromium	100,000	120,000	52 J	60 J	41 J	45 J	21 J	39	34	46	64 J	33 J	120 J	63 J	43	66 J	69 J	61 J	83
Cobalt	660	23	14 J	15 J	11 J	12 J	9.6 J	9.1	8.3	8.3	16 J	6.6 J	19 J	18 J	11	15	11	15	22
Copper	3,000	3,100	28 J	30 J	32 J	24 J	20 J	23	20	23	35 J	15 J	37 J	33 J	22	25	30	30	33
Lead	80	400	8.5 J	7.2 J	18 J	6.7 J	10 J	7.7	6	5.1	7.9 J	4.1 J	8.3 J	8.9 J	6.9	6.2	6.1	12	8.3
Molybdenum	380	390	< 2.0 UJ	< 2.1 UJ	< 1.9 UJ	< 1.9 UJ	< 2.0 UJ	< 2	< 2	< 2	< 1.9 UJ	< 2.0 UJ	< 1.9 UJ	< 1.9	< 2	< 2.1	< 2.0	< 1.9	< 2.0
Nickel	1,600	1,500	100 J	130 J	88 J	96 J	38 J	67	65	68	120 J	57 J	170 J	150 J	110	160	130	130	250
Selenium	380	390	< 4.1 UJ	< 4.2 UJ	< 3.8 UJ	< 3.8 UJ	< 4.1 UJ	< 4.1	< 4	< 4	< 3.8 UJ	< 4.0 UJ	< 3.8 UJ	< 3.8 UJ	< 4.1	< 4.2	< 4.1	< 3.9	< 4.0
Silver	380	390	< 1.0 UJ	< 1.0 UJ	< 0.95 UJ	< 0.96 UJ	< 1.0 UJ	< 1	< 0.99	< 1	< 0.95 UJ	< 1.0 UJ	< 0.96 UJ	< 0.95 UJ	< 1	< 1.0	< 1.0	< 0.97	< 1.0
Thallium	5	NV	< 2.0 UJ	< 2.1 UJ	< 1.9 UJ	< 1.9 UJ	< 2.0 UJ	< 2	< 2	< 2	< 1.9 UJ	< 2.0 UJ	< 1.9 UJ	< 1.9 UJ	< 2	< 2.1	< 2.0	< 1.9	< 2.0
Vanadium	530	390	24 J	26 J	20 J	20 J	18 J	24	21	24	27 J	17 J	30 J	26 J	21	26	23	27	30
Zinc	23,000	23,000	45 J	44 J	52 J	39 J	30 J	38	35	34	50 J	25 J	49 J	50 J	37	44	39	48	48
Mercury	18	5.6	0.032 J	0.051 J	0.072 J	0.049 J	0.27 J	0.031	0.027	0.027	0.029 J	0.031 J	0.067 J	0.075 J	0.04	0.061	0.048	0.32	0.056

