REPORT

PRELIMINARY ENDANGERMENT ASSESSMENT
West Weber Site
West Weber Avenue, Stockton, CA

November 20, 2008

GPE Project No. 536.2

Submitted to:

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November 20, 2008

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RE: REPORT – PRELIMINARY ENDANGERMENT ASSESSMENT
West Weber Redevelopment Area, W. Weber Avenue, Stockton

Mr. Lile:

The attached report is submitted on behalf of CRV Enterprises and Stockton Cold Storage, the owner of the subject site, an industrial use area adjacent to the turning basin of the Stockton Deepwater Ship Channel. The purpose of this PEA is to assess the risk to human health and ecological receptors, and the potential threat to groundwater from a release of pesticides.

Sincerely,

Geo-Phase Environmental Inc.
Stephen M. Lankford, PG, REA

cc: Ava Kenny, City of Stockton
Ryan Voorhees, CRV Enterprises
Mike McNulty, Stockton Cold Storage

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GEO-PHASE ENVIRONMENTAL

REPORT
PRELIMINARY ENDANGERMENT ASSESSMENT

West Weber Redevelopment Are
West Weber Avenue, Stockton

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GPE Project No. 536.2

EXECUTIVE SUMMARY

Purpose
The site has been in industrial use for about 100 years. It has been designated by the City of Stockton as a redevelopment area. Plans call for redeveloping the site to a mixture of commercial and residential uses. Over the years, a number of environmental concerns and potential impairments have been identified that could adversely affect the health of future occupants and residents. Prior to the anticipated redevelopment, additional environmental testing and evaluation was completed to more fully assess the potential health impacts to the public.

Site Use and Setting
The site consists of several parcels situated on the peninsula formed between the Stockton Deep Water Ship Channel and Old Mormon Slough (see Figure 1). Much of the site is currently vacant but there is a cold storage facility, a truck towing business, and a fruit packing operation on the site. Past uses have consisted primarily of food packing and warehousing, and as a bulk fuel distribution facility. Rail spurs have been used to provide heavy transportation access to the businesses. Past Phase I ESA investigations (Raney, 2005 & BSK, 1999) have identified several areas of environmental concern that warranted additional investigation and a health risk assessment (HRA).

Scope of Work
The tasks accomplished during completion of this PEA included collecting shallow soil samples from approximately 150 sample points, installing 14 soil borings to groundwater, and conducting soil vapor surveys at three “closed” leaking UST sites. The resultant samples were subjected to laboratory analysis to test for the possible presence of a variety of heavy metals, organo-chlorine pesticides, and volatile and semi-volatile organic compounds.

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Sample Analytical Results

The analytical testing indicates the soil in the vicinity of the former rail spurs (Figures 4A & B) has been impacted with elevated concentrations of certain heavy metals, particularly, arsenic, lead, and chromium. In addition some samples contain detectable semi-volatile organic compounds, and diesel or oil-range total petroleum hydrocarbons (TPH). A grid of shallow sample points on ½-acre spacing (Figure 3) also yields some samples containing these materials.

Deeper soil in the areas of a former bulk fuel storage terminal and the building at 1404 W. Weber (Figure 5) have been impacted with low concentrations of diesel-range hydrocarbons and associated semi-volatile organic compounds (S-VOCs). The groundwater at these sites, lies about 10 feet below grade, but did not contain detectable concentrations of contaminants.

Soil vapor survey results at the three sites of closed, leaking underground gasoline tanks (Figure 6) indicated that low levels of volatile organic compound remain in the interstices of the soil.

Low concentrations of arsenic and other metals were found in the groundwater samples, and a few of these are in excess of established Maximum Contaminant Levels (MCLs). These samples are primarily from the area of the former bulk petroleum terminal. The background level of metals in groundwater remains unknown, however, and it is therefore not possible to determine definitively whether these metals are actually contaminants, or naturally occurring minerals.

Human Health Hazard Assessment

Upon completion of the field and laboratory work, DTSC-approved software, known as CalTOX, was employed to help evaluate the risk posed to human health by the chemicals detected in the soil. Traditionally, the risk associated with non-specific total petroleum hydrocarbons (TPH) has not been quantified because these are very broad and variable mixtures of chemicals. On an interim basis, however, DTSC has approved the use a conceptual method approved by the State of Massachusetts to evaluate such risk on a semi-quantitative basis, and the method was used in this assessment. Another program available at DTSC and known as HERD Soil Gas Screen, was used to evaluate human heath risk posed by volatile chemicals in the shallow soil gas at the three former leaking UST sites. This program uses the Johnson-Ettinger model of vapor intrusion. A U.S. EPA computer program known as ProUCL was used to statistically analyze the distribution of laboratory data for each sample group, and derive a mean concentration for each detected chemical to a 95 percent upper confidence limit (UCL). In the case of sample groups with too few samples to represent a statistically significant sample population, the highest detected concentration was used as the default exposure point concentration. Based, in large part, on the ProUCL statistical analysis, the certain metals, principally arsenic and lead were identified as Chemicals of Potential Concern (COPCs) in the soil. Petroleum hydrocarbons were also identified as a COPC. Soil from deeper borings in the vicinity of the building at 1404 W.

Weber and the former petroleum bulk terminal contained elevated concentrations of certain volatile and semi-volatile organic chemicals, which were also identified as COPCs.

Fourteen groundwater samples were collected at points of particular concern, but no evidence was found to suggest the groundwater represents a human health concern except for several metals above Maximum Contaminant Levels (MCLs) and trace concentrations of volatile organic compounds in the area of the former bulk petroleum facility. Since the shallow groundwater is generally considered non-potable, and is not used as a sources of drinking water, there is no possibility that resident will ingest the water. In any case, the background concentration of metals in groundwater remains unknown, and it may be that the metals above MCL are entirely naturally occurring.

Soil vapor samples were collected within the footprints of three closed leaking underground tank sites. Analysis of volatile organic chemicals from soil gas samples indicated the presence of several volatile Chemicals of Potential Concern (COPCs) at each of the three former tank sites.

The computerized health risk model known as CalTOX was used to assess the human health risk of the COPCs resident in the soil. In the CalTOX model, it was assumed that a hypothetical future resident would live on the site for 70 years and be available for exposure to the COPCs. The CalTOX software contains a library of characteristics and toxicity information on various chemicals, but not all the COPCs were included in the CalTOX library of chemicals. In most of these cases, surrogates were used with similar toxicity characteristic to estimate the potential human health risk.

In general, the exposure pathways most likely to affect humans are through ingestion of shallow (root zone) soil or inhalation of chemically impacted dust or vapor. Dermal contact is also a possible exposure pathway, but less likely to have an adverse human health impact. As a part of this assessment, the CalTOX model took into consideration the plant uptake of the various chemicals.

Total Petroleum Hydrocarbons (TPH) is present in several sample groups, but as mentioned above, using methods adopted by the State of Massachusetts and provisionally accepted by DTSC, the health risk attributable to TPH was estimated and included in the shallow soil risk assessment.

The following table represents the total of increased cancer risk and the non-cancer chemical risk indices due to impacted soil as estimated by the CalTOX program and supplemented by the TPH risk calculations:

Chemical	Increased Cancer Risk	Hazard Index (non-Cancer)
½ Acre Sample Grid w/o Select Spls	2.7E-6	1.4E+1
Rail Spurs w/ Select Grid Spls	1.3E-3	2.3E+1
Soil Spreading Area	3.1E-5	1.3E+2
SCS Shop Area	1.3E-7	5.5E-1
Waste Oil Area	1.8E-4	2.0E+0
1404 W. Weber	8.9E-3	2.6E-1
Bulk Terminal	<1.0E-10	1.4E-2
SCS - Building 1	4.2E-8	3.4E-2

The soil gas information from 3 former leaking underground tank sites was evaluated with the computerized health risk model known as HERD Soil Gas Screen, useing the Johnson-Ettinger model of vapor infiltration. The model considers toxicity effects of various chemicals to evaluate potential health effects of vapor intrusion for each volatile chemical. It was assumed that a receptor would be a hypothetical future resident, and be available for exposure to the COPCs by inhalation of vapors intruding indoor spaces. The software contains a library of characteristics and toxicity information on various chemicals identified as COPCs. The following table represents the increased cancer risk and the non-cancer chemical risk estimated by the HERD Soil Gas Screen program:

Chemical	Increased Cancer Risk	Hazard Index (non-Cancer)
Tank Site 1	None	1.3E-1 (= 0.13)
Tank Site 2	9.1E-7	5.2E-2 (= 0.52)
Tank Site 4	None	2.8E-2 (= 0.28)

General Observations

The hazard index in the above tables is a measure of the non-carcinogenic health hazard associated with COPCs at the site. Any value over 1 indicates an elevated risk to human health. Increased cancer risks of less than one in one million (i.e. 1.0E-6) and hazard indices of less than 1 are considered so low as not to require additional evaluation.

In this case, the health risk from inhalation of indoor vapors associated with former leaking underground tank sites is negligible. With regard to the shallow soils, several individual samples contained exceptionally high contaminant concentrations, which significantly elevated the health risk estimate for the entire sample group. In general, however, nearly all of the non-cancer health risk is from arsenic, which is widely distributed in the shallow soil.

Based on the information developed for this PEA, the following conclusions are drawn:

1. The soil-related, elevated hazard indices and cancer risks are attributed mostly to arsenic with an additional contribution from lead. These metals are associated with the former rail spurs. It is suspected that past spraying of lead-arsenate solution along the tracks may have been used as a weed control measure. This was a common railroad practice in past years.

2. The regular ½-acre grid and the random soil sample results indicate that there are scattered points of elevated arsenic, lead or oil contamination, but much of this is also attributed to the rail spurs.

3. The areas near 1404 W. Weber and the former bulk fuel terminal have been impacted with low levels of diesel fuel and associated S-VOCs, but these do not appear to pose a significantly elevated health hazard save for isolated soil samples. Mitigation in specific limited areas will be appropriate, however. The groundwater does not appear to have been significantly impacted by these releases.

4. The former closed underground fuel tank sites were investigated, and residual volatile organic compounds and gasoline hydrocarbons are resident in the shallow soil. Tank Site 1 holds the greatest concentrations of these vapors. Based on the results of Johnson-Ettinger vapor intrusion modeling, however, the sites do not appear likely to pose a significantly elevated health risk.

5. Other areas on the site, including areas associated with former chromium-treated brine coolant system on the Stockton Cold Storage facility, and the shop area of that facility do not appear to have impacted the site with significantly increased health risks. While some elevated concentrations of chromium are present, limited speciation information indicates that most of the chromium is trivalent rather than the much more toxic hexavalent variety. The chromium levels in the soil at this location do not pose a significant human health risk.

6. The arsenic in the shallow soil will require mitigation, most likely in the form of excavation and removal. Prior to beginning this, additional site characterization will be needed to develop a vertical profile of contaminant distribution. This would take the form of establishing three or more rows of borings that transect a spur (preferably where the tracks are still in place), and collecting soil samples at various distances from the tracks and depths below the surface. Analytical testing for arsenic, lead, and other chemicals will provide valuable information regarding the volume of soil that may need to be removed.

7. Organic soil contamination associated with the former bulk fuel terminal lies as close as 4 feet from the ground surface. The shallow contamination at the site should be removed and the potential risk from vapor intrusion to future buildings should be evaluated further by completing a supplemental soil vapor survey.

1.0 INTRODUCTION

As defined by California Health and Safety Code, Division 20, Section 25319.5, a Preliminary Endangerment Assessment (PEA) is "*an activity which is performed to determine whether current or past waste management practices have resulted in the release of hazardous substances which pose a threat to public health or the environment*".

1.1 Purpose and Scope of Work

The Purpose of this PEA was to assess whether the former and current industrial uses of the subject site may have resulted in a release of organo-chlorine pesticides, volatile or semi-volatile organic compounds, contaminant heavy metals, or petroleum hydrocarbons that impacted the soil or groundwater and thereby pose a human health hazard and an ecological hazard. To accomplish this goal, the following tasks were completed:

1. Identified potential exposure pathways,
2. Collected a series of shallow soil samples and tested them for the presence of a variety of metals, organic compounds, petroleum hydrocarbons, and pesticides,
3. Collected and tested several soil samples for the possible presence of extractable hydrocarbons and volatile organic compounds,
4. Collected fourteen groundwater samples and tested them for the presence of petroleum, organic compounds, and heavy metals,
5. Conducted a screening-level assessment of soil toxicity and resultant human health risk,
6. Evaluated possible ecological impacts to the flora and fauna, and
7. Provided a series of recommendations based on the findings of this PEA.

1.2 Report Organization

Sections 2 and 3 summarize what is known of the history and past use of the site, as well as the present site status. A general description of the site location and setting is also provided. Section 4 provides general information regarding the geological and hydrologic setting, and the possible pathways in which receptors (people) could be exposed to the contaminants. The actual sampling and laboratory analytical results are documented in Section 5, and Section 6 evaluates the quality of the information so obtained, and provides a general chemical characterization of chemicals found in the samples, and Section 7 addresses some loose ends. Section 8 describes the methods used to evaluate the laboratory results and estimate the potential risk to human health resulting from the soil contamination. Section 9 supplements the preceding section with a description of the possible impact to sensitive biota (plants and animals). Section 10 provides information on the nearby community and lists nearby residents and businesses and identifies pertinent elected officials and regulatory agencies. The conclusions and recommendations are detailed in Section 11. Figures with graphical information are also provided, and appendices containing laboratory data sheets and other basic information support the text.

2.0 SITE DESCRIPTION

The following sub-sections provide a detailed description of the location, setting, and current and past uses of the site and adjacent parcels.

2.1 Site Identification

The following table summarizes the current parcels (see Figure 2 for Parcel Map) that are included in the site as well as adjacent parcels that may ultimately be included in the W. Weber redevelopment site.

Text Table 2.1 – Parcel Identification

Parcel APN	Area (Acres)	Address(s)	Owner	Current Occupant
Included Parcels				
145-190-16	10.57	1315, 1317, 1325, 1330, 1541 W. Weber	CRV Enterprises	Fresha Properties
145-190-08	9.54	1404 W. Weber	CRV Enterprises	SOS Towing & ACC
145-190-17	2.49	1331 W. Weber	CRV Enterprises	Vacant
145-190-15	5.00	None Known	Stockton Cold Storage	Undeveloped
145-190-13	5.64	1320 W. Weber	Stockton Cold Storage	Stockton Cold Storage
145-190-14	4.04	1320 W. Weber	Stockton Cold Storage	Stockton Cold Storage
Adjacent Parcels				
145-190-10	± 1.60	None Known	McCormick & Baxter	Undeveloped
145-190-11	± 2.10	None Known	McCormick & Baxter	Undeveloped
145-190-02*	3.17	1245 W. Weber	Greg Culhane	Sel-Mor Products
145-190-12	± 1.45	N/A	UPRR	RR ROW
N/A	± 2.75	N/A	City of Stockton	W. Weber Street ROW

* This Parcel is not part of the VCA, but may be added in the future

The City of Stockton has expressed a willingness to contribute the Weber Street right-of-way to the redevelopment project. The two McCormick and Baxter parcels, are a part of a Superfund investigation may ultimately be included in the redevelopment project. The owner of the Culhane property has declined an invitation to join the redevelopment project group at this time, but it may become part of it at some later date.

2.2 Site Location & Setting

San Joaquin County has a Mediterranean climate with arid summers and mild winters. It has average annual rainfall of about 12 to 14 inches, most of which falls between November and March.

This part of Stockton is adjacent to the south shore of the Stockton Deepwater Ship Channel. The area has traditionally been in industrial use and this use continues to this time, although much of the area is currently vacant. Businesses currently on the site include a frozen food storage facility, a truck towing service, a bulk materials (gravel etc.) storage area, and a fruit

plant packing company. Stockton has, however, designated the area for redevelopment for use as a mixed commercial and medium density residential area. (See Figures 1 & 2 for the site location and graphical details.)

Hydrogeology

As shown on the USGS topographic map (Figure 1), the area is a nearly flat lying peninsula, which is part of the San Joaquin River system. It has little topographic variation, and was partially created by material from dredging, and from imported fill material. According to a the San Joaquin County Groundwater Report (Hirata, 1999), it appears that first groundwater lies approximately 6 to 10 feet below ground surface and flows in a southerly direction. Groundwater monitoring data from the adjacent McCormick and Baxter site confirms this.

Soils & Geology

Based on Page, 1986, the geologic features of this portion of San Joaquin County are typical of California's Central Valley, a large northwest/southeast trending asymmetric trough bounded by mostly pre-Tertiary metamorphic, sedimentary and granitic rocks. Depth to basement rock in the Valley ranges up to at least 6 vertical miles in the southern portions of the Central Valley (the "San Joaquin" Valley), and to up to 10 miles in sediment thickness in the northern expanse of the valley (the "Sacramento" Valley). In most of San Joaquin County, with the exception of its eastern and western margins which are dominated by the foothills of the Sierra Nevada and Coast Ranges, respectively, recently (Cenozoic) deposited terrestrial, lacustrine, and marine sediments overlie older (pre-Tertiary in age) consolidated marine sediments. These older sedimentary units in turn overlie Mesozoic crystalline basement rocks.

The formation of soils in San Joaquin County is dependent on the sedimentary transport path from the primary sediment sources. These sediment sources are the Coastal Range to the west and the Sierra Nevada to the east of the County. Generally, the longer the transport path the greater the working of the sediments prior to deposition as soils. Along the San Joaquin River and in the delta regions west of Stockton, the low energy river and flood plain environments deposit layers of silt and clays during seasonal floods. These fine-grained sediments flocculate out of slack water as floodwaters recede. The erosion of the Coast Range forms portions of far western San Joaquin County soils and transport of these sediments is facilitated through seasonal run-off of the minor streams of the Coast Range. These soils are formed in environments similar to those of eastern San Joaquin county, i.e., alluvial fans, but tend to be less well worked in comparison to their Sierran derived counterparts due to the shorter transport path.

The USDA Soils Conservation Service *Soil Survey of San Joaquin County, California*, October 1992 soil survey report classifies soil in San Joaquin County. The *Survey* generally classifies the soils in this area of Stockton as part of the Jacktone-Hollenbeck-Stockton association; a nearly level soil in basins or basin rims. Somewhat poorly drained to moderately well drained fine textured soils, moderately deep to deep to a cemented hardpan. The specific on site soil types consists of Urban Land Complex soil. This highly disturbed soil is not classafiable due to human activities. The on-site soil is, however, believed to

consist of a mixture of imported fill and Jacktone Clay poorly drained, moderately deep to hardpan and exhibits slow permeability. Information from soil borings at the adjacent McCormick and Baxter site is believed to be generally applicable to soils found on the site. Below about 10 feet, that native clays and silts give way to laterally discontinuous fluvial sand layers interbedded with the finer material. At about 240 feet there is a course, sand and gravel layer. This is the boundary between the "shallow" and "deep" zones.

Field experience indicates that there is essentially no area on the peninsula that remains undisturbed, and significant portions of it appear to consist, at least partially, of fill material. Evidence of former buildings is abundant in the form of scattered small pieces of construction debris, especially concrete and brick fragments.

According to Munger (2002), and Cal-DOGR (1982), the West Weber site does not lie in, or near, any petroleum production fields. No oil or gas production wells have ever been drilled on the site.

2.3 Site Background

The site is currently in low intensity industrial use, and only four businesses currently using the site. The largest is Stockton Cold Storage, a facility that warehouses frozen foods. In addition, there are three tenants on the CRV property. Fresha Properties operates a business at 1541 W. Weber. This business is engaged in packing strawberry plants for commercial use. The building at 1404 W. Weber is occupied by SOS Towing, which is engaged in truck towing and repairing. American Civil Constructors (ACC) does not occupy buildings on the site, but they use a part of the land near the intersection of Old Mormon Slough and the main ship channel to a storage yard for bulk rock materials needed to maintain earthen levees. Much of the West Weber site is currently vacant and unused. Since the early 20th Century, the site has been in industrial use for a wide variety of businesses. The primary uses have been for warehousing and as a bulk fuel terminal. For a more complete listing of past occupants, see Geo-Phase Environmental, 2007.

The past uses of the site have entailed the use and storage of hazardous materials. The past business activities have included four underground storage tank sites and a bulk fuel storage facility with large, aboveground tanks. Rail spurs were used to serve large warehousing operations. The West Weber site was the subject of two Phase I Environmental Site Assessments (ESAs) completed in the past few years, (Raney, 2005 & BSK, 1995). Reportedly, the Culhane property, which is a part of the redevopment area, has been the subject of several investigations, but Mr. Culhane did not make the applicable reports available, and he has declined to participate in this current assessment.

Past environmental investigations have included remedial investigations of three leaking underground gasoline tanks, a remedial investigation of a chromium release at the Stockton Cold Storage facility, and soil borings associated with various assessments. Residual, low level contaminants have been known to exist in the area of the three remedial tank investigations as well as the former bulk fuel facility and a former waste oil drum storage area.

2.4 Site Status

In the past, a total of four underground storage tank (UST) locations were investigated and three of them were targets of remedial investigations, but after mitigation, all four were eventually officially closed by the San Joaquin County Environmental Health Department with California Regional Water Quality Control Board (RWQCB) concurrence. A chromium release at the Stockton Cold Storage facility was investigated under the supervision of the RWQCB. The release was deemed adequately mitigated and the investigation was officially closed by the agency. Based on a review of an electronic State and Federal environmental databases, the site is not, and has not been, subject to official attention regarding on-site environmental conditions excluding the tank closures and the chromium release.

The site is not currently the target of any official environmental investigations save for this current VCP investigation.

3.0 APPARENT PROBLEM

Prior to this PEA, a number of environmental investigations identified several areas of environmental concern regarding the W. Weber peninsula. In several cases, follow-up site investigations and remedial action resulted. These investigations have been previously summarized (Geo-Phase Environmental, 2007). Currently, the site is not the target of attention by any official environmental regulatory agency, except as regards this current investigation.

Based on the results of this PEA, the area of most environmental concern is the heavy metals contamination along former rail spurs, presumably from past application of lead arsenate as a weed control measure. Additional scattered and localized areas also have heavy metals contamination.

Other areas of potential concern are two areas of low-level diesel or oil contamination, and three former leaking UST sites that have been investigated and closed.

The Site Conceptual Model Diagram (Figure 8) provides a summary of the potential contaminant pathways and receptors.

4.0 ENVIRONMENTAL SETTING

4.1 Factors Related to Soil Pathways

The site is in a partially vacant industrial use area. The nearest offsite, developed industrial site is the former McCormick and Baxter facility on the south side of Old Mormon Slough. To the west are the facilities of the Port of Stockton. North of the Ship Channel are various commercial and industrial enterprises. East of the I-5 right-of-way and the modern Mormon Slough are vacant parcels and multifamily residences. Part of the area is now the focus of a redevelopment project. The nearest residences are the multi-family units east of I-5, about 1,000 feet from the subject site.

The site's only access to vehicles is from Weber Avenue. For the most part, the site is guarded by cyclone fence with gated access points. The peninsula is also accessible by boat, but there is no boat service, and as a practical matter, there is limited small boat traffic in this part of the river due to the operation of the adjacent Port of Stockton facility.

The site is situated at near the buried geological ridge that separates the Sacramento and San Joaquin Valleys. Approximately 10,000 feet of sediment are present at this point, and the upper 6,000 feet are Quaternary and Cenezoic alluvium. The Quaternary Victor Formation (also called the Modesto Formation) forms much of the flood deposits that are present under Stockton. These deposits are composed of a heterogeneous mixture of sand, silt and clay with little lateral continuity. Fan deposits of the Calaveras River and San Joaquin Rivers are virtually indistinguishable from the Victor Formation. Soil information from the adjacent McCormick and Baxter site suggest the subsurface material to 240 feet is gray-green micaceous clayey silt with calcitic nodules and gray-green sand, silty sand. Sand and silty sand layers are laterally discontinuous, generally a few feet thick and do not exceed 30 feet.

4.2 Factors Related to Surface Water Pathways

There is no surface water on the subject site, however, as described above, surface water in the form of the Stockton Deep Water Ship Channel and Old Mormon Slough surround the peninsula on thee sides. The peninsula is mostly protected by levees, and appears to be internally drained. It does not appear that much storm water runoff makes its way to adjacent waterways except from outward-facing levee slopes.

4.3 Factors Related to Groundwater Pathways

As described above, the groundwater surface lies about 6 to 10 feet below grade and flows in a southerly direction. The saturated zone to a depth of about 230 feet is considered to be the "shallow aquifer". This interval has been interpreted to consist of clay and silt with laterally discontinuous sand lenses deposited in a flood basin environment. Underlying deposits are part of the Laguna Formation. The upper 230 feet of sediment has been subdivided into several zones. The shallowest zone (A-Zone) extends to a depth of about 60 feet below grade. These zones within the shallow aquifer are not hydraulically separate. Zones below 200 feet are more porous and permeable layers, and are considered the "deep aquifer". It is the deeper aquifer that is used as a source of municipal and industrial water. Past studies

have not identified any nearby water production wells completed opposite the shallow aquifer, and no municipal wells are within ¼ mile of the site.

4.4 Factors Related to Air Pathways

The chemicals of potential concern include buried volatile and semi-volatile organic compounds. There is a possibility that vapors migrating up to the ground surface could be inhaled by future residents. For the most part, the surface of the West Weber site is unpaved ground. The prevailing wind direction is from the northwest.

5.0 SAMPLING ACTIVITIES AND ANALYTICAL RESULTS

The sampling strategy and protocols are described in the Sampling Plan for this PEA, entitled. *Final Draft Work Plan, Site Sampling, West Weber Redevelopment Site, Stockton, California*, and dated January 15, 2008. There were a few deviations from the Work Plan (see Section 5.11).

In general, the various sample points were identified in the field by using the City of Stockton GIS grid system to convert the planned sample points identified in the sampling plan to latitude and longitude coordinates. A Garmin 76CSx hand-held GPS device was used in the field to locate the various sampling points. The device is capable of accuracy within about 10 lateral feet. In some cases, field conditions required that actual sample points be moved slightly from the planned position. Such deviations were noted in the field, and are reflected in the map locations attached to this report.

The sample sites were identified according to the strategy set forth in the site sample plan (Geo-Phase Environmental, 2008). At each sample point, soil samples were collected from a depth of 0 to 1 foot, and from 1 to 2 feet.

Except for samples collected under Building 1 of the Stockton Cold Storage facility, the shallow soil samples were collected from February 4 through February 19, 2008 using Geo-Probe soil boring equipment. The Geo-Probe was used to push a 4-foot long soil sampling core directly into the ground. Upon retrieval, the uppermost layer of vegetation, gravel, and other obviously surficial debris was removed and discarded. Then, the 0 to 1 foot sample and the 1 to 2 foot sample were collected by cutting the sample sleeve and the sample material into appropriate lengths. The samples were sealed, with Teflon sheets, capped, labeled, logged, and placed in a cooler chilled to 4 degrees C for transport to the laboratory under chain-of-custody protocol. Chain of custody (CofC) forms are documents used to track the handling of samples. All dates, times, persons and companies handling the samples were listed from the time the sample is collected to its ultimate disposal. Sampling equipment was periodically steam cleaned to help prevent sample cross-contamination.

Upon completion of each day's fieldwork, the accumulated samples, accompanied by the Chain-of-Custody were transported to Argon Laboratories of Ceres, CA, a California Environmental Protection Agency (Cal-EPA) certified laboratory (certification # 2359). Some testing was subcontracted to McCambell Laboratories, also a State certified analytical lab. All samples were tested for by one or more of the following:

- Total Petroleum Hydrocarbons as gasoline by EPA method 8015m,
- Total Extractible Petroleum Hydrocarbons (diesel or oil) by EPA method 8015m,
- Semi-volatile organic compounds by EPA method 8270,
- Volatile organic compounds by EPA method 8260b,
- CAM 17 Metals by EPA Method 6020A
- Organochlorine pesticides by EPA method 8081A

The specific chemicals and their reporting limits are included in the Summary Tables, and the laboratory data sheets are in Appendix K.

The following sub-sections address specific areas of concern targeting for investigation.

5.1 Soil Gas Surveys Related to Former UST Sites

Three of four former underground tank sites were targets of remedial investigations. The forth tank site (# 3) was closed and did not leak to impact the surrounding soil. (See related documents and laboratory reports in Raney, (2002, v. 2). The three sites of past remedial investigations of leaking underground gasoline tanks (Tank Sites 1, 2 & 4) were further investigated by extracting samples of air from the pore spaces of the soil at each former tank site. The purpose of the sampling was to determine if residual gasoline contamination at these sites might be sufficient to cause a health hazard from vapor intrusion into future residential buildings. Four points were authoritatively selected at each of the three LUST sites for soil gas sampling. The sample points were located within the footprint of the original tank excavations.

In general, the gas sampler on the Geo-Probe soil-boring rig was used to advance the soil gas probe to a depth of five feet. Figure 6 provides a graphical representation of the tank sites and soil vapor sample points. The Post-Run Tubing (PRT) system inserts a gas-sampling probe to the desired depth; generally 5 feet. Once the point is reached, the protective sheath is retracted to expose the sampling tip. The annulus between the connective tubing and the soil boring was sealed with bentonite to prevent ambient air from entering the sample chamber. The atmospheric air was triple purged from the tubing and sampler prior to actually collecting the sample material. After a period of 20 minutes, the protective sheath was retracted, and the soil vapor was drawn into the sample container, a 1-liter Summa canister provided by the analytical laboratory. The flow was controlled with the sample valve connected to a flow controller regulated to an entry rate of 100 to 200 ml per minute. The sample was deemed complete when the vacuum pressure gauge registered 5 mm of mercury or less. In most cases, the reading at completion was zero; indicating the canister was completely filled.

At Tank Site 2, the first sample was successfully collected, but the pressure in the canister of the second sample reached a point where it stopped falling. While waiting for the canister to fill, the decision was made to install another boring and begin collecting the third sample. Some time later, it was noted that the tubing connecting the canisters to the probes, was filling with water. It appeared that a small, laterally discontinuous “perched” water table was present. The perched water table also accounts for the failure of the two canisters to completely fill. The decision was made in the field to re-drill these two sample points and to collect the vapor samples from the shallower depth of 3 feet. These replacement samples were successfully collected.

A total of 12 soil vapor sample points were originally planned, and 16 Summa canisters were ordered to contain the samples as well as trip blank and split replicate samples. During the course of the actual sampling, one canister was found to have leaked, and was therefore not used. Two canisters were used as split replicates, and two samples were ruined due to the perched water table. These incidents resulted in an inadequate number of usable Summa canisters. The net result was that the only 3 of the 4 planed sample points at Tank Site 2 were actually collected, and no travel blank was available. In addition, it was not possible to return a travel blank sample.

In summary, a total of 11 soil vapor samples and two split replicates were collected. The canisters were sealed, labeled, and shipped to the State certified analytical laboratory, Air Toxics Ltd., under chain-of-custody for analysis. Each sample was tested using method TO-15 (selected volatile organics) and Total Petroleum Hydrocarbons (TPH-G).

Gasoline hydrocarbons and volatile organic compounds were detected in all of the samples. See Summary Table 9 for a complete results summary. The following table summarizes the significant analytical results:

Text Table 5.1 – Soil Vapor Analytical Results

Analyte Units	TPH-G µg/m3	Acetone µg/m3	Heptane µg/m3	Benzene µg/m3	Toluene µg/m3	Ethylbenzene µg/m3	m,p Xylene µg/m3	o Xylene µg/m3
Residential CHHSL	N/A	N/A	N/A	36	135,000	N/A	319,000	315,000
EPA Shallow Soil Target		35,000	N/A	310	4,000	2,200	70,000	70,000
TS-1-B1	180,000	1,500	ND<43	ND<32	1,300	370	430	99
TS-1-B2	160,000	33,000	ND<84	ND<65	1,100	1,000	2,200	530
TS-1-B3a	94,000	320	ND<41	ND<32	120	ND<44	84	ND<44
TS-1-B3b (replicate)	100,000	340	ND<41	ND<32	110	ND<44	87	ND<44
TS-1-B4	150,000	8,200	ND<41	ND<32	900	ND<46	88	ND<44
TS-2-B1	44,000	330	640	83	100	56	140	ND<50
TS-2-B2	16,000	380	340	ND<33	ND<39	ND<44	48	ND<44
TS-2-B3	15,000	660	250	ND<32	ND<38	ND<44	ND<44	ND<44
TS-4-B1	17,000	490	380	ND<32	47	ND<46	52	ND<44
TS-4-B2	12,000	220	300	ND<32	ND<38	ND<46	52	ND<44
TS-4-B3a	9,000	170	210	ND<32	ND<38	ND<46	ND<44	ND<44
TS-4-B3b (replicate)	9,200	160	170	ND<32	ND<38	ND<46	ND<44	ND<44
TS-4-B4	18,000	310	420	ND<32	41	ND<46	95	ND<44

N/A = No Screening Level Available
ND = Not Detectable
TPH-G = Total Gasoline Hydrocarbons

The line in the table designated as Residential CHHSL is the DTSC screening level for soil vapor at residential sites (see Cal-EPA, 2005), and the line designated as EPA Shallow Target is the U.S.EPA residential screening level for shallow soil gas at residential sites (see U.S. EPA, 2002). There is no established screening level for gasoline hydrocarbons, because gasoline is a highly variable mixture of chemicals rather than an individual chemical. The table indicates that acetone vapor at Tank Site 1 approaches the U.S.EPA screening level, and benzene at Tank Site 2 exceeds the DTSC screening level, but not the U.S.EPA

screening level. In general, it is apparent that residual soil vapor concentrations are much greater at Tank Site 1 than at Tank Sites 2 or 4.

5.2 Shallow Soil Sample Grid

Most of the 44-acre site is open land, with a number of former buildings having been demolished. The overall area was investigated by laying out a ½-acre grid of shallow, screening-level, sample points (Figure 3). The lateral (E-W) grid spaces were labeled with letters (A to M) and the vertical grid spaces (N-S) were identified with numbers (1 to 8). Sample points that fall on the footprints of existing buildings or rail spurs or other obstructions were not used. Similarly, sites that fall within the soil spreading area on the Stockton Cold Storage land were not sampled because other provisions were made to sample this area. A total of 48 sample points were occupied representing 96 samples plus 6 split replicates collected for QA/QC purposes. Each sample was tested as follows:

- Total Extractible Petroleum Hydrocarbons by EPA method 8015m and,
- Semi-volatile organic compounds by EPA method 8270,
- CAM 17 Metals by EPA Method 6020A

The specific chemicals and their reporting limits are summarized in the laboratory data sheets in Appendix K. While a number of CAM-17 metals were detected, a glance at the analytical data, shows that the primary contaminants are arsenic, lead, and chromium. The following table offers a brief summary of the results of the arsenic, lead, and chromium results and total extractable oil-range petroleum hydrocarbons. A more complete table is attached as Summary Tables 1 and 2. Concentrations in excess of background levels are in bold face.