Table 3
Soil Analytical Results - Metals (mg/kg)
Chestnut Street, Livermore, CA

Chemical of Concern	CHHSL Residential (mg/kg)	Residential RSL (mg/kg)	C8-2	C8-5	C9-2	C9-5	C9-60	C10-2	C10-5	C11-2	C11-5	C12-2	C12-5	C13-2	C13-5	C13-60	C14-2	C14-5	C14-60
Antimony	30	31	< 2.1 UJ	< 2.0 UJ	< 2.1	< 2.1 UJ	< 2.0	< 2.0 UJ	< 2.0 UJ	< 2.1 UJ	< 2.0 UJ	< 2.1 UJ	< 1.9 UJ	< 2.0 UJ	< 2.0 UJ	< 2.1 UJ	< 2.0 UJ	< 2.0 UJ	< 2.0 UJ
Arsenic	0.07	0.39	5.8	5.5	5.5	5.2	4.9	5.6	4.6	5.9	4.7	6.4	< 3.8	6.3	4.7	5.9	6.4	< 4.0	4.4
Barium	5,200	15,000	230 J	210 J	230	190 J	210	220 J	160 J	200 J	120 J	260 J	110 J	240 J	170 J	220 J	240 J	110 J	170 J
Beryllium	160	160	< 0.42	< 0.4	< 0.41	< 0.41	< 0.4	< 0.4	< 0.4	< 0.41	< 0.41	< 0.41	< 0.38	< 0.4	< 0.4	0.79	1.0	< 0.4	< 0.41
Cadmium	1.7	70	< 0.52	< 0.51	< 0.52	< 0.52	< 0.5	< 0.5	< 0.51	< 0.52	< 0.51	< 0.52	< 0.48	< 0.5	< 0.5	< 0.53	< 0.5	< 0.51	< 0.51
Chromium	100,000	120,000	84 J	86 J	82	210 J	71	76 J	71 J	88 J	160 J	94 J	49 J	90 J	83 J	100 J	100 J	52 J	64 J
Cobalt	660	23	19	19	20	15	17	17	14	19	27	31	12	20	15	19	18	17	14
Copper	3,000	3,100	40	36	37	32	34	33	28	41	20	40	21	38	28	34	35	20	30
Lead	80	400	9.5	8.9	8.4	11	7.5	12	8.0	9.7	5.4	9.3	4.9	9.5	7.0	10	10	5.0	10
Molybdenum	380	390	< 2.1	< 2.0	< 2.1	30	< 2.0	< 2.0	< 2.0	< 2.1	< 2.0	< 2.1	< 1.9	< 2.0	< 2.0	< 2.1	< 2	2.5 UJ	< 2.0 UJ
Nickel	1,600	1,500	160	170	160	140	140	140	150	170	360	350	140	200	170	180	190	160	120
Selenium	380	390	< 4.2	< 4.0	< 4.1	< 4.1	< 4.0	< 4.0	< 4.0	< 4.1	< 4.1	< 4.1	< 3.8	< 4.0	< 4.0	< 4.2	< 4	< 4	< 4.1
Silver	380	390	< 1.0	< 1.0	< 1.0	< 1.0	< 0.99	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.96	< 1.0	< 0.99	< 1.1	< 0.99	< 1.0	< 1.0
Thallium	5	NV	< 2.1	< 2.0	< 2.1	< 2.1	< 2.0	< 2.0	< 2.0	< 2.1	< 2.0	< 2.1	< 1.9	< 2.0	< 2.0	< 2.1	< 2	< 2	< 2.0
Vanadium	530	390	37	34	36	31	31	34	28	36	22	35	20	36	28	37	33	19	27
Zinc	23,000	23,000	53	53	54	44	48	58	47	57	42	54	35	56	51	53	53	34	47
Mercury	18	5.6	0.041	0.087	0.035	0.028	0.043	0.054	0.066	0.079	0.034	0.06	0.047	0.048	0.058	0.052	0.056	0.098 J	0.037 J

Notes:

- C3-60 is a field duplicate of C3-5.
- C6-60 is a field duplicate of C6-5.
- C9-60 is a field duplicate of C9-2.
- C13-60 is a field duplicate of C13-5.
- C14-60 is a field duplicate of C14-5.
- C2-60 is a field duplicate of C2-2.
- CHHSL = California Human Health Screening Level from the Office of Environmental Health Hazard Assessment (OEHHA).
- RSL = Regional Screening Level from the U.S. Environmental Protection Agency (U.S. EPA).
- mg/kg = milligrams per kilogram (parts per million).
- NV = No RSL, CHHSL available for this compound.
- Bold concentrations indicate that the analyte was detected above the laboratory reporting limit.
- Less than sign (<) indicates that the analyte was not detected above the laboratory reporting limit.
- Shaded concentrations indicate that the concentration exceeds the CHSSL or RSL.
- J = estimated concentration.
- UJ = estimated reporting limit.

Table 4
Soil Analytical Results - PAHs (µg/kg)
Chestnut Street, Livermore, CA

Chemical of Concern	RSL Residential (µg/kg)	CHHSL Residential (µg/kg)	C9-2	C9-60	C10-2	C10-60	C11-2	C12-2	C13-2	C14-2
Acenaphthene	3.40E+06	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Acenaphthylene	NV	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Anthracene	1.70E+07	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Benzo[a]anthracene	150	NV	< 5	< 4.9	< 4.9	16 J	< 5	< 4.9	< 5	< 5
Benzo[a]pyrene	15	38	< 5	< 4.9	< 4.9	21 J	< 5	< 4.9	< 5	< 5
Benzo[b]fluoranthene	150	NV	< 5	< 4.9	< 4.9	31 J	< 5	< 4.9	< 5	< 5
Benzo[g,h,i]perylene	NV	NV	< 5	< 4.9	< 4.9	13	< 5	< 4.9	< 5	< 5
Benzo[k]fluoranthene	1500	NV	< 5	< 4.9	< 4.9	14	< 5	< 4.9	< 5	< 5
Chrysene	15000	NV	< 5	< 4.9	< 4.9	22 J	< 5	< 4.9	< 5	< 5
Dibenz(a,h)anthracene	15	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Fluoranthene	2.30E+06	NV	< 5	< 4.9	< 4.9	20 J	< 5	< 4.9	< 5	< 5
Fluorene	2.30E+06	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Indeno[1,2,3-cd]pyrene	150	NV	< 5	< 4.9	< 4.9	10	< 5	< 4.9	< 5	< 5
Naphthalene	3600	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Phenanthrene	NV	NV	< 5	< 4.9	< 4.9	< 9.9	< 5	< 4.9	< 5	< 5
Pyrene	1.70E+06	NV	< 5	< 4.9	< 4.9	31 J	< 5	< 4.9	< 5	< 5

Notes:

C6-60 is a field duplicate of C6-5.