Text Table 5.2 – Soil Screen Analytical Results

Analyte	Arsenic Mg/Kg	Lead mg/Kg	Chrome mg/Kg	TEPH-Oil mg/Kg
Background	9.1	15	8.2	0
CHSSL	0.07	150	17-Cr6	N/A
EPA SSL	0.39	400	39 – Cr6	N/A
PRG	.062	150	30-Cr6	N/A
SCR-F1-0-1	**9.4**	**33**	5.5	ND<20
SCR-F1-1-2	8.3	8.7	5.4	ND<20
SCR-G1-0-1	**26**	**20**	5.9	ND<20
SCR-G1-1-2	5.4	7.7	7.1	ND<20
SCR-H1-0-1	**10**	**38**	5.3	**93**
SCR-H1-1-2	7.2	9.5	4.1	ND<20
SCR-M1-0-1	6.2	**42**	5.6	**130**
SCR-M1-1.2	6.1	**43**	5.6	ND<20
SCR-F2-0-1A	2.9	6.9	3.7	**60**
SCR-F2-0-1B	2.4	6.3	3.4	**84**
SCR-F2-1-2	4.2	4.2	4.6	ND<20
SCR-H2-0-1	**11**	**17**	5.1	ND<20
SCR-H2-1-2	7.4	**26**	5.7	ND<20
SCR-12-0-1	7.7	14	5.3	ND<20
SCR-I2-1-2	6.4	5.2	5.6	ND<20
SCR-J2-0-1	5.0	8.1	6.0	ND<20

SCR-J2-1-2	4.7	4.1	5.8	ND<20
SCR-K2-0-1	**11**	9.7	4.4	ND<20
SCR-K2-1-2	**9.5**	7.5	5.2	ND<20
SCR-L2-0-1A	4.8	6.4	5.3	ND<20
SCR-L2-0-1B	4.4	6.7	5.4	ND<20
SCR-L2-1-2	9.1	8.0	4.3	ND<20
SCR-M2-0-1	5.6	7.7	6.3	ND<20
SCR-M2-1-2	6.1	18	4.2	ND<20
SCR-G3-0-1	**9.4**	**360**	3.6	ND<20
SCR-G3-1-2	7.0	**150**	4.8	ND<20
SCR-H3-0-1	4.8	8.1	5.3	ND<20
SCR-H3-1-2	6.5	6.4	5.5	ND<20
SCR-I3-0-1	3.3	3.2	6.7	ND<20
SCR-I3-1-2	**120**	**62**	2.9	ND<20
SCR-J3-0-1A	5.5	**20**	7.0	ND<20
SCR-J3-0-1B	3.9	3.6	6.8	ND<20
SCR-J3-1-2	5.7	6.9	6.5	ND<20
SCR-M3-0-1	4.0	8.5	5.8	**110**
SCR-M3-1-2	2.7	**16**	4.6	ND<20
SCR-B4-0-1	4.6	**110**	3.7	**110**
SCR-B4-1-2	3.1	**75**	2.9	**51**
SCR-D4-0-1	3.0	4.8	4.0	**470**
SCR-D4-1-2	4.1	10	4.6	**910**
SCR-E4-0-1	3.5	4.3	6.6	**160**
SCR-E4-1-2	3.8	5.4	**11**	ND<20
SCR-F4-0-1	5.4	7.2	6.3	ND<20
SCR-F4-1-2	4.7	13	5.6	ND<20
SCR-G4-0-1	4.3	10	4.5	ND<20
SCR-G4-1-2	3.1	2.9	4.9	ND<20
SCR-I4-0-1	5.6	**17**	8.2	ND<20
SCR-I4-1-2	3.6	3.8	5.5	ND<20
SCR-J4-0-1	2.8	6.7	4.6	ND<20
SCR-K4-0-1	8.3	7.6	3.9	ND<20
SCR-K4-1-2	5.0	**18**	7.0	ND<20
SCR-L4-0-1A	3.9	5.0	4.6	ND<20
SCR-L4-0-1B	4.0	5.3	5.0	ND<20
SCR-L4-1-2	3.0	3.6	6.2	ND<20
SCR-M4-0-1	2.1	5.1	5.3	ND<20
SCR-M4-1-2	4.7	4.8	5.9	ND<20
SCR-B5-0-1	3.3	**120**	5.3	ND<20
SCR-B5-1-2	2.8	6.6	5.2	ND<20
SCR-C5-0-1	**18**	**80**	10	ND<20
SCR-C5-1-2	1.9	**21**	3.9	ND<20
SCR-D5-0-1	4.9	10	4.5	**140**
SCR-D5-1-2	5.1	5.1	4.7	**87**
SCR-E5-0-1	5.0	2.6	6.8	ND<20
SCR-E5-1-2	2.7	3.0	4.1	ND<20
SCR-F5-0-1	6.0	3.1	4.5	ND<20
SCR-F5-1-2	2.7	5.1	5.0	ND<20
SCR-I5-0-1	4.1	7.0	4.9	ND<20
SCR-I5-1-2	6.1	**46**	**31**	ND<20
SCR-J5-0-1	5.8	15	4.5	ND<20
SCR-J5-1-2	4.5	4.7	3.8	ND<20
SCR-K5-0-1	1.3	11	2.9	**990**
SCR-K5-1-2	3.0	8.5	4.0	ND<20
SCR-L5-0-1	1.1	**16**	3.8	**3,000**

SCR-L5-1-2	2.6	5.2	4.7	ND<20
SCR-D6-0-1	3.1	3.5	4.9	ND<20
SCR-D6-1-2	4.8	6.3	4.5	ND<20
SCR-I6-0-1	3.9	4.1	**20**	ND<20
SCR-I6-1-2	9.1	**23**	4.8	ND<20
SCR-J6-0-1	2.3	4.0	4.4	ND<20
SCR-J6-1-2	2.4	3.8	4.0	ND<20
SCR-K6-0-1	4.8	**16**	3.8	**1,100**
SCR-K6-1-2	3.7	7.5	ND<1	ND<20
SCR-L6-0-1	5.9	**16**	4.3	ND<20
SCR-L6-1-2	2.8	8.3	3.7	ND<20
SCR-D7-0-1	3.9	12	5.4	ND<20
SCR-D7-1-2	5.2	8.3	4.7	ND<20
SCR-E7-0-1A	2.7	6.7	5.5	ND<20
SCR-E7-0-1B	2.7	7.1	5.6	ND<20
SCR-E7-1-2	3.6	**25**	4.1	ND<20
SCR-I7-0-1	4.9	8.5	3.4	ND<20
SCR-I7-1-2	5.1	8.1	4.2	ND<20
SCR-J7-0-1A	5.9	4.9	4.3	ND<20
SCR-J7-0-1B	5.3	4.7	4.3	ND<20
SCR-J7-1-2	3.1	7.7	3.3	ND<20
SCR-K7-0-1	4.9	8.3	4.2	ND<20
SCR-K7-1-2	8.7	**26**	4.7	**52**
SCR-L7-0-1	5.6	13	4.2	ND<20
SCR-L7-1-2	4.4	**16**	4.3	ND<20
SCR-E8-0-1	4.8	7.2	5.0	ND<20
SCR-E8-1-2	4.3	**18**	4.5	ND<20
SCR-F8-0-1	4.3	**130**	7.9	ND<20
SCR-F8-1-2	3.2	**770**	**25**	ND<20
SCR-J8-0-1	8.2	**36**	4.2	ND<20
SCR-J8-1-2	**13**	**34**	4.1	ND<20
SCR-K8-0-1	7.7	**23**	4.8	ND<20
SCR-K8-1-2	8.7	**37**	5.7	**100**

N/A = No Screening Level Available
ND = Not Detectable
Sample I.D.s ending in "B" are split replicates

The columns show the sample results in excess of the established background concentrations of metals (see Section 8.1), and the rows include California Human Health Screening Levels (CHHSLs) (Cal-EPA, 2005), U.S.-EPA soil screening levels (EPA SSLs) (http://www.epa.gov/NCEA/iris/intro.htm), and EPA preliminary remediation goals (PRGs) (U.S. EPA, 2004). See Section 6.2.1 for additional discussion of screening levels.

The screening concentrations for Chromium are actually for hexavalent chromium (chrome 6). The more common trivalent chromium has a screening level of 100,000 mg/Kg, and is largely non-toxic. A total of 10 samples contain greater than the background arsenic concentrations, 34 samples contain greater than background levels of lead, and 5 samples contain greater than background chromium concentrations. A total of 17 samples also contain detectable concentrations of oil-range petroleum hydrocarbons.

None of the samples contained detectable concentration of organo-chlorine pesticides, or of semi-volatile organic compounds, except soil samples from sample points SCR-I2, SCR-K2, SCR-L2, and SCR-E5, which contained trace to low concentrations of S-VOCs as follows:

	Benzo(a) anthracene µg/Kg	Benzo(a) pyrene µg/Kg	Benzo(b) flouranthene µg/Kg	Benzo(g,h,i) perylene µg/Kg	Chrysene µg/Kg	Fluoranthene µg/Kg	Indeno(1,2,3-cd)pyrene µg/Kg	Pyrene µg/Kg
CHHSL	N/A	38	N/A	N/A	N/A	N/A	N/A	N/A
EPA SSL	150	15	1,500	N/A	15,000	2,300,000	N/A	1,700,000
EPA PRG	620	62	6,200	N/A	3,800	2,300,000	620	2,300,000
SCR-I2-1-2	ND<330	**390**	**380**	**430**	ND<330	**420**	ND<330	**530**
SCR-K2-1-2	ND<330	**510**	**480**	**630**	ND<330	ND<330	ND<330	**670**
SCR-L2-1-2	**540**	**680**	**700**	**390**	**510**	**440**	**340**	**530**

5.3 Rail Spur Shallow Soil Samples

One shallow sample point was collected for each approximately 100 linear feet of right-of-way (42 sample points). Including 4 split replicates, a total of 86 rail spur samples were collected. The sample points are shown on Figures 4A & B.

Each sample was tested as follows:

- Total Extractible Petroleum Hydrocarbons (diesel or oil) by EPA method 8015m and,
- Semi-volatile organic compounds by EPA method 8270,
- CAM 17 Metals by EPA Method 6020A
- Organo-chlorine pesticides by EPA method 8081B

The specific chemicals and their reporting limits are summarized in the summary tables and the laboratory data sheets are in Appendix K.

The complete summary or results are in Summary Table 2, but the following table offers a brief summary of the results of the arsenic, lead, and chromium results and total extractable oil-range petroleum hydrocarbons:

Test Table 5.3.1 - Rail Spur Soil Analytical Results

	Arsenic mg/Kg	Lead mg/Kg	Chrome mg/Kg	Oil mg/Kg
Background	9.1	15	8.2	0
CHSSL	0.07	150	17-Cr6	N/A
EPA SSL	0.39	400	39 – Cr6	N/A
EPA PRG	.062	150	30-Cr6	N/A
RR-7-0-1	**45**	2.1	1.9	ND<20
RR-7-0-2	**47**	2.1	1.8	ND<20
RR-8-0-1	**110**	**42**	**8.3**	**200**
RR-8-1-2	**45**	4.5	1.9	ND<20
RR-9-0-1	**11**	3.4	ND<1	ND<20
RR-9-1-2	**31**	2.3	2.1	ND<20

RR-10-0-1	**450**	**99**	7.0	**120**
RR-10-1-2	5.3	8.3	3.8	ND<20
RR-11-0-1	**180**	**90**	4.1	**73**
RR-11-1-2	**84**	2.1	2.4	ND<20
RR-12-0-1	**84**	3.1	1.7	ND<20
RR-12-1-2	**78**	2.4	2.3	ND<20
RR-13-0-1	2.7	1.7	1.5	ND<20
RR-13-1-2	**210**	8.9	**22**	ND<20
RR-14-0-1A	**140**	**43**	6.3	ND<20
RR-14-0-1B	**92**	**44**	4.1	ND<20
RR-14-1-2	**160**	**82**	**1,000**	ND<20
RR-15-0-1	**78**	14	3.1	ND<20
RR-15-1-2	**120**	3.1	1.9	ND<20
RR-16-0-1	5.6	1.2	1.3	**120**
RR-16-1-2	**58**	8.6	3.2	ND<20
RR-17-0-1	**140**	14	4.0	**110**
RR-17-1-2	**24**	1.4	1.5	ND<20
RR-18-0-1	**100**	5.8	**14**	ND<20
RR-18-1-2	1.9	2.7	1.4	ND<20
RR-19-0-1	**41**	2.5	1.4	ND<20
RR-19-1-2	**18**	1.3	3.8	ND<20
RR-20-0-1	5.2	**18**	6.3	ND<20
RR-20-1-2	2.9	3.0	6.2	ND<20
RR-21-0-1	5.7	9.5	5.7	ND<20
RR-21-1-2	3.7	10	6.4	ND<20
RR-26-0-1	3.2	**32**	2.4	ND<20
RR-26-1-2	2.6	10	3.9	ND<20
RR-27-0-1	5.2	5.3	2.5	ND<20
RR-27-1-2	6.5	11	2.0	ND<20
RR-28-0-1	**170**	2.1	1.1	ND<20
RR-28-1-2	7.8	8.6	3.3	ND<20
RR-29-0-1	**21**	8.0	3.5	ND<20
RR-29-1-2	7.8	9.7	3.7	ND<20
RR-30-0-1	8.5	12	2.2	ND<20
RR-30-1-2	**9.4**	9.3	3.1	ND<20
RR-31-0-1	**9.5**	7.5	3.1	ND<20
RR-31-1-2	7.8	8.4	2.7	ND<20
RR-32-0-1	**61**	**32**	2.6	120
RR-32-1-2	**51**	9.6	4.1	ND<20
RR-33-0-1	8.9	9.9	1.9	ND<20
RR-33-1-2	**11**	9.9	2.1	ND<20
RR-34-0-1	5.5	7.1	3.0	ND<20
RR-34-1-2	6.4	11	1.8	ND<20
RR-35-0-1	2.9	3.9	2.6	70
RR-35-1-2	**9.4**	**32**	2.4	ND<20
RR-36-0-1	**9.8**	8.1	2.3	86
RR-36-1-2	1.2	8.8	2.5	260
RR-37-0-1A	9.0	8.6	1.9	ND<20
RR-37-0-1B	**12**	**17**	1.9	ND<20
RR-37-1-2	4.2	4.9	3.0	ND<20
RR-38-0-1	**9.9**	14	2.2	ND<20
RR-38-1-2	**9.8**	**24**	2.3	ND<20
RR-39-0-1	**72**	7.8	3.2	ND<20
RR-39-1-2	**240**	6.3	4.9	ND<20
RR-40-0-1	5.7	**49**	4.7	290
RR-40-1-2	**48**	9.1	4.3	ND<20
RR-41-0-1	**11**	3.1	6.8	ND<20

RR-41-1-2	**11**	15	3.7	ND<20
RR-42-0-1	**95**	**28**	5.8	ND<20
RR-42-1-2	9.1	8.0	4.7	ND<20
RR-43-0-1	7.8	4.5	4.3	380
RR-43-1-2	**97**	**98**	1.4	ND<20
RR-44-0-1	**30**	**48**	5.9	450
RR-44-1-2	2.2	4.4	2.9	2,500
RR-45-0-1	7.9	22	4.9	69
RR-45-1-2	6.5	7.0	3.5	ND<20
RR-46-0-1A	4.3	14	5.5	100
RR-46-0-1B	6.8	**19**	5.4	71
RR-46-1-2	3.8	6.5	3.6	ND<20
RR-51-0-1	1.1	2.1	ND<1	ND<20
RR-51-1-2	1.2	2.2	ND<1	ND<20
RR-52-0-1	**12**	7.2	4.7	ND<20
RR-52-1-2	5.0	8.2	4.6	ND<20
RR-53-0-1	ND<1	2.8	ND<1	ND<20
RR-53-1-2	6.6	12	2.4	ND<20
RR-54-0-1	ND<1	1.4	ND<1	ND<20
RR-54-1-2	7.9	7.1	3.0	ND<20
RR-55-0-1A	3.2	12	4.4	ND<20
RR-55-0-1B	4.0	12	3.9	ND<20
RR-55-1-2	2.0	5.0	ND<1	ND<20

N/A = No Screening Level Available
ND = Not Detectable
Sample I.D.s ending in "B" are split replicates

The metals table also includes columns showing the sample results in excess of the established background concentrations of the respective metals (Section 8.1). The sample analytical results indicate that samples contain elevated concentration of heavy metals above background levels. A total of 44 samples (53%) contain greater than the background arsenic concentration, 18 samples (21%) contain greater that background levels of lead, and 4 samples (5%) contain greater than background chromium concentration. A total of 16 samples (19%) also contain detectable concentrations of oil-range petroleum hydrocarbons.

None of the samples contained detectable concentration of organo-chlorine pesticide except for a trace of Dieldrin in RR-20-0-1, or of semi-volatile organic compounds, except soil samples from sample points RR-14 and RR-20, which contained trace to low concentrations of S-VOCs. Samples RR-14-0-1A and RR-20-0-1 contained at least one S-VOC chemical in excess of EPA preliminary remediation goals. The following table indicated S-VOCs detected in excess of EPA PRGs:

Text Table 5.3.2 – S-VOCs in Rail Spur Samples

	Acena phtylene µg/Kg	Benzo(a) anthracene µg/Kg	Benzo(a) pyrene µg/Kg	Benzo(b) fluoranthene µg/Kg	Benzo(k) flouranthene µg/Kg	Chry sene µg/Kg	Fluor anthene µg/Kg	Napth alene µg/Kg	Phen anthrene µg/Kg	Pyrene µg/Kg
CHSSL	N/A	N/A	38	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EPA-SSL	N/A	150	15	150	1,500	15,000	2,300,000	3,900	N/A	1,700,000
EPA PRG	2,100	620	62	620	6,200	3,800	2,300,000	1,700	N/A	2,300.000
RR-14-0-1A	**3,600**	ND<3,300	ND<3,300	ND<3,300	ND<3,300	ND<3,300	**5,200**	**3,400**	**11,000**	ND<330
RR-20-0-1	ND<330	**440**	**550**	**970**	**340**	**650**	**370**	ND<330	ND<330	**340**

N/A = No Screening Level Available
ND = Not Detectable

It is noteworthy that the split replicate (RR-14-0-1B) of the first sample did not contain detectable S-VOCs.

Figure 4A provides a graphical representation of the distribution of the contaminant metals and 4B shows the distribution of oil.

5.4 Stockton Cold Storage Targeted Shallow Soil Samples

Authoritatively selected sample points were designated at two sites on the Stockton Cold Storage facility. An area near the shop building was investigated with 6 designated sample points and two installations under Building 1 identified in the Phase I ESA (BSK, 1999) as having handled chromium treated brine were also investigated. Most of Building 1 is situated on a wood truss floor with concrete footings and piers. One sample point was located beneath the idle cooling coils formerly used to cool chromium-treated brine water, and the other was from beneath a concrete pad that forms the floor of the pump room that was used to circulate the brine. Access was gained by drilling a 4-inch diameter core hole through the 9-inch thick slab. In both cases, the sampling was completed using hand auger soil boring tools. Two samples were collected at each of these eight designated sample points. The sample point locations are shown on Figure 6.

The shop-area samples were tested as follows:

- Total Extractible Petroleum Hydrocarbons by EPA method 8015m,
- Semi-volatile organic compounds by EPA method 8270 and,
- CAM 17 Metals by EPA method 6020A

The samples from beneath Building 1 were tested only for the presence of total chromium and hexavalent chromium using EPA methods 6020 and 7199.

The specific chemicals and their reporting limits are summarized in the Summary Tables and the laboratory data sheets are in Appendix K.

The following table offers a brief summary of the results of the arsenic, lead, and chromium results and total extractable oil-range petroleum hydrocarbons:

Text Table 5.4 – Stockton Cold Storage Targeted Soil Analytical Results

	Arsenic mg/Kg	Lead mg/Kg	Chrome mg/Kg	Oil mg/Kg
Background	9.1	15	8.2	0
CHSSL	0.07	150	17-Cr6	N/A
EPA SSL	0.39	400	39 – Cr6	N/A
PRG	.062	150	30-Cr6	N/A
Shop Area				
Shop-SS1-0-1	5.5	6.6	5.5	ND<20
Shop-SS1-1-2	7.5	8.2	4.8	ND<20
Shop-SS2-0-1	3.6	9.3	4.9	ND<20
Shop-SS2-1-2	1.9	**62**	4.9	ND<20
Shop-SS3-0-1	3.0	6.0	4.4	ND<20
Shop-SS3-1-2	3.7	3.6	4.8	ND<20
Shop-SS4-0-1	5.2	11	4.9	ND<20
Shop-SS4-1-2	3.6	4.5	4.5	ND<20
Shop-SS5-0-1	3.5	8.8	5.5	ND<20
Shop-SS5-1-2	4.5	**29**	5.8	ND<20
Shop-SS6-0-1	1.4	3.3	5.1	ND<20
Shop-SS6-1-2	1.3	3.2	4.9	ND<20

Building 1 Spls	Total Chrome	Chrome-6
CHSSL	N/A	17
EPA SSL	N/A	39
PRG	N/A	30
Coil 1-1.5	50	0.57
Coil 2.5-3	47	0.76
Engine Room .5-1	51	8.8
Engine Room 2.3 - 3	6.2	1.7

N/A = No Screening Level Available
ND = Not Detectable

The table also includes columns showing the sample results in excess of the established background concentrations of the respective metals (Section 8.1). The sample analytical results indicate that several samples contain slightly elevated concentrations of lead above the established background level of 15 mg/Kg. No petroleum hydrocarbons or semi-volatile organic compounds were detected. In the case of the Building 1 soil samples, the chromium was speciated and most of the material proved to be in the relatively non-toxic, trivalent state. The more toxic hexavalent chromium is below screening levels.

5.5 Random Shallow Soil Sampling of Soil Spreading Area

The soil spreading area is a vacant lot along the western side of the Stockton Cold Storage site was targeted for investigation by a suite of 13 randomly selected sample points (see Site Sampling plan, Geo-Phase Environmental, 2008 for details). The 13 randomly selected sample points resulted in a group of 28 total samples, including 2 split replicates. The sample points and distribution of principal contaminants are shown on Figure 6.

Each sample was tested as follows:

- Total Extractible Petroleum Hydrocarbons by EPA method 8015m,
- Semi-volatile organic compounds by EPA method 8270 and,
- CAM 17 Metals by EPA Method 6020A

The specific chemicals and their reporting limits are summarized in Summary Table 3 and the laboratory data sheets are in Appendix K.

The following table offers a brief summary of the results of the arsenic, lead, and chromium results and total extractable oil-range petroleum hydrocarbons.

Text Table 5.5 – Soil Spreading Area Sample Analytical Results

	Arsenic mg/Kg	Lead mg/Kg	Chrome mg/Kg	Oil mg/Kg
Background	9.1	15	8.2	0
CHSSL	0.07	150	17-Cr6	N/A
EPA SSL	0.39	400	39 – Cr6	N/A
PRG	.062	150	30-Cr6	N/A
SS-1-0-1	2.7	9.7	3.0	ND<20
SS-1-1-2	2.8	4.9	4.4	ND<20
SS-2-0-1	3.0	**16**	2.8	ND<20
SS-2-1-2	1.6	5.8	2.6	ND<20
SS-3-0-1A	3.5	**72**	3.6	110
SS-3-0-1B	3.6	**52**	3.0	66
SS-3-1-2	3.4	4.6	2.5	ND<20
SS-4-0-1	4.5	5.5	2.6	ND<20
SS-4-1-2	3.8	8.1	2.9	ND<20
SS-5-0-1	2.8	11	3.2	79
SS-5-1-2	3.4	15	2.7	ND<20
SS-6-0-1	3.9	**39**	3.1	ND<20
SS-6-1-2	2.2	7.9	2.5	ND<20
SS-7-0-1	2.8	10	2.6	110
SS-7-1-2	2.2	5.9	2.4	ND<20
SS-8-0-1	4.7	15	3.1	71
SS-8-1-2	3.3	11	2.7	ND<20
SS-9-0-1	3.4	12	3.1	ND<20
SS-9-1-2	4.2	**19**	3.1	ND<20
SS-10-0-1	5.0	**18**	3.0	ND<20
SS-10-1-2	4.6	**92**	4.4	ND<20
SS-11-0-1	3.5	**27**	3.8	ND<20
SS-11-1-2	7.9	**19**	2.7	ND<20
SS-12-0-1	3.3	**36**	2.6	ND<20
SS-12-1-2	5.3	**6,200**	**53**	ND<20
SS-13-0-1A	2.9	**21**	2.5	ND<20
SS-13-0-1B	3.4	**18**	2.4	ND<20
SS-13-1-2	3.6	**16**	2.7	ND<20

N/A = No Screening Level Available
ND = Not Detectable
Sample I.D.s ending in "B" are split replicates

The sample analytical results indicate that samples contain elevated concentration of heavy metals above background levels. No sample contains greater than the background arsenic

concentration, 14 samples (50%) contain greater that background levels of lead, and 1 sample (4%) contain greater than background chromium concentration. A total of 5 samples (18%) also contain detectable concentrations of oil-range petroleum hydrocarbons. It is clear that the sample, SS-12-1-2, is most heavily impacted, with more than 6,000 parts per million of lead. None of the sample contained detectable concentration of organo-chlorine pesticide, or of semi-volatile organic compounds.

None of the samples contained detectable concentrations of organo-chlorine pesticides, or of semi-volatile organic compounds. Figure 6 provides a graphical representation of the distribution of the principal contaminants.

5.6 1404 W. Weber – Soil Borings and Shallow Soil Samples

The area just south of the building at 1404 W. Weber was identified in an earlier report as a site of possible soil contamination from S-VOCs (Geo-Phase, 2007). Six points near the building were authoritatively selected for shallow soil sampling, and three points were selected to advance Geo-Probe soil borings to a depth sufficient to obtain groundwater samples as well as soil samples. In general, the borings to groundwater encountered soils consisting almost entirely of clay and silt. This fine-grained material is poorly permeable and would not easily produce sufficient water to produce an adequate groundwater sample. Consequently, the borings generally had to be advanced to a depth of more than 20 feet to obtain a groundwater sample, even though the depth to the groundwater surface was found at little more than 10 feet below the surface. The boring locations are shown on Figure 5, and shallow soil sample points are shown on Figure 6. Both groundwater and selected soil samples were tested as follows:

- Total Extractible Petroleum Hydrocarbons by EPA method 8015m,
- Semi-volatile organic compounds by EPA method 8270 and,
- CAM 17 Metals by EPA Method 6020A (both total and dissolved)

The specific chemicals and their reporting limits are summarized in the Summary Tables and the laboratory data sheets are in Appendix K.

The following tables offer a brief summary of the results of the arsenic, lead, and chromium results and total petroleum hydrocarbons.

Text Table 5.6.1 – 1404 W. Weber Soil and Groundwater Analytical Results

	Arsenic mg/Kg	**Lead** mg/Kg	**Chrome** mg/Kg	**Oil** mg/Kg	**Diesel** mg/Kg	**Gasoline**
Background	9.1	15	8.2			
CHSSL	0.07	150	17-Cr6	N/A	N/A	N/A
EPA SSL	0.39	400	39 – Cr6	N/A	N/A	N/A
PRG	.062	150	30-Cr6	N/A	N/A	N/A
Shallow Soil Spls						
1404-SS1-0-1	6.3	**23**	4.3	ND<20	N/A	N/A
1404-SS1-1-2	3.7	**21**	4.1	ND<20	N/A	N/A

1404-SS2-0-1	4.2	13	3.9	ND<20	N/A	N/A
1404-SS2-1-2	5.1	15	3.9	ND<20	N/A	N/A
1404-SS3-0-1	4.5	8.4	3.7	ND<20	N/A	N/A
1404-SS3-1-2	4.9	10	3.4	ND<20	N/A	N/A
1404-SS4-0-1	3.6	10	3.4	ND<20	N/A	N/A
1404-SS4-1-2	6.6	12	3.4	ND<20	N/A	N/A
1404-SS5-0-1	5.0	9.0	3.9	ND<20	N/A	N/A
1404-SS5-1-2	7.6	**43**	4.6	ND<20	N/A	N/A
1404-SS6-0-1A	5.9	9.6	3.7	ND<20	N/A	N/A
1404-SS6-0-1B	4.1	4.9	7.3	ND<20	N/A	N/A
1404-SS6-1-2	4.6	9.0	5.2	ND<20	N/A	N/A
Boring Soil Spls						
1404-B1-4-5	5.6	**26**	4.6	ND<20	**85**	N/A
1404-B1-8-9	6.5	9	4.7	ND<20	ND<5	N/A
1404-B1-15-16	5.4	13	5.1	ND<20	ND<5	N/A
1404-B2-4-5	4.9	**22**	4.4	ND<20	ND<5	N/A
1404-B2-8-9	5.6	15	4.5	ND<20	ND<5	N/A
1404-B2-15-16	6.7	4.4	4.7	ND<20	ND<5	N/A
1404-B3-4-5	5.1	12	4.7	ND<20	ND<5	N/A
1404-B3-8-9	4.5	**20**	4.6	ND<20	ND<5	N/A
1404-B3-15-16	1.4	3.7	3.8	ND<20	ND<5	N/A
GW Spls	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MCL	50	15	50	N/A	N/A	N/A
1404-B1	26	13	10	ND<250	ND<50	ND<50
1404-B2	**64**	**16**	22	ND<250	ND<50	ND<50
1404-B3	20	**27**	34	ND<250	ND<50	ND<50
Dissolved Metals						
1404-B1	2.2	ND<1	15			
1404-B2	9.8	ND<1	17			
1404-B3	4.2	ND<1	23			

N/A = No Screening Level Available
ND = Not Detectable
Sample I.D.s ending in "B" are split replicates

None of the soil samples contained metals in excess of screening levels, although one sample (1404-B1-4-5) contained a trace concentration of diesel fuel. One groundwater sample contained total arsenic slightly in excess of established limits for drinking water standards (MCL) and two samples contained total lead in excess of MCL. Without entrained silt and clay, the dissolved concentrations of the metals were within MCL limits.

No S-VOCs were detected in the groundwater samples form the three soil borings. One soil sample, B1-4-5, contained significant S-VOC levels and two samples contained traces as summarized below:

Text Table 5.6.2 – S-VOCs in 1404 W. Weber Soil Samples

S-VOC	1404-B1-4-5 (µg/Mg)	1404-B3-8-0 (µg/Mg)	1404-SS2-1-2 (µg/Mg)	EPA SSL (µg/Mg)	EPA PRG (µg/Mg)
2-Methylnaphtalene	**2,000**	ND<330	ND<330	31,000	N/A
Acenapthalene	**4,800**	**430**	ND<330	N/A	2,100
Anthracene	**14,000**	ND<330	ND<330	17,000,000	22,000,000
Benzo(a)anthracene	**9,100**	ND<330	ND<330	150	620

Benzo(a)pyrene	**3,000**	ND<330	ND<330	15	62
Benzo(b)Fluoranthene	**5,000**	ND<330	ND<330	150	620
Benzo(k)Fluoranthene	**1,700**	ND<330	ND<330	1,500	6,200
Chrysene	**8,900**	ND<330	ND<330	15,000	3,800
Dibenzofuran	**2,500**	ND<330	ND<330	N/A	15,000
Fluoranthene	**37,000**	ND<330	**570**	2,300,000	2,300,000
Fluorine	**5,200**	ND<330	ND<330	4,700,000	2,700,000
Napthalene	**3,300**	ND<330	ND<330	3,900	1,700
Phenanthrene	**32,000**	**360**	**350**	N/A	N/A
Pyrene	**27,000**	ND<330	**500**	1,700,000	2,300,000

Clearly, several of these S-VOCs are in excess of EPA SSLs and PRGs. In addition to these analytical results, boring B2 produced samples with what appeared to be staining and exuding unusual odors. Moreover, evidence was found that the soil to a depth of at least 16 feet, consists of fill, as evidenced by the presence of a large chunk of wood recovered from boring B-2 at that depth.

It appears that the soil in this area has been impacted by diesel-range hydrocarbons along with associated S-VOCs, and the material was introduced as fill material rather than as a result of a tank release or fuel dumping. No evidence was found that the groundwater has been significantly affected.

5.7 Soil Borings – Oil Storage Area

An area near the extreme west end of the peninsula has been used as a storage area for waste oil drums immediately north of the business at 1541 W. Weber Avenue (Geo-Phase, 2007). Five points were authoritatively selected on the footprint of the asphalt-paved storage area to advance Geo-Probe soil borings to a depth sufficient to obtain groundwater samples. In general, the borings to groundwater encountered soils consisting almost entirely of clay and silt. In this area, due to a topographic depression, the depth to groundwater was about 6 feet below grade, and the borings were advance to a depth of 12 feet to obtain an adequate water sample. The boring locations are shown on Figure 5. Both groundwater and selected soil samples were tested as follows:

- Total Extractible Petroleum Hydrocarbons (diesel or oil) by EPA method 8015m and,
- Semi-volatile organic compounds by EPA method 8270,
- CAM 17 Metals by EPA Method 6020A

The specific chemicals and their reporting limits are summarized in the Summary Tables and the laboratory data sheets are in Appendix K.

The following tables offer a brief summary of the results of the arsenic, lead, and chromium results and total petroleum hydrocarbons.

Text Table 5.7 – Waste Oil Area Soil & Groundwater Sample Analytical Results

Sample ID	Arsenic mg/Kg	Lead mg/Kg	Chrome mg/Kg	Oil mg/Kg
Background	9.1	15	8.2	0
CHSSL	0.07	150	17-Cr6	N/A
EPA SSL	0.39	400	39 – Cr6	N/A
EPA PRG	.062	150	30-Cr6	N/A
Boring Soil Spls				
WO-B1-1-2	**19**	**27**	4.5	ND<20
WO-B1-7-8	1.8	3.9	4.9	ND<20
WO-B2-1-2	6.8	9.2	5.8	ND<20
WO-B2-7-8	4.8	3.3	5.0	ND<20
WO-B3-1-2	**20**	**27**	4.9	ND<20
WO-B3-7-8	1.8	3.9	4.9	ND<20
WO-B4-1-2	**9.4**	**21**	4.7	ND<20
WO-B4-7-8	8.0	4.3	4.7	ND<20
WO-B5-1-2	**27**	13	4.7	ND<20
WO-B5-7.8	3.2	ND<1	4.9	ND<20
Water Spls	µg/L	µg/L	µg/L	µg/L
MCLs	50	15	50	N/A
Total Metals				
WO-B1	5.0	ND<1	9.9	ND<250
WO-B2	2.3	ND<1	11	ND<250
WO-B3	2.6	ND<1	25	ND<250
WO-B4A	3.1	ND<1	17	ND<250
WO-B4B	4.0	ND<1	17	ND<250
WO-B5	5.2	ND<1	13	ND<250
Dissolved Metals				
WO-B1	5.2	ND<1	3.1	ND<250
WO-B2	2.0	ND<1	7.1	ND<250
WO-B3	2.1	ND<1	1.8	ND<250
WO-B4A	3.6	ND<1	22	ND<250
WO-B4B	4.0	ND<1	17	ND<250
WO-B5	4.9	ND<1	14	ND<250

N/A = No Screening Level Available
ND = Not Detectable
Sample I.D.s ending in "B" are split replicates

Several shallow soil samples contain arsenic and or lead concentrations above background, probably due to the very close proximity of a former rail spur, but there is no other evidence of contamination associated with this installation.