C9-60 is a field duplicate of C9-2.

C10-60 is a field duplicate of C10-2 for PAHs only.

C13-60 is a field duplicate of C13-5.

C14-60 is a field duplicate of C14-5.

C2-60 is a field duplicate of C2-2.

CHHSL = California Human Health Screening Level from the Office of Environmental

Health Hazard Assessment (OEHHHA).

RSL = Regional Screening Level from the U.S. Environmental Protection Agency (U.S. EPA).

mg/kg = milligrams per kilogram (parts per million).

NV = No RSL, CHHSL, ESL available for this compound.

Bold concentrations indicate that the analyte was detected above the laboratory reporting limit.

Less than sign (<) indicates that the analyte was not detected above the laboratory reporting limit.

Shaded concentrations indicate that the concentration exceeds the CHHSL or RSL.

J = estimated concentration.

Table 4
 Soil Analytical Results - PAHs (µg/kg)
 Chestnut Street, Livermore, CA

Chemical of Concern	RSL Residential (µg/kg)	CHHSL Residential (µg/kg)	C1-2	C1-5	C2-2	C2-5	C2-60	C3-2	C3-5	C3-60	C4-2	C4-5	C5-2	C5-5	C6-2	C7-2	C8-2
Acenaphthene	3.40E+06	NV	< 9.9	< 25	< 5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Acenaphthylene	NV	NV	< 9.9	< 25	< 5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Anthracene	1.70E+07	NV	< 9.9	< 25	< 5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Benzo[a]anthracene	150	NV	< 9.9	< 25	8.7	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Benzo[a]pyrene	15	38	< 9.9	< 25	11	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Benzo[b]fluoranthene	150	NV	< 9.9	< 25	14	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Benzo[g,h,i]perylene	NV	NV	< 9.9	< 25	9	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Benzo[k]fluoranthene	1500	NV	< 9.9	< 25	9.5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Chrysene	15000	NV	< 9.9	< 25	11	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Dibenz(a,h)anthracene	15	NV	< 9.9	< 25	< 5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Fluoranthene	2.30E+06	NV	< 9.9	< 25	11	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Fluorene	2.30E+06	NV	< 9.9	< 25	< 5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Indeno[1,2,3-cd]pyrene	150	NV	< 9.9	< 25	6.1	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Naphthalene	3600	NV	< 9.9	< 25	< 5	< 5	< 10	36	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Phenanthrene	NV	NV	< 9.9	< 25	< 5	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5
Pyrene	1.70E+06	NV	< 9.9	< 25	16	< 5	< 10	< 9.9	< 25	< 5	< 5	< 25	< 5	< 10	< 50	< 25	< 5

Table 5
Soil Analytical Data - Pesticides (µg/kg)
Chestnut Street, Livermore, CA

Chemical of Concern	CHHSL Residential (µg/kg)	Residential RSL (µg/kg)	C6-2	C7-2	C7-60	C8-2	C9-2	C9-60	C10-2	C11-2	C12-2	C13-2	C14-2
4,4'-DDD	2300	2000	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
4,4'-DDE	1600	1400	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
4,4'-DDT	1600	1700	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Aldrin	33	29	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
alpha-BHC	NV	77	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
alpha-Chlordane	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
beta-BHC	NV	270	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Chlordane (technical)	430	1600	< 40	< 40	< 40	< 39	< 40	< 40	< 39	< 40	< 39	< 40	< 40
delta-BHC	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Dieldrin	35	30	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Endosulfan I	NV	370000	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Endosulfan II	NV	370000	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Endosulfan sulfate	NV	370000	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Endrin	21000	18000	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Endrin aldehyde	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Endrin ketone	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
gamma-BHC (Lindane)	500	520	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
gamma-Chlordane	NV	NV	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Heptachlor	130	110	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Heptachlor epoxide	NV	53	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Methoxychlor	340000	310000	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Toxaphene	460	440	< 40	< 40	< 40	< 39	< 40	< 40	< 39	< 40	< 39	< 40	< 40

Notes:

C7-60 is a field duplicate of C7-2 for pesticides only.

C9-60 is a field duplicate of C9-2.

CHHSL = California Human Health Screening Level from the Office of Environmental Health Hazard Assessment (OEHHA).

RSL = Regional Screening Level from the U.S. Environmental Protection Agency (U.S. EPA).
mg/kg = milligrams per kilogram (parts per million).

NV = No RSL, CHHSL, ESL available for this compound.

Less than sign (<) indicates that the analyte was not detected above the laboratory reporting limit.