5.8 Soil Borings – Former Bulk Terminal

An area just north of W. Weber Avenue was formerly the site of bulk petroleum distribution facility that included a number of large, aboveground tanks (Geo-Phase, 2007). Six points were authoritatively selected on the footprint of the facility to advance Geo-Probe soil borings to a depth sufficient to obtain groundwater samples. In general, the borings to groundwater encountered soils consisting almost entirely of clay and silt. This fine-grained

material is poorly permeable and would not easily produce sufficient water to produce an adequate groundwater sample. Consequently, the borings generally had to be advanced to a depth of more than 20 feet to obtain a groundwater sample, even though the depth to the groundwater surface was found at little more than 10 feet below the surface. The boring locations are shown on Figure 5. Both groundwater and selected soil samples were tested as follows:

- Total Extractible Petroleum Hydrocarbons (diesel or oil) by EPA method 8015m and,
- Semi-volatile organic compounds by EPA method 8270,
- CAM 17 Metals by EPA Method 6020A

The specific chemicals and their reporting limits are summarized in the Summary Tables and the laboratory data sheets are in Appendix K. The following tables offer a brief summary of the results of the arsenic, lead, and chromium results and total petroleum hydrocarbons.

Text Table 5.8 – Bulk Plant Soil & Groundwater Analytical Results

Sample ID	Arsenic µg/Kg	Lead µg/Kg	Chrome µg/Kg	Oil µg/Kg	Diesel µg/Kg	Gasoline µg/Kg
MCL	50	15	50-Cr6	N/A	N/A	N/A
Bulk-B1	29	**25**	12	ND<250	ND<50	ND<50
Bulk-B2	42	12	8.5	ND<250	ND<50	ND<50
Bulk-B3	36	**59**	11	ND<250	ND<50	ND<50
Bulk-B4	22	9.2	24	ND<250	ND<50	ND<50
Bulk-B5	21	15	13	ND<250	ND<50	ND<50
Bulk-B6	29	**24**	11	ND<250	ND<50	ND<50
Bulk Plant Dissolved Metals						
Bulk-B1	22	ND<1	6.7			
Bulk-B2	21	ND<1	5.4			
Bulk-B3	3.4	ND<1	13			
Bulk-B4	8.1	ND<1	8.3			
Bulk-B5	19	7.9	10			
Bulk-B6	18	ND<1	6.6			
Boring Soil Spls	Arsenic (mg/Kg)	Lead (mg/Kg)	Chrome (mg/Kg)	Oil (mg/Kg)	Diesel (mg/Kg)	Gasoline (mg/Kg)
Background	9.1	15	8.2	0	0	0
CHSSL	0.07	150	17-Cr6	N/A	N/A	N/A
EPA SSL	0.39	400	39 – Cr6	N/A	N/A	N/A
PRG	.062	150	30-Cr6	N/A	N/A	N/A
Bulk-B1-4-5	5.7	6.5	6.0	ND<20	ND<5	ND<50
Bulk-B1-8-9	7.0	6.5	5.3	ND<20	ND<5	ND<50
Bulk-B1-15-16	2.2	4.0	3.7	ND<20	ND<5	ND<50
Bulk-B1-23-24	6.3	4.3	6.0	ND<20	ND<5	ND<50
Bulk-B2-4-5	4.0	4.1	5.9	ND<20	ND<5	ND<50
Bulk-B2-8-9	14	13	4.2	ND<20	ND<5	ND<50
Bulk-B2-15-16	4.0	4.2	5.7	ND<20	ND<5	ND<50
Bulk-B3-4-5	5.2	6.1	5.2	ND<20	ND<5	N/A
Bulk-B3-8-9	7.4	**22**	3.9	ND<20	ND<5	N/A
Bulk-B3-15-16	**20**	3.7	4.7	ND<20	ND<5	N/A
Bulk-B4-4-5	5.3	5.8	5.8	ND<20	ND<5	ND<50
Bulk-B4-8-9	7.8	8.3	5.0	ND<20	ND<5	ND<50

Bulk-B4-15-16	6.6	4.5	5.2	ND<20	**460**	**40**
Bulk-B4-19-20	**12**	5.2	3.7	ND<20	**91**	**38**
Bulk-B4-23-24	2.8	4.3	3.4	ND<20	**160**	**18**
Bulk-B5-4-5	3.7	3.4	6.2	ND<20	ND<5	ND<50
Bulk-B5-8-9	8.7	7.3	4.8	ND<20	ND<5	ND<50
Bulk-B5-15-16	5.7	4.3	4.5	ND<20	ND<5	ND<50
Bulk-B6-4-5	1.4	2.8	1.2	ND<20	ND<5	ND<50
Bulk-B6-8-9	8.6	12	4.3	ND<20	ND<5	ND<50
Bulk-B6-15-16	4.2	3.5	2.6	ND<20	ND<5	ND<50

Low levels of diesel contamination were detected in boring B-4, but no hydrocarbons were detected in any of the groundwater samples. The laboratory reported that the chromatograms of the three samples with gasoline are atypical of gasoline. The material appears to actually be a fraction of the diesel contamination. In addition, unusual odors, soil stain, or PID readings were detected in soil samples from borings, B-2 and B-6, although no contaminants were reported in laboratory analyses. Slightly elevated concentrations of arsenic were detected in two of the borings.

Semi-volatile organics were detected in several samples as follows:

	Phenol (mg/Kg)	n-Butyl benzene (mg/Kg)	Sec-Butyl benzene (mg/Kg)	Isopropyl benzene (mg/Kg)	n-propyl benzene (mg/Kg)	1,1,2,2-Tetra chloroethane (mg/Kg)	1,1,2 Trichloro ethane (mg/Kg)
CHHSL	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EPA - SSL	18,000,000	N/A	N/A	N/A	N/A	2,000	590
EPA - PRG	18,000,000	240,000	220,000	570,000	240,000	3,200	730
Bulk-B2-4-5	**740**	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Bulk-B4-15-16	ND<330	**13**	**13**	**6**	**8**	ND<5	**48**
Bulk-B4-19-20	ND<330	ND<5	**13**	ND<5	ND<5	**11**	**45**
Bulk-B4-23-24	ND<330	ND<5	**16**	ND<5	ND<5	**21**	**45**
Bulk-B6-4-5	**610**	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5

Low levels of the BTEX volatile organic compounds ethylbenzene and xylene were also detected in soil samples from boring B-4.

5.9 Waste Disposal

Decon water from washing sample equipment was containerized in an appropriate DOT container for later recycling by a licensed hazardous waste hauler. Laboratory testing of the water indicated that residual contaminant concentrations were within residential health guidelines and the water was disposed of on the site. No waste soil cuttings were generated during the Geo-Probe drilling process or shallow soil sampling.

5.10 Documentation

A general field log was maintained during the fieldwork. Notes were made of the date and time of the work, the personnel on site, the general weather, and the sequence and time of significant field events. Careful notes were taken of each shallow sample collected for laboratory analysis. A log form describing the sample as well as sample location and time accompanied the shallow soil samples. Photographs supplemented the log information, and

general site photos were made to show the overall site and the sampling area. Photocopies of the field notes are attached as Appendix B. Photos are attached as Appendix A, and boring logs are attached as Appendix C.

5.11 Deviations From the Work Plan

The following points summarize material deviations from the Work Plan.

- The sampling plan called for soil sample pesticide analysis using EPA method 8081a. Actual analysis was completed, however, using method 8081b.

- The DTSC staff directed that CAM-17 metals analyses be conducted for both total and dissolved metal in groundwater samples.

- The sampling plan called for CAM-17 heavy metals sample analysis using EPA method 7000. Actual analysis was completed, however, using method 6020a. The samples from beneath Building 1 were tested only for the presence of total chromium and hexavalent chromium using EPA methods 6020 and 7199.

- In several instances, field conditions required that sample locations be moved or in a few cases eliminated. The maps in Figures 3 though 7 are reflective of the actual sample locations. In addition, the latitude/longitude coordinates of each sample location are included in the field notes.

- Greg Culhane, the owner of the Culhane property, denied permission to enter the site for the purpose of collecting samples. As a result, the samples proposed in the Site Sampling Plan, could not be obtained.

- During the course of collecting soil vapor samples at Tank Site 2, two of the sample collection probes encountered a small, perched water table at the depth of 5 feet. As a result, the samples could not be obtained and the two Summa Canisters were rendered unusable. It was also found that a third canister had leaked. The two samples from the perched water table were eventually collecting by resetting the probes to three feet. This unexpected loss of three Summa canisters resulted, however, in an insufficient supply of canisters to complete the work as described in the Sampling Plan. Only three, instead of the planed four samples points were occupied, and no travel blank could be returned.

6.0 DATA QUALITY EVALUATION

Data evaluation is the process of analyzing site characteristics and data to identify Chemicals of Potential Concern (COPCs) to be evaluated in the human health risk assessment. This section identifies data of sufficient quality for use in the risk assessment, summarizes the chemical characterizations of soil and groundwater, and provides a summary of COPCs.

6.1 Data Quality

The following criteria were considered to evaluate the quality of the laboratory data points:

- Laboratory QC data sheets are reviewed to verify that the analytical laboratory analytical procedures were within acceptable limits as regards repeatability and contaminant recoverability.

- Blank contamination is evaluated based on the results of field and laboratory blank data. Common laboratory contaminants are eliminated if detected concentrations are within 10 times the associated blank concentrations (Cal-EPA, 1994). All other chemicals are eliminated if detected concentrations are within 5 times blank concentrations.

- Sample Quantitation Limits (SQLs) must be sufficiently low such that chemicals can be selected at levels of potential concern. Data are reviewed to determine if SQLs are sufficiently low.

6.1.1 Temperature Blanks

The temperature blanks from the ice chests in which the samples were transported to the laboratory were measured upon reaching the lab with an infrared digital thermometer. (See CofC forms for details). A few ice chest temperature blanks were not tested due to the failure of the lab courier to bring a suitable infrared thermometer. All temperature blanks tested, indicated the samples were adequately chilled to less than 4 degree C.

6.1.2 Split Replicates

Analyses of a split replicate samples (see Summary Tables) indicate a reasonable degree of repeatability in the laboratory analytical procedures. The following is a listing of split replicate samples:

Shallow Soil Sample Grid

1. SCR-F2-0-1B
2. SCR-L2-0-1B
3. SCR-J3-0-1B
4. SCR-L4-0-1B
5. SCR-E7-0-1B
6. SCR-J7-0-1B
7. SS-3-0-1B
8. SS-13-0-1B

Rail Spur Shallow Soil Samples

1. RR-14-0-1B
2. RR-37-0-1B
3. RR-46-0-1B
4. RR-55-0-1B

Targeted Shallow Soil Samples

1. 1404-SS6-0-1B

Groundwater Samples

1. WO-B4B

Soil Vapor Samples

1. TS-1-B3b
2. TS-4-B3b

Analytical results of all the split replicate samples produced a reasonable degree of repeatability except in the case of the 8270 analysis (S-VOCs) at sample point RR-14. During the sampling, the sample soil sample sleeves were of inadequate volume to provide enough material to perform two sets of analyses. Consequently, split replicates were collected by using the Geo-Probe to drive the sample core in to the soil at a point about 3 to 4 inches away from the initial sample point. It is likely that the discrepancy in S-VOC results in sample RR-14-0-1 is due extremely localized, and laterally discontinuous impact of low levels of S-VOCs, rather than a problem with laboratory procedures.

6.1.3 Equipment Blanks

During soil sampling, equipment blanks were created to verify the reusable sample equipment was being cleaned adequately between uses. Analysis of the resultant samples is summarized as follows:

2/4/08 – No sample - sample containers not available

2/6/08 - Blank sample – EQ1

- 8270 – ND, All Analytes
- 8081b – ND, All Analytes
- CAM-17 – ND, All Analytes
- 8015m – ND, All Analytes

2/7/08 – Blank Sample – EQ2

- 8270 – ND. All Analytes
- 8081b – ND, All Analytes
- CAM-17 – ND, All Analytes
- 8015m – ND, All Analytes

2/12/08 – Blank Sample EQ3

- 8270 – ND, All Analytes
- CAM-17 – ND, All Analytes except:

Barium	66 μg/L
Chromium	4.8 μg/L
Molybdenum	1.1 μg/L

Zinc 17 µg/L

- 8015m – ND, All Analytes

2/13/08 – No Equipment Blank Taken – No sampling equipment was re-used, except for two shallow soil borings in the area of the waste oil storage area.

2/14/08 – No Equipment Blank Taken - Prior blanks were deemed adequate to demonstrate cleanliness of soil sampling equipment.

2/15/08 – No Equipment Blank Taken – No sampling equipment was re-used except for two soil borings in the area of 1404 W. Weber.

2/19/08 – Blank Sample – EQ4

- 8270 – ND, All Analytes
- CAM-17 – ND, All Analytes except:
  Barium 6.3 µg/L
  Chromium 2.3 µg/L
- 8015m – ND – All Analytes

3/30/08 – No Equipment Blank Taken – No Sampling Equipment was re-used.

6.1.4 Trip Blanks

During groundwater sampling, trip blanks were created to verify the field procedures did not result in contamination of samples or sample containers. In the case of soil vapor samples, due to problems pertaining to the supply of suitable sample containers (see Section 5.1 above). Analysis of the resultant samples is summarized as follows:

2/12/08 – Trip Blank 1

- 8270 – ND, All Analytes
- CAM-17 – ND, All Analytes except:
  Barium 9.5 µg/L
  Molybdenum 1.7 µg/L
- 8015m – ND, All Analytes

2/13/08 - Trip Blank 2

- 8270 – ND, All Analytes
- CAM-17 – ND, All Analytes except:
  Barium 8.3 µg/L
  Chromium 1.4 µg/L
  Zinc 9.1 µg/L
- 8015m – ND, All Analytes

2/15/08 No Trip Blank

2/19/08 - Trip Blank 3

- 8270 – ND, All Analytes
- CAM-17 – ND, All Analytes except:
  Barium 5.8 µg/L
- 8015m – ND, All Analytes

Several metals were detected in travel and trip blanks at trace concentrations. These materials may be present to inadequate sample decontamination, or to slightly impure source water. The only metal detected in blank samples that is also a likely site contaminant, is chromium, which was identified in one trip blank and two equipment blanks.

6.1.5 Laboratory QC

Lab Report 802010
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

A number of the 8270 laboratory sample extracts were diluted lest the MS-GC equipment be damaged during the analytical process. The principal reason for the dilution was the presence of discoloration suggestive of oil in the extract. The degree of dilution ranged from none to as high as 10 to 1 for 8270 analyses. An unavoidable result of this dilution is the minimum reporting limit (SQL) for chemicals is increased by an equal factor (see Appendix K). This may have resulted in some chemicals going un-reported, that otherwise would be detectable. No other qualifications or other issues are noted in the report.

One sample, RR-14-1-2, was subjected to additional testing for hexavalent chromium. No QC issues were noted for this sample.

Lab Report 802017
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

A number of the 8270 laboratory sample extracts were diluted lest the MS-GC equipment be damaged during the analytical process. The principal reason for the dilution was the presence of discoloration suggestive of oil in the extract. The degree of dilution ranged from none to as high as 100 to 1 for 8270 analyses. An unavoidable result of this dilution is the minimum reporting limit (SQL) for chemicals is increased by an equal factor (see Appendix K). This may have resulted in some chemicals going un-reported, that otherwise would be detectable.

In sample SS-6-0-1, notations indicate the spike/surrogate was outside of limits due to matrix interference, and the surrogate was diluted out. The LCS was within acceptable ranges. The surrogate deficiencies are not deemed to represent a major data flaw because the Laboratory Control Standard demonstrates the accuracy of the lab procedures. No other qualifications or other issues are noted in the report.

Later, the samples with the highest dilution factors in 8270 analyses were re-run at a dilution factor of 10 to 1, and a supplemental report was provided. At the time, the re-run samples were past the allowable "hold time", but the degradation in sample quality is thought to be minimal.

Lab Report 802019
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

A number of the 8270 laboratory sample extracts were diluted lest the MS-GC equipment be damaged during the analytical process. The principal reason for the dilution was the presence of discoloration suggestive of oil in the extract. The degree of dilution ranged from none to as high as 50 to 1 for 8270 analyses. An unavoidable result of this dilution is the minimum reporting limit (SQL) for chemicals is increased by an equal factor (see Appendix K). This may have resulted in some chemicals going un-reported, that otherwise would be detectable. No other qualifications or other issues are noted in the report.

Lab Report 802034
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

A number of the 8270 laboratory sample extracts were diluted lest the MS-GC equipment be damaged during the analytical process. The principal reason for the dilution was the presence of discoloration suggestive of oil in the extract. The degree of dilution ranged from none to as high as 5 to 1 for 8270 analyses. An unavoidable result of this dilution is the minimum reporting limit (SQL) for chemicals is increased by an equal factor (see Appendix K). This may have resulted in some chemicals going un-reported, that otherwise would be detectable. No other qualifications or other issues are noted in the report.

Lab Report 802038
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

No sample dilutions are reported. No other qualifications or other issues are noted in the report.

Lab Report 802045
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate

analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

A number of the 8270 and 8015 laboratory sample extracts were diluted lest the MS-GC equipment be damaged during the analytical process. The principal reason for the dilution was the presence of discoloration suggestive of oil in the extract. The degree of dilution ranged from none to as high as 100 to 1 for 8270 analyses. An unavoidable result of this dilution is the minimum reporting limit (SQL) for chemicals is increased by an equal factor (see Appendix K). This may have resulted in some chemicals going un-reported, that otherwise would be detectable.

In samples RR-40-0-1 RR-43-0-1 and others with 100 to 1 dilution factors, notations indicate the spike/surrogate was outside of limits due to matrix interference, and the surrogate was diluted out. The LCS was within acceptable ranges. The surrogate deficiencies are not deemed to represent a major data flaw because the Laboratory Control Standard demonstrates the accuracy of the lab procedures. No other qualifications or other issues are noted in the report.

Later, the samples with the highest dilution factors in 8270 analyses were re-run at a dilution factor of 10 to 1, and a supplemental report was provided. At the time, the re-run samples were past the allowable “hold time”, but the degradation in sample quality is thought to be minimal.

Lab Report 802050
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

A number of the 8270 laboratory sample extracts were diluted lest the MS-GC equipment be damaged during the analytical process. The principal reason for the dilution was the presence of discoloration suggestive of oil in the extract. The degree of dilution ranged from none to as high as 50 to 1 for 8270 analyses. An unavoidable result of this dilution is the minimum reporting limit (SQL) for chemicals is increased by an equal factor (see Appendix K). This may have resulted in some chemicals going un-reported, that otherwise would be detectable. No other qualifications or other issues are noted in the report.

Lab Report 802058
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

No sample dilutions are reported. No other qualifications or other issues are noted in the report.

Lab Report 803049
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

No sample dilutions are reported. No other qualifications or other issues are noted in the report.

Lab Report 803070
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

No sample dilutions are reported. No other qualifications or other issues are noted in the report.

Lab Report 804001
Laboratory data sheets describing QC analytical tests indicate that laboratory procedures were of an acceptable quality (see Appendix K). All matrix spike and matrix spike duplicate analytical results were within the acceptable range of recovery for the analytical methods and all laboratory blanks were non-detect for the chemicals of concern.

No sample dilutions are reported. No other qualifications or other issues are noted in the report.

Air Toxics Lab Report 0802410
The RPD of duplicate samples TS-2-B3 and TS-2-B3 lab duplicate exceeded acceptance limits for some species due to target compound concentrations present at less than 5 times the reporting limit. No other qualifications or other issues are noted in the report.

6.2 Chemical Characterization

This sub-section briefly summarizes the nature and extent of chemicals detected in the soil, soil vapor, and groundwater samples for purposes of providing context to the risk assessment.

6.2.1 Chemicals Found in Soil Samples

For the purposes of the risk evaluation, the overall shallow soil population was broken into several sub-groups, depending on the principal source of the contaminant chemicals. Generally, these sub-groups correspond to the sample groups described above, however based on inspection, a number of the sample points from the ½-acre grid of shallow soil

samples are believed to have been affected by lead arsenate spraying of nearby rail spurs. A total of 58 samples from 27 sample points were so designated. The following grid sample points were therefore included as rail spur samples and removed from the ½ acre sample grid population:

SCR-F1	SCR-M2	SCR-G4
SCR-G1	SCR-G3	SCR-I4
SCR-H1	SCR-H3	SCR-J4
SCR-F2	SCR-I3	SCR-K4
SCR-H2	SCR-J3	SCR-L4
SCR-I2	SCR-B4	SCR-M4
SCR-J2	SCR-D4	SCR-D6
SCR-K2	SCR-E4	SCR-D7
SCR-L2	SCR-F4	SCR-E7

Based on the information from the laboratory analytical results (see Summary Tables), the tables below were prepared to summarize the identity of detected chemicals, total number of samples analyzed (including replicates), total number of detections, range of detection limits, and range of concentrations detected for soil samples. In the case of the metals, only concentrations in excess of established background concentrations were considered to represent detections.

The PEA guidance manual (Cal-EPA, 1994) directs that certain Polycyclic Aromatic Hydrocarbons (PAHs) be treated as if they all were the PAH, benzo(a)pyrene. A table in the manual provides toxicity equivalency factors used to convert the toxic effects of various PAH concentrations into an equivalent effect as if the selected PAH was, in fact, banezo(a)pyrene. The pertinent PAH's along with their Toxicity Equivalency Factors (TEF's) to benzo(a)pyrene are:

Chemical	**TEF**
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(j)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Ideno(1,2,3-c,d)pyrene	0.1

In the case of samples with detectable concentrations of any the these chemicals, the TEF was applied to the concentration and the result was added to the detected concentration of benzo(a)pyrene to derive a Toxicity Equivalency Quotient (TEQ). In addition, Bostrom (2002) indicates that a benzo(a)pyrene TEF of 0.0005 may be used as a surrogate for phenanthrene. The table below reflects this process.

Text Table 6.2.1.1 - Soil Sample Characterization Table

Chemical	No. of Spls	No. of Detects Over BG	Range of SQL (mg/Kg)	Range of Reported Concentrations (mg/Kg)
½ Acre Grid w/o Select RR Spls				
Antimony	47	0	2	N/A
Arsenic	47	2	1	1.1 - 18
Barium	47	0	5	N/A
Beryllium	47	1	1	<1 - 130
Cadmium	47	0	0.5	N/A
Chromium	47	3	1	<1 - 31
Cobalt	47	0	1	N/A
Copper	47	4	2	<2 – 9.3
Lead	47	20	1	2.6 - 770
Mercury	47	0	0.5	N/A
Molybdenum	47	25	1	<1 – 2.8
Nickel	47	0	1	N/A
Selenium	47	0	1	N/A
Silver	47	0	1	N/A
Thallium	47	0	1	N/A
Vanadium	47	0	1	N/A
Zinc	47	8	6	19 - 570
TPH-O	47	9	20	<20 – 3,000
Rail Spurs + Select ½ Acre Grid				
Antimony	145	0	2	N/A
Arsenic	145	51	1	2.1 - 450
Barium	145	5	5	<52 - 300
Beryllium	145	0	1	N/A
Cadmium	145	0	0.5	N/A
Chromium	145	4	1	<1 – 1,000
Cobalt	145	1	1	1 – 30
Copper	145	5	2	<2 – 33
Lead	145	32	1	1.2- 360
Mercury	145	0	0.1	N/A
Molybdenum	145	16	1	<1 – 27
Nickel	145	2	1	<1 - 150
Selenium	145	0	1	N/A
Silver	145	0	1	N/A
Vanadium	145	0	1	N/A
Zinc	145	6	5	13 - 220
TPH-O	145	24	20	<20 – 2,500
Acenaphtylene	145	1	0.33-16	<0.33 – 3.6**
Benzo(a)pyrene (TEQ)	145	5	0.33-16	<0.33 – 0.843**
Benzo(g,h,l)perylene	145	4	0.33 - 16	<0.33 – 0.630**
Fluoranthene	145	4	0.33-16	<0.33 – 5.2
Napthalene	145	1	0.33-16	<0.33 – 3.4**
Pyrene	145	5	0.33-16	<0.33 – 0.67**
Dieldrin	86	1	0.002	<0.002 – 0.0046
Soil Spreading Area				
Arsenic	28	0	1	1.6 – 7.9
Barium	28	1	5	80 - 290
Beryllium	28	0	1	N/A
Chromium	28	1	1	2.4 – 53
Cobalt	28	0	1	N/A

Copper	28	0	2	N/A
Lead	28	15	1	4.6 – 6,200
Molybdenum	28	1	1	<1 – 1.9
Nickel	28	0	1	N/A
Vanadium	28	0	1	N/A
Zinc	28	2	5	24 – 1,000
TPH-O	28	5	20	<20 - 110
SCS Shop Area				
Arsenic	12	0	1	N/A
Barium	12	1	5	86 - 230
Beryllium	12	0	1	N/A
Chromium	12	0	1	N/A
Cobalt	12	0	1	N/A
Copper	12	0	2	N/A
Lead	12	2	1	3.2 - 62
Molybdenum	12	1	1	<1 – 1.4
Nickel	12	0	1	N/A
Vanadium	12	0	1	N/A
Zinc	12	1	5	29 – 140
Waste Oil Area				
Arsenic	10	3	1	1.8 - 27
Barium	10	0	5	N/A
Beryllium	10	0	1	N/A
Chromium	10	0	1	N/A
Cobalt	10	0	1	N/A
Copper	10	0	2	N/A
Lead	10	3	1	<1 - 27
Molybdenum	10	2	1	<1 – 2.6
Nickel	10	0	1	N/A
Vanadium	10	0	1	N/A
Zinc	10	0	5	N/A
1404 W Weber				
Arsenic	22	0	1	NA
Barium	22	0	5	N/A
Beryllium	22	0	1	N/A
Chromium	22	0	1	N/A
Cobalt	22	1	1	9.9 - 23
Copper	22	0	2	N/A
Lead	22	6	1	3.7 - 43
Molybdenum	22	12	1	<1 – 1.8
Nickel	22	0	1	N/A
Vanadium	22	0	1	N/A
Zinc	22	0	5	N/A
TPH-D	22	1	5	<5 - 85
2-Methylnapthalene	22	1	0.33	<0.33 – 2.0
Acenaphtylene	22	2	0.33	<0.33 – 4.8
Anthracene	22	1	0.33	<0.33 – 14
Benzo(a)pyrene (TEQ)	22	1	0.33	<0.33 – 4.7
Dibenzofuran	22	1	0.33	<0.33 – 2.5
Fluoranthene	22	2	0.33	<0.33 – 37
Flourine	22	1	0.33	<0.33 – 5.2
Napthalene	22	1	0.33	<0.33 – 3.3
Pyrene	22	2	0.33	<0.33 – 27
Bulk Terminal				
Arsenic	21	3	1	1.4-20
Barium	21	2	5	80 - 280
Beryllium	21	2	1	N/A

Chromium	21	0	1	N/A
Cobalt	21	0	1	N/A
Copper	21	0	2	N/A
Lead	21	1	1	2.8 - 22
Molybdenum	21	2	1	<1 – 2.2
Nickel	21	0	1	N/A
Vanadium	21	0	1	N/A
Zinc	21	0	5	N/A
TPH-D	21	3	5	<5 - 460
Phenol	21	2	0.33	<0.33 – 0.74
n-Butylbenzene	21	1	0.005	<0.005 – 0.013
Sec-Butylbenzene	21	3	0.005	<0.005 – 0.016
Isopropylbenzene	21	1	0.005	<0.005 – 0.006
n-propylbenzene	21	1	0.005	<0.005 – 0.008
1,1,2,2-Tetrachloroethane	21	2	0.005	<0.005 – 0.021
1,1,2 Trichloroethane	21	3	0.005	<0.005 – 0.048
SCS - Building 1				
Chrome	4	3	1	6.2 - 51
Chrome-6	4	1	1	0.57 – 8.8

Note: Detection of Metals include only those above background
** Actual maximum detected is less than maximum SQL due to laboratory sample dilution.

Not all chemicals detected at a site warrant a quantitative evaluation. In many cases, chemicals are detected at so low a concentration as to pose a negligible risk and may be eliminated from further consideration. On the other hand, it cannot be assumed that chemicals that were tested for, but not detected, are altogether absent. In this investigation, several soil samples, due to the dark coloration of the extract, were diluted by as much as 100 to 1, with correspondingly elevated reporting limits or SQLs. Due to the elevated reporting limits, low concentrations of several chemicals may, in effect, be masked by high concentrations of others. For the purposes of this assessment, it is assumed that a chemical detected in any sample within a given sample group is present in all samples at a concentration of ½ the SQL. This is considered an acceptable approach to evaluating chemicals that may be present at less than detectable concentrations (U.S. EPA, 1989).

Various governmental agencies have established screening levels of particular chemicals. The screening levels are, in turn, based on information regarding reference doses and reference concentrations established for the various chemicals. The various sources do not include all possible chemicals and they are not entirely consistent with regard to concentrations below which a particular chemical may be deemed not to represent a potential health hazard. The hierarchy of databases that was used to select screening levels for individual chemicals is:

1. OEHHA Toxicity Criteria Database including all chemicals in the CHHSL database (Cal-EPA, 2005),
2. EPA soil screening levels (EPA SSLs) from EPA-IRIS chemical database including a screening level calculator (http://www.epa.gov/NCEA/iris/intro.htm),
3. The EPA Region 9 PRG Tables (U.S. EPA, 2004), which are based in toxicity information available in the USEPA IRIS list of chemicals.

These sources offer three sets of screening levels (CHHSLs, EPA SSLs, and/or PRGs) for a list of specific contaminants for both residential and industrial-use sites. For purposes of reference, these screening levels have been included in the various summary and text tables dealing with sample analytic data. The screening levels were not, however, used to exclude chemicals from consideration as a potential health risk. All chemicals detected at greater-than-background concentration were further evaluated for their potential health risk.

In general, all chemicals that have been detected in a given sample group and are above background concentrations are considered to be Chemicals of Potential Concern (COPCs). The table below (6.1.1.2) lists detected chemicals, their maximum contaminant concentrations, and the pertinent CHHSLs, EPA SSLs, and PRGs. Included in the following table are Total Petroleum Hydrocarbons (TPH). Strictly speaking, TPH is not a chemical, but rather a mixture that may include many hundreds of chemicals. In general, only the broad range of hydrocarbons present in a given sample are distinguished in TPH analyses. These are usually identified as gasoline, diesel, or oil-range hydrocarbons.

Text Table 6.1.1.2 – Health Screening Levels of Soil Contaminants

Chemical	**Max Conc.** (mg/Kg)	**Background (mg/Kg)**	**CHHSL** (mg/Kg)	**EPA SSL** (mg/Kg)	**EPA PRG** (mg/Kg)
½ Acre Sample Grid w/o Select RR					
Arsenic	113	9.1	0.07	0.39	0.062
Beryllium	130	0.5	150	160	150
Chromium	31	8.2	17 (Cr-6)	39 (Cr-6)	30 (Cr-6)
Copper	9.3	7.4	3,000	3,100	3,000
Lead	770	15	150	400	150
Nickel	82	59	1,600	1,600	1,600
Zinc	570	120	23,000	23,000	23,000
TPH-O	3,000	0	N/A	N/A	N/A
Rail Spurs + Select ½ Acre Grid					
Arsenic	450	9.1	0.07	0.39	0.062
Barium	300	220	4,200	15,000	5,400
Chromium	1,000 (22)#	8.2	17 (Cr-6)	39 (Cr-6)	30 (Cr-6)
Cobalt	30	25	660	23	900
Copper	33	7.4	3,000	3,100	3,000
Lead	360	15	150	400	150
Molybdenum	27	0.5	380	390	390
Nickel	150	59	1,600	1,600	1,600
Zinc	220	120	23,000	23,000	23,000
TPH-O	2,500	0	N/A	N/A	N/A
Acenaphtylene	3.6	0	N/A	N/A	2.1
Benzo(a)pyrene (TEQ)	0.843	0	0.038	0.015	0.062
Benzo(g,h,l)perylene*	0.630	0	N/A	N/A	N/A
Fluoranthene	5.2	0	N/A	2,300	2,300
Napthalene	3.4	0	N/A	3.9	1.7
Pyrene	0.67	0	N/A	1,700	2,300
Dieldrin	0.0046	0	0.035	0.030	0.300
Soil Spreading Area					
Arsenic	7.9	9.1	0.07	0.39	0.062

Barium	290	220	4,200	15,000	5,400
Chromium	53	8.2	17 (Cr-6)	39 (Cr-6)	30 (Cr-6)
Lead	6,200	15	150	400	150
Molybdenum	1.9	0.5	380	390	390
Zinc	1,000	120	23,000	23,000	23,000
TPH-O	110	0	N/A	N/A	N/A
SCS Shop Area					
Barium	230	220	4,200	15,000	5,400
Lead	62	15	150	400	150
Molybdenum	1.4	0.5	380	390	390
Zinc	140	120	23,000	23,000	23,000
Waste Oil Area					
Arsenic	20	9.1	0.07	0.39	0.062
1404 W Weber					
Lead	43	15	150	400	150
Molybdenum	1.8	0.5	380	390	390
Selenium	1.8	0.5	280	390	390
TPH-D	85	0	N/A	N/A	N/A
2-Methylnapthalene	2.0	0	N/A	31	N/A
Acenaphtylene	4.8	0	N/A	N/A	2.1
Anthracene	14	0	N/A	17,000	22,000
Benzo(a)pyrene (TEQ)	4.7	0	0.038	0.015	0.062
Dibenzofuran	2.5	0	N/A	.000037	15
Fluoranthene	37	0	N/A	2,300	2,300
Flourine	5.2	0	N/A	4,700	2,700
Napthalene	3.3	0	N/A	3.9	1.7
Pyrene	27	0	N/A	1,700	2,300
Bulk Terminal					
Arsenic	20	9.1	0.07	0.39	0.062
Barium	280	220	4,200	15,000	5,400
Lead	22	15	150	400	150
Molybdenum	2.2	0.5	380	390	390
TPH-D	460	0	N/A	N/A	N/A
Phenol	0.74	0	N/A	18,000	18,000
n-Butylbenzene	0.013	0	N/A	N/A	240
Sec-Butylbenzene	0.016	0	N/A	N/A	220
Isopropylbenzene	0.006	0	N/A	N/A	570
n-propylbenzene	0.008	0	N/A	N/A	240
1,1,2,2-Tetrachloroethane	0.021	0	N/A	2.0	3.2
1,1,2 Trichloroethane	0.048	0	N/A	0.59	0.73
SCS - Building 1					
Total Chrome	51	8.2	N/A	N/A	N/A
Chrome-6	8.8	N/A	17	39	30

* No screening level has been established by EPA or DTSC Benzo(g,h,i)perylene, however the state of Michigan has established a direct soil contact screening level of 2,500 mg/Kg

\# This sample contains 1,000 mg/Kg of total chromium. Speciation completed by the laboratory indicate only 22 mg/kg of this total is hexavalent chromium.