Table 6
Field Parameters and Groundwater Depth
Chestnut Street, Livermore, CA

Boring	Depth to Water Initial (ft)	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	pH	ORP (mV)
C-1	48.0	19.26	1.017	7.43	7.61	80.5
C-2	49.0	18.39	0.912	7.81	7.65	16.5
C-9	43.0	19.22	0.978	6.48	7.70	23.8
C-12	45.0	19.50	1.028	6.90	7.31	66.6
C-14	46.0	18.21	1.045	8.56	7.14	179.5

Notes:

ft = feet

°C = degrees Celcius

mS/cm = miliSiemens per centimeter

DO = Dissolved Oxygen

mg/L = miligrams per liter

ORP = Oxidation Reduction Potential

Table 9
Groundwater Analytical Results - VOCs (µg/L)
Chestnut Street, Livermore, CA

Chemical of Concern	CDHS MCLs (µg/L)	C1GW	C2GW	C9GW	C12GW	C14GW	C20GW
1,1,1,2-Tetrachloroethane	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,1-Trichloroethane	200	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	1,200	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethane	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethene	6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloropropene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2,3-Trichlorobenzene	NV	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2,4-Trichlorobenzene	5	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromo-3-Chloropropane	0.2	< 1	< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	600	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,3,5-Trimethylbenzene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichloropropane	NV	< 1	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2,2-Dichloropropane	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Butanone (MEK)	NV	< 50	< 50	< 50	< 50	< 50	< 50
2-Chlorotoluene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Hexanone	NV	< 50	< 50	< 50	< 50	< 50	< 50
4-Chlorotoluene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
4-Isopropyltoluene	NV	< 1	< 1	< 1	< 1	< 1	< 1
4-Methyl-2-pentanone (MIBK)	NV	< 50	< 50	< 50	< 50	< 50	< 50
Acetone	NV	< 50	< 50	< 50	< 50	< 50	< 50 UJ
Benzene	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromobenzene	NV	< 1	< 1	< 1	< 1	< 1	< 1
Bromoform	NV	< 1	< 1	< 1	< 1	< 1	< 1
Bromomethane	NV	< 1	< 1	< 1	< 1	< 1	< 1
Carbon disulfide	NV	< 5	< 5	< 5	< 5	< 5	< 5
Carbon tetrachloride	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chlorobenzene	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chlorobromomethane	NV	< 1	< 1	< 1	< 1	< 1	< 1
Chlorodibromomethane	NV	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chloroethane	NV	< 1	< 1	< 1	< 1	< 1	< 1

Table 10
 Soil Gas Analytical Results (µg/L)
 Chestnut Street, Livermore, CA

Chemical of Concern	CHHSL Residential (µg/L)	C1-SG	C2-SG	C3-SG	C4-SG	C5-SG	C6-SG*
m,p-Xylenes	320	0.019	<.004	<.0038	0.014	0.15	<.0038
o-Xylene	320	0.0052	<.004	<.0038	<.0041	0.03	<.0038
Styrene	NV	<.0038	<.0039	<.0037	<.0040	<.0039	<.0037
Bromoform	NV	0.01	0.0098	<.0089	0.027	0.022	<.0089
1,1,2,2-Tetrachloroethane	NV	<.0061	<.0063	<.0059	<.0065	<.0062	<.0059
4-Ethyltoluene	NV	<.0044	<.0045	<.0043	<.0046	<.0044	<.0043
1,3,5-Trimethylbenzene	NV	<.0044	<.0045	<.0043	<.0046	<.0044	<.0043
1,2,4-Trimethylbenzene	NV	<.0044	<.0045	<.0043	<.0046	<.0044	<.0043
1,3-Dichlorobenzene	NV	<.0053	<.0055	<.0052	<.0057	<.0054	<.0052
1,4-Dichlorobenzene	NV	<.0053	<.0055	<.0052	<.0057	<.0054	<.0052
Benzyl chloride	NV	<.0046	<.0047	<.0045	<.0049	<.0047	<.0045
1,2-Dichlorobenzene	NV	<.0053	<.0055	<.0052	<.0057	<.0054	<.0052
1,2,4-Trichlorobenzene	NV	<.0066	<.0068	<.0064	<.007	<.0067	<.0064
Hexachlorobutadiene	NV	<.0094	<.0098	<.0092	<.01	<.0097	<.0092
Helium (ppmv)	-	<1,800	<1,800	<1,700	<1,900	<1,800	<13,000

Notes:

*C6-SG = Field duplicate of C3-SG.

µg/L = micrograms/liter.

CHHSL = California Human Health Screening Level from the Office of Environmental Health Hazard Assessment (OEHHA).

NV = No CHHSL available for this compound.

Bold concentrations indicate that the analyte was detected above the laboratory reporting limit.

ND = the analyte was not detected above the laboratory reporting limit.

Shaded concentrations indicate that the concentration exceeds the CHSSL or ESL.