Screening levels have not been identified for all of the chemicals that were detected in the soil samples. Based on the established background metals concentrations (see Section 8.1), all of the chemicals listed in Table 6.1.1.2 are identified as COPCs.

6.2.2 Chemicals Found in Groundwater Samples

No S-VOCs were detected in any groundwater sample. No samples contained the heavy metals, antimony, beryllium, mercury, silver or thallium. Two samples from the former bulk plant contained trace volatile organic chemicals in association with TPH/TEPH soil detections. Based on the information from the laboratory analytical results (see Summary Tables), the following table was prepared to summarize the identity of detected chemicals, total number of samples analyzed (including replicates), total number of detections, range of detection limits, and range of concentrations detected in groundwater samples.

Text Table 6.2.2.1 - Groundwater Sample Characterization Table

Chemical	No. of Spls	No. of Detects	Range of SQL (µg/L)	Range of Reported Concentrations (µg/L)
Waste Oil Area				
Total Arsenic	6	6	1	2.3 – 5.2
Dissolved Arsenic	6	6	1	2.0 – 5.2
Total Lead	0	0	1	N/A
Dissolved Lead	0	0	1	N/A
Total Cadmium	0	0	1	N/A
Dissolved Cadmium	0	0	1	N/A
Total Chromium	6	6	1	9.9 – 25
Dissolved Chromium	6	6	1	1.8 - 22
Total Barium	6	6	5	91 – 210
Dissolved Barium	6	6	5	79 - 340
Total Cobalt	6	3	1	<1 – 3.8
Dissolved Cobalt	6	4	1	<1 – 3.7
Total Copper	6	3	5	<5 – 8.7
Dissolved Copper	6	3	5	<5 - 11
Total Molybdenum	6	6	1	8.8 – 23
Dissolved Molybdenum	6	6	1	3.9 - 23
Total Nickel	6	4	1	2.1 – 5.9
Dissolved Nickel	6	1	1	<1 – 5.7
Total Selenium	6	6	1	1.0 – 2.0
Dissolved Selenium	6	4	1	<1 – 1.8
Total Vanadium	6	6	1	7.1 – 11
Dissolved Vanadium	6	5	1	<1 – 11
Total Zinc	6	6	5	7.3 – 21
Dissolved Zinc	6	4	5	<5 - 340
1404 W Weber				
Total Arsenic	3	3	1	20 - 64
Dissolved Arsenic	3	3	1	2.2 – 9.8
Total Lead	3	3	1	13 – 27
Dissolved Lead	3	0	1	N/A
Total Cadmium	3	1	1	<1 – 1.1
Dissolved Cadmium	3	0	1	N/A
Total Chromium	3	3	1	10 - 34
Dissolved Chromium	3	3	1	15 - 23
Total Barium	3	3	5	150 - 580
Dissolved Barium	3	3	5	160 – 640
Total Cobalt	3	3	1	79 – 130

Dissolved Cobalt	3	3	1	1.9 – 2.7
Total Copper	3	3	5	7.6 – 23
Dissolved Copper	3	0	5	N/A
Total Molybdenum	3	3	1	1.1 – 2.1
Dissolved Molybdenum	3	3	1	1.5 – 2.9
Total Nickel	3	3	1	59 - 150
Dissolved Nickel	3	2	1	<5 – 6.5
Total Selenium	3	3	1	9 - 17
Dissolved Selenium	3	3	1	2.1 – 3.8
Total Vanadium	3	3	1	24 – 290
Dissolved Vanadium	3	3	1	6.0 – 9.5
Total Zinc	3	3	5	79 – 260
Dissolved Zinc	3	3	5	93 - 240
Bulk Terminal				
Total Arsenic	6	6	1	21 - 42
Dissolved Arsenic	6	6	1	3.4 – 22
Total Lead	6	6	1	9.2 – 59
Dissolved Lead	6	1	1	<1 – 7.9
Total Chromium	6	6	1	8.5 – 24
Dissolved Chromium	6	6	1	5.4 - 13
Total Barium	6	6	5	280 – 2,400
Dissolved Barium	6	6	5	130 – 2,100
Total Cadmium	6	2	1	<1 – 1.3
Dissolved Cadmium	6	0	1	N/A
Total Cobalt	6	6	1	35 – 340
Dissolved Cobalt	6	6	1	1.2 - 44
Total Copper	6	6	5	7.2 – 29
Dissolved Copper	6	1	5	<5 - 14
Total Molybdenum	6	6	1	2.6 – 7.1
Dissolved Molybdenum	6	6	1	2.9 - 13
Total Nickel	6	6	1	61 – 300
Dissolved Nickel	6	5	1	<5 – 70
Total Selenium	6	6	1	5 – 24
Dissolved Selenium	6	5	1	<1 – 9.4
Total Vanadium	6	6	1	16 –61
Dissolved Vanadium	6	6	1	2.4 – 23
Total Zinc	6	6	5	75 – 360
Dissolved Zinc	6	6	5	33 - 140
MTBE	6	2	0.5	<0.5 – 1.6
sec-Butylbenzene	6	1	0.5	<0.5 – 0.8
1,2-Dichloroethane	6	1	0.5	<0.5 – 0.9
1,1,2-Trichloroethane	6	1	0.5	<0.5 – 1.2

Note: No. of Samples includes QA Samples

There is insufficient data to derive statistically valid background concentrations for naturally occurring groundwater contaminants (i.e. metals). The list of COPCs was therefore derived by comparing the laboratory analytical data with maximum contaminant levels (MCLs) as established by Title 22, CCR or by the U.S. EPA. In a few cases, no MCL has been established, and EPA IRIS screening levels have been adopted in lieu of MCLs for these. Metals that are present above the MCL are considered to be Chemicals of Potential Concern (COPCs) initial basis as are all VOC's and S-VOC's. The metals have been tested as both total metals and dissolved metals. Total metals concentrations include the portion of each metal that is adhering to suspended silt and clay, and thus, properly should be considered as a

soil contaminant. Since the suspended solids content is dependent on such factors as extraction rate, soil matrix grain size, and others miscellaneous features, total metals should not be considered as representative of groundwater conditions. Dissolved metals are much more representative of actual groundwater conditions. The following table lists the pertinent MCLs for chemicals identified in the groundwater laboratory analyses:

Text Table 6.2.2.2 – Health Screening Levels of Groundwater Contaminants

Chemical	Max Conc. (µg/L)	MCL (µg/L)
Waste Oil Area		
Dissolved Arsenic	5.2	50
Dissolved Lead	<1	15
Dissolved Chromium	22	50
Dissolved Barium	340	1,000
Dissolved Cadmium	<1	5
Dissolved Cobalt	3.4	11*
Dissolved Copper	11	1,000
Dissolved Molybdenum	23	180*
Dissolved Nickel	5.7	100
Dissolved Selenium	1.8	50
Dissolved Vanadium	11	260*
Dissolved Zinc	340	5,000
1404 W Weber		
Dissolved Arsenic	9.8	50
Dissolved Lead	<1	15
Dissolved Chromium	23	50
Dissolved Barium	640	1,000
Dissolved Cadmium	<1	5
Dissolved Cobalt	2.7	11*
Dissolved Copper	<5	1,000
Dissolved Molybdenum	2.9	180*
Dissolved Nickel	6.5	100
Dissolved Selenium	3.8	50
Dissolved Vanadium	9.5	260*
Dissolved Zinc	240	5.000
Bulk Terminal		
Dissolved Arsenic	22	50
Dissolved Lead	7.9	15
Dissolved Chromium	13	50
Dissolved Barium	**2,100**	1,000
Dissolved Cadmium	<1	5
Dissolved Cobalt	**44**	11*
Dissolved Copper	14	1,000
Dissolved Molybdenum	4.9	180*
Dissolved Nickel	70	100
Dissolved Selenium	9.4	50
Dissolved Vanadium	23	260*
Dissolved Zinc	140	5,000
MTBE	1.6	13
sec-Butylbenzene	0.8	80
1,2-Dichloroethane	**0.9**	0.5
1,1,2-Trichloroethane	1.2	5

* No MCL limit is has been determined. Limit value is from EPA IRIS database.

Based on the information summarized in the table, none of the detected chemicals exceeded MCLs and are this identified as COPCs except as follows:

Text Table 6.2.2.3 – Groundwater COPCs

Area of Interest	***Chemicals of Potential Concern (COPCs)***
Waste Oil Area	No COPCs
1404 W. Weber	Benzo(a)pyrene (TEQ) Dibenzofuran
Bulk Terminal	Barium Cobalt 1,2 Dichlorethane

6.2.3 Chemicals Found in Soil Vapor Samples

Based on the information from the laboratory analytical results (see Summary Tables), the following table was prepared to summarize the identity of detected chemicals, total number of samples analyzed (including replicates), total number of detections, range of detection limits, and range of concentrations detected in soil vapor samples.

Text Table 6.2.3.1 – Soil Vapor Sample Characterization Table

Chemical	No. of Spls	No. of Detects	Range of SQL (μg/M^3)	Range of Reported Concentrations (μg/M^3)
Tank Site 1				
Ethanol	5	1	76 - 150	<76 – <150
Acetone	5	5	96 - 190	320 – 33,000
MethylEthyl Ketone	5	1	31 - 60	<31 - <60
Toluene	5	5	38 - 77	110 – 1,300
Ethylbenzene	5	2	44 - 89	< 44 – 1,000
m,p, Xylene	5	5	44 - 89	84 – 2,200
o Xylene	5	2	44 - 89	<44 - 530
Tank Site 2				
Ethanol	3	1	76 - 86	<76 – 90
Acetone	3	3	96 - 110	330 - 660
Carbon Disulfide	3	1	31 - 36	<31 - 40
MethylEthyl Ketone	3	3	30 - 34	55 - 89
Tetrahydrofuran	3	3	30 - 34	70 - 150
Cyclohexane	3	3	30 - 34	38 - 110
Heptane	3	3	41 - 47	250 - 640
Benzene	3	1	31 - 36	<32 - 83
Toluene	3	1	38 - 43	<38 - 100
Ethylbenzene	3	1	44 - 50	<44 - 56
m,p, Xylene	3	2	44 - 50	<44 - 140
Tank Site 4				
Acetone	5	5	76	160 - 490
MethylEthyl Ketone	5	5	30	40 - 130
Tetrahydrofuran	5	5	30	52 - 82
Cyclohexane	5	3	35	<35 – 50

Heptane	5	5	41	170 - 420
Toluene	5	2	38	<38 - 47
m,p, Xylene	3	3	44	<44 - 95

Note: No. of Samples includes QA Samples

All of the chemicals actually detected are considered to be Chemicals of Potential Concern (COPCs). Shallow soil screening levels are available for consideration of indoor vapor intrusion from the DTSC CHHSLs and from U.S. EPA, (2002). For comparison, the following table lists the pertinent screening levels for chemicals identified in the soil vapor laboratory analyses:

Text Table 6.2.3.2 – Health Screening Levels of Soil Vapor Contaminants

Chemical	Max Conc. ($\mu g/M^3$)	DTSC CHHSL ($\mu g/M^3$)	EPA Screen ($\mu g/M^3$)
Tank Site 1			
Ethanol	<150	N/A	19,000
Acetone	33,000	N/A	35,000
MethylEthyl Ketone	<60	N/A	10,000
Toluene	1,300	135,000	1,100
Ethylbenzene	1,000	N/A	2,200
m,p, Xylene	2,200	317,000	70,000
o Xylene	530	315,000	70,000
Tank Site 2			
Ethanol	90	N/A	19,000
Acetone	660	N/A	35,000
Carbon Disulfide	40	N/A	700
MethylEthyl Ketone	89	N/A	10,000
Tetrahydrofuran	150	N/A	N/A
Cyclohexane	110	N/A	570
Heptane	640	N/A	N/A
Benzene	83	36	310
Toluene	100	135,000	4,000
Ethylbenzene	56	N/A	2,200
m,p, Xylene	140	317.000	70,000
Tank Site 4			
Acetone	490	N/A	35,000
MethylEthyl Ketone	130	N/A	10,000
Tetrahydrofuran	82	N/A	N/A
Cyclohexane	50	N/A	570
Heptane	420	N/A	N/A
Toluene	47	135,000	4,000
m,p, Xylene	95	317,000	70,000

No screening levels have been identified for all of the chemicals that were detected in the soil samples. Based on the information summarized in the table, no chemicals of concern were present in excess of screening levels except for a benzene concentration slightly in excess of the DTSC screening level at tank Site 2, and the measured concentration of acetone was only slightly less than the screening level for Tank Site 1. Additional modeling was conducted for Tanks Site 1 and 2 using the Johnson-Ettinger one-dimensional model. See Section 8.3 for details.

6.2.4 Additional Discussion of COPCs

The laboratory analytical data summarized above clearly indicate that the shallow soil along the former rail spurs (see Figure 4A) has been impacted with elevated concentrations of arsenic and lead. In most cases, the elevated lead concentrations are still below the threshold screening level of 150 mg/Kg, but all arsenic concentrations in excess of the established background concentration of 9.1 mg/Kg are deemed to represent an environmental impairment to the site, and a potential human health hazard. Past investigations of the site that include a historical use element do not suggest that any of the past uses are likely to have entailed the use of lead or arsenic except for the rail spurs. In the past, it was common for railroads to spray a lead arsenate solution along tracks as a weed control measure. We postulate that the elevated lead and arsenic levels are a result of past spraying by the railroad that was responsible for the spurs.

The ½-acre shallow soil sample grid also produced scattered samples with elevated concentrations of metals. The ½-acre shallow soil grid map (Figure 3) shows, however, that the majority of the impacted samples are within a short distance of one of the rail spurs. It seems likely that much of this contamination is actually attributable to the presumed lead arsenate spraying along the rail spurs. Shallow samples from the waste oil area (e.g. WO-B3) also fall into the category of metal-impacted soil lying very near a former rail spur. Metals in soil do not tend to migrate far, but during spraying, the wind could easily have blown droplets of the spray some distance, resulting in the metals near, but not immediately adjacent to, the rail spurs.

Several samples (e.g. screening samples SCR-J8, SCR-F8: Figure 3, and soil spreading area samples SS-12: Figure 6) containing elevated concentrations of metals, primarily lead, lie along the south periphery of the peninsula. These sites are in, or near, a largely unused, weedy area that also is the site of various discarded items. It is possible or likely that these shallow soil impacts are the result of disposal of lead-acid batteries or similar items not related to rail spurs.

The data indicate that two locations have been affected by weathered diesel fuel in the soil. These sites are the former bulk petroleum distribution facility, and the area immediately south of 1404 W. Weber. In both cases, low levels of diesel fuel and S-VOCs are present in the soil, but no impact to the groundwater has been detected except traces of Benzo(a)pyrene and Dibenzofuran at 1404 W. Weber and volatile organics in two sample from the bulk terminal. In the case of 1404 W. Weber, the evidence suggests the contamination is from imported fill material that had already been impacted at the time it was placed at the site. Based on historical aerial photos dating back to 1937, it appears that the material may have been deposited sometime prior to 1937. In the waste oil area, there is no evidence that the storage of oil at the site has impacted the soil or groundwater. Several shallow soil samples (WO-B3-1-2, WO-B4-1-2, WO-B4-7-8, and WO-B5-1-2) exceed the established arsenic

background concentration, but these are attributed to contamination from a former rail spur immediately adjacent.

7.0 OTHER CONSIDERATIONS

7.1 Tank Site 3

As has been documented elsewhere, a former 2,000-gallon gasoline UST at 1541 W. Weber was removed in 1991 (Geo-Phase Environmental, 2007). Confirmation soil sampling indicated the soil was not impacted with petroleum hydrocarbons and there was no evidence the tank leaked (Raney, 2005, vol. 2). The tank was officially closed by the San Joaquin County EHD.

7.2 Closed Chromium Release

Prior to 1988, Building One of the Stockton Cold Storage facility was also the site of an ammonia cooling system that also operated with a brine solution as a secondary refrigerant. The solution contained chromic acid, a chromium-based additive as a corrosion inhibitor. The coolant was circulated through the floor under the building and it was suspected that a leak had occurred between buildings 1 and 2. In a 1993 remedial investigation with RWQCB regulatory oversight, three groundwater monitoring wells were constructed and samples were collected. Filtered groundwater samples did not contain detectable total chromium of hexavalent chromium. In 1995, the Regional Water Quality Control Board officially closed the remedial investigation. In BSK's Phase I ESA (1999), leakage and corrosion were noted in the area of the in a room adjacent to the transfer pumps. Copies of pertinent documents are included in Appendix J. Limited chromium speciation completed for this PEA suggests most of the chromium is trivalent rather than the more toxic hexavalent form.

7.3 McCormick & Baxter Site

The McCormick and Baxter NPL site is not believed to have directly impacted the subject site. The two McCormick and Baxter parcels situated directly adjacent to the east of the Stockton Cold Storage site was formerly used as a storage area for treated wood. This use has resulted in the shallow soil on these parcels being impacted by elevated concentrations of arsenic. (See U.S. EPA, 1999, Record of Decision.) Wind-borne dust from the McCormick and Baxter parcels could adversely affect future residents if the arsenic-impacted dust were inhaled. This situation could pose an on-going environmental issue for possible future residents, unless adequately mitigated.

An EPA-approved remedial action plan calls for the excavation and removal of the arsenic-impacted shallow soil. The soil is to be placed on the main McCormick and Baxter site south of Old Mormon Slough. Reportedly, this work is to be completed during this calendar year.

7.4 Culhane Site

Owing to the denial of access discussed elsewhere, the past history and current conditions on the Culhane property are only poorly understood. Bases on what is known of the site, the principal area of concern lies with former rail spurs that have transected the property. The spurs are likely to have resulted in impacts to soil similar to those described for the CRV Enterprises and Stockton Cold Storage sites.

8.0 HUMAN HEALTH SCREENING EVALUATION

8.1 Background Concentrations

As described in the sample plan (Geo-Phase Environmental, 2008), the only chemicals tested for that were deemed likely to have detectable background concentrations were the seventeen (CAM-17) contaminant heavy metals, which are all naturally occurring chemicals. All the organic chemicals are produced artificially, and would not be expected to be present naturally.

From the main body of laboratory data, the actual CAM-17 analytical results were compared with the DTSC-established screening levels (CHHSLs) as set forth in Cal-EPA, 2005. The screening levels are the soil concentrations above which additional investigation may be indicated. The following table summarizes the maximum soil concentrations of the CAM-17 metals found in this investigation and compares them with the corresponding screening level (CHHSL):

Text Table 8.1.1 - CAM –17 Residential Soil Screening Levels

CAM-17 Metal	Maximum Detected (from all spls)	Screening Level (Residential CHHSL)
Antimony	ND<2.0 mg/Kg	30 mg/Kg
Arsenic	120 mg/Kg	0.07 mg/Kg
Barium	300 mg/Kg	5,200 mg/Kg
Beryllium	ND<1 mg/kg	150 mg/Kg
Cadmium	ND<1 mg/Kg	1.7 mg/Kg
Chromium	1,000 mg/Kg	17 mg/Kg (Cr-6)
Cobalt	30 mg/Kg	660 mg/Kg
Copper	33 mg/Kg	3,000 mg/Kg
Lead	770 mg/Kg	150 mg/Kg
Mercury	ND<0.1 mg/Kg	18 mg/Kg
Molybdenum	27 mg/Kg	380 mg/Kg
Nickel	150 mg/Kg	1,600 mg/Kg
Selenium	1.8 mg/Kg	380 mg/Kg
Silver	ND<1 mg/Kg	380 mg/Kg
Thallium	ND<1 mg/Kg	5 mg/Kg
Vanadium	31 mg/Kg	530 mg/Kg
Zinc	1,000 mg/Kg	23,000 mg/Kg

Note: the CHHSL for chromium applies to hexavalent chrome

Clearly, some detected metals concentrations far exceed the screening levels and it was therefore important to establish actual maximum background concentrations. In some cases, soil screening levels may be exceeded by the naturally occurring background concentrations. For example, the Cal-EPA soil screening level for arsenic of 0.07 mg/Kg is much lower than the naturally occurring, arsenic background concentrations for most California soils. Based on one government soil study (LBNL, 1995), it was noted that the upper bound background concentrations for arsenic in the soils of the San Francisco Bay Area is as high as 19.1 mg/Kg, or more than 200 times the Cal-EPA screening level. In cases such as this, it is generally accepted that naturally occurring hazardous materials are not considered as

contamination, and the appropriate "action level" is the maximum background level of the naturally occurring material.

In an initial attempt to establish background concentrations of the metals, a group of 10 sample points were selected for the sampling plan. The points were placed at locations believed unlikely to have been contaminated. The samples from these points were tested for the background concentrations of the various CAM-17 heavy metals. One of the planed background sample points was situated on the Culhane property, and insofar as Mr. Culhane ultimately declined to grant permission to enter the premises for purposes of sample collection, only 9 of the 10 proposed background sample points were occupied and sampled. The following table summarizes the laboratory analytical results for arsenic, lead, and chromium of the nine background samples (See laboratory data sheets in Appendix K, and Figure 7 for sample locations).

Text Table 8.1.2 – Background Sample Results

Sample I.D.	Arsenic	Lead	Chromium
BG-1	8.4 mg/Kg	29 mg/Kg	6.2 mg/Kg
BG-2	5 mg/Kg	6.1 mg/Kg	6.7 mg/Kg
BG-3	3 mg/Kg	3.8 mg/Kg	6.2 mg/Kg
BG-4	NOT COLLECTED - ON CULHANE PROPERTY		
BG-5	6.4 mg/Kg	27 mg/Kg	4.8 mg/Kg
BG-6	7.8 mg/Kg	68 mg/Kg	5.3 mg/Kg
BG-7	3.2 mg/Kg	9 mg/Kg	6.9 mg/Kg
BG-8	3.2 mg/Kg	19 mg/Kg	6.1 mg/Kg
BG-9	3.5 mg/Kg	3.3 mg/Kg	4.9 mg/Kg
BG-10	5.1 mg/Kg	580 mg/Kg	13 mg/Kg

At a glance, it is apparent that samples BG-1, BG-5, BG-6, and especially BG-10 are can not actually be representative of background conditions. Since 5 of the 9 samples are clearly not at background condition, these sample results cannot be safely relied on for establishing background concentrations for the metals. Instead, a statistical analysis was used as a substitute method of establishing the background concentration.

The suite of samples from the ½-acre sample grid represents a systematic, and statistically significant sample population of the entire study area. The analysis begins with the assumption that the concentration of a naturally occurring chemical will follow a statistically "normal" distribution pattern. If, however, there is contamination present, the distribution of a contaminant will tend to follow a "bimodal", and non-normal distribution. In general, the samples that have been contaminated with a given material will fall above and outside the normal distribution of a naturally occurring distribution of the same chemical.

The U.S.EPA software known as Pro-UCL (U.S. EPA, 1994) was employed to evaluate the distribution of the CAM-17 metals in the sample population. This program is intended to evaluate a group of sample results and assess the "exposure point" concentration of a given chemical, but one of the functions of the program is an application that evaluates a group of

data points and evaluates whether it represents a normal distribution. The data set of concentrations of each of the CAM-17 metals from the ½-acre sample grid was input to the program, to test whether the distribution was normal. In cases where it was not normal, the sample(s) with the highest concentrations were sequentially removed until the program indicated that the remaining sample population was normally distributed. A metals background worksheet is attached as Appendix E. In some cases, there were few or no detections, and the in these cases the background was established as ½ of the laboratory reporting limit. The following table summarizes the results of the analysis:

Text Table 8.1.3 – Background Metals Concentrations (from ½ Acre Sample Grid)

Metal	Max. Detected (from all spls)	Max Detected (½-acre grid)	No. Detects In Grid	Derived B.G. Conc.
Antimony	ND<2.0 mg/Kg	ND<2.0 mg/Kg	0 of 104	1 mg/Kg (=1/2 MDL)
Arsenic	120 mg/Kg	120 mg/Kg	104 of 104	9.1 mg/Kg
Barium	300 mg/Kg	300 mg/Kg	104 of 104	220 mg/Kg
Beryllium	130 mg/kg	130 mg/kg	1 of 104	0.5 mg/Kg (=1/2 MDL)
Cadmium	ND<1 mg/Kg	ND<1 mg/Kg	0 of 104	0.5 mg/Kg (=1/2 MDL)
Chromium	1,000 mg/Kg	1,000 mg/Kg	103 of 104	8.2 mg/Kg
Cobalt	30 mg/Kg	25 mg/Kg	104 of 104	25 mg/Kg
Copper	33 mg/Kg	9.1 mg/Kg	103 of 104	7.4 mg/Kg
Lead	770 mg/Kg	770 mg/Kg	104 of 104	15 mg/Kg
Mercury	ND<0.1 mg/Kg	ND<0.1 mg/Kg	0 of 104	0.05 mg/Kg (=1/2 MDL)
Molybdenum	27 mg/Kg	27 mg/Kg	20 of 104	0.5 mg/Kg (=1/2 MDL)
Nickel	150 mg/Kg	95 mg/Kg	103 of 104	59 mg/Kg
Selenium	1.8 mg/Kg	ND<1 mg/Kg	0 of 104	0.5 mg/Kg (=1/2 MDL)
Silver	ND<1 mg/Kg	ND<1 mg/Kg	0 of 104	0.5 mg/Kg (=1/2 MDL)
Thallium	ND<1 mg/Kg	ND<1 mg/Kg	0 of 104	0.5 mg/Kg (=1/2 MDL)
Vanadium	31 mg/Kg	12 mg/Kg	104 of 104	17 mg/Kg
Zinc	1,000 mg/Kg	100 mg/Kg	104 of 104	120 mg/Kg

In the case of barium, no normally distributed grouping could be established. This appears to be caused by the way the reported concentrations tend to step in increments of 10 mg/Kg (e.g. 110 mg/Kg to 120 to 130, etc.). The stepwise reporting results in an apparent absence of randomness, and Pro-UCL interprets this as a non-normal distribution. In absence of a maximum normal concentration, the mean value plus two standard deviations was taken to represent a concentrations expected to be close to the maximum normal concentration. From basic statistics theory, 68 percent of a normal population will fall within the standard deviation of the mean, and 95 percent will fall within two standard deviations. The background concentration of 220 mg/Kg in the table above reflects the mean concentration plus 2 standard deviations.

The background concentrations of metal in groundwater remain unknown due to the absence of a statically significant number of samples.

Based on the data summarized in the above table, the metals arsenic, barium, beryllium chromium, copper, lead, molybdenum, nickel, vanadium and zinc were deemed worthy of additional evaluation owning to detections in excess of the background concentrations.

8.2 Exposure Pathways and Media of Concern

Exposure assessment is the process of describing, measuring or estimating the intensity, frequency, and duration of potential human exposure to chemicals of potential concern (COPCs) in environmental media (e.g., soil, water and air) at a site. This section of the report discusses the mechanisms by which people (receptors) might come in contact with COPCs at the site. The exposure assessment follows the recommendations for conducting an exposure assessment provided in the U.S. EPA's "Risk Assessment Guidance for Superfund" ("RAGS"; U.S. EPA, 1989), and the more recent guidance in U.S. EPA's "Guidelines for Exposure Assessment" (U.S. EPA, 1992), principally as they are applied in the human risk assessment program known as CalTOX (Cal-EPA, 1993) and in the Johnson-Ettinger vapor intrusion model (U.S EPA, 2003). In accordance with U.S. EPA (1989), an exposure assessment consists of three basic steps:

- Characterization of the exposure setting (physical environment and potential receptors).
- Identification of exposure pathways (potential sources, points of release, and exposure routes).
- Quantification of pathway-specific exposures (exposure point concentrations and intake (dose) assumptions).

The purpose of the first step is to characterize the salient features of the site that might influence current or future human exposure to COPCs and to identify potential receptors. Potential pathways of human exposure are identified in the second step by characterizing the sources of COPCs released to the environment, points of release, and potential exposure routes. In the third step, the qualitative information from the first two steps is integrated with estimates of exposure concentrations and intake assumptions to quantitatively estimate exposure (dose). The CalTOX model is capable of performing all of these functions for soils, and the Johnson-Ettinger model performs a similar function for vapor intrusion from volatile organics entrained in soil.

Exposure assessment is conducted within the context of a site conceptual model (SCM). As described in DTSC's PEA Guidance Manual (Cal-EPA, 1994), the purpose of the SCM is to describe what is known about chemical sources, migration pathways, exposure routes, and possible exposure scenarios. Figure 8 presents the SCM developed for the site.

An exposure pathway is a description of the mechanism by which an individual may come into contact with COPCs in the environment. In accordance with U.S. EPA RAGS (U.S. EPA, 1989), all potential exposure pathways applicable to the site have been identified and addressed. An exposure pathway is defined by four elements (U.S. EPA, 1989):

1. A source and mechanism of COPC release to the environment;
2. An environmental receiving or transport medium (e.g., air, soil) for the

released COPC;

3. A point of potential contact with the medium of concern; and
4. An exposure route (e.g., inhalation, ingestion) at the contact point.

An exposure pathway is considered "complete" if all elements are present, and only complete exposure pathways need be evaluated. The characterization of the potential exposure pathways at the site based on existing information is presented in the SCM in Figure 8.

Based upon the COPC-affected media and migration pathways (Figure 8), points of potential human contact with site-related COPCs include surface water, ambient (outdoor) air with dust-borne contaminants, and direct soil contact. If the site is developed, indoor air could also become a pathway. Ingestion of groundwater could also be a pathway, but there is no nearby water production well that would offer a point of contact, nor is it expected that such wells would be drilled in the future.

Potential exposure routes associated with the air are through dust inhalation or ingestion, and inhalation of fumes of volatile chemicals. Direct dermal contact or ingestion of impacted soil are routes associated with the soil media. Potential exposure routes associated with affected water consist of dermal contact or ingestion with groundwater or surface water (primarily storm water). Some of the COPCs are volatile, especial in regard to the former UST sites, and inhalation of vapors is considered as a likely exposure pathway.

Given the characteristics of the COPCs and release processes discussed above, the potential exposure pathways for the proposed future residential land use of the site are presented below. The residents are generally assumed to be at the site 16 hours per day, 350 days per year for 70 years.

8.3 Exposure Point Concentrations and Chemical Groups

The concentrations of chemicals at specific exposure points will vary over space and time. However, a single estimate of an exposure point concentration is required for risk assessment calculations consistent with PEA Guidelines (Cal-EPA, 1994). This single value must be representative of the average concentration to which a person would be exposed over the duration of the exposure.

Exposure point concentrations are generally estimated from measured concentrations in environmental media, or estimated based on fate and transport models. Depending on a number of factors, including the distribution of the data, the proportion of the samples reported as non-detect, and the total number of samples, there are several statistical algorithms that may be used to estimate exposure point concentrations. U.S. EPA Supplemental RAGS guidance (U.S. EPA, 1992) stipulates that the exposure point concentration estimates should be based on the 95 percent upper confidence limit (95% UCL) of the mean to estimate an exposure scenario. In the event that the calculated 95% UCLs exceeds the maximum detected value, the maximum value may be used as the exposure point concentration (U.S. EPA, 1989).

The presence of a chemical in some, but not all, samples suggests that it may also be present in the non-detect samples at some concentration between zero and the sample quantitation limit (SQL) for each sample. There are several methods for estimating the concentration in these non-detect samples (U.S. EPA, 1992). These include simple substitution methods, distributional methods, and robust statistical methods. The default position of U.S. EPA (1989) is to substitute ½ the SQL for all non-detects. U.S. EPA (1992) guidance indicates that the substitution of ½ the SQL is adequate when the proportion of non-detect samples is less than 10 to 15 percent. If the fraction of non-detects becomes large, then assuming that the value of each non-detect is equal to ½ SQL will nearly always result in a substantial over-estimation of the mean of such data sets, with the degree of overestimation increasing with increasing proportions of non-detects.

The use of ½ SQL values for non-detect samples was used in this PEA. It must be noted however, that due to the high dilutions used in some of the method-8270 sample extracts, this convention almost certainly has resulted in a considerable over-estimate of some exposure point concentrations of semi-volatile organic compounds.

Soil

Contaminated soil has been broken down into one of several areas using the general categories set forth in Text Table 6.2.1.1. The U.S. EPA has generated an Excel-based program known as Pro-UCL, version 3.0 (US-EPA, 1994) that takes any series of contaminant concentrations, and performs a suite of statistical analyses on them to generate a best-fit 95% UCL exposure point concentration for each chemical. The 95% UCLs are calculated using a variety of methods, and based on the statistical distribution, the program recommends which calculated UCL value is best suited to the available data. For the purposes of operating the Pro-UCL program, it was assumed that the soil analyses fell into one of several populations, in general accordance with the source areas identified above.

In sample groups with less than a statistically valid sample population (e.g. 1404 soil boring samples), the default assumption is made that the highest detected concentration is representative of the entire exposure point. The table below represents the various source areas that were considered, along with the respective COPCs and the imputed exposure point concentrations. As discussed above, the minimum value input into the sample distribution is ½ the SQL value.

The Pro-UCL program's statistical analysis indicates that the distribution of a number of the various chemicals do not follow normal distribution curves, and are considered non-parametric. Non-parametric distributions are typical when a sample population contains a minority of samples with significantly elevated contaminant concentrations. In several cases, the Pro-UCL-derived exposure point concentration (Appendix F) was considerably greater than the maximum measured concentration. In these cases, the greatest actual concentration was used as the exposure point concentration. The following table summarizes the exposure point concentrations derived using the Pro-UCL software:

Text Table 8.3.1 - Imputed Mean Soil Exposure Point Concentrations

Chemical & Group	95% UCL	Method
½ Acre Sample Grid w/o Select Spls		
Arsenic	5.75 mg/Kg#	Approx. Gamma UCL
Beryllium	15.3 mg/Kg	95% Chebychev UCL
Chromium	9.4 mg/Kg	95% Chebychev UCL
Copper	4.7 mg/Kg	Students-t UCL
Lead	200 mg/Kg	99% Chebychev UCL
Nickel	32.3 mg/Kg#	Approx. Gamma UCL
Zinc	119 mg/Kg#	95% Chebychev UCL
TPH-O	822 mg/Kg	99% Chebychev UCL
Rail Spurs with Select ½ Acre Grid Spls		
Arsenic	48.0 mg/Kg	95% Chebychev UCL
Barium	143.6 mg/Kg#	Approx Gamma UCL
Chromium	41.1 mg/Kg	95% Chebychev UCL
Cobalt	12.7 mg/Kg#	Students-t UCL
Copper	4.7 mg/Kg#	95% Chebychev UCL
Lead	36.6 mg/Kg	97.5% Chebychev UCL
Molybdenum	1.09 mg/Kg	Students-t UCL
Nickel	38.3 mg/Kg#	95% Chebychev UCL
Zinc	62.0 mg/Kg#	95% Chebychev UCL
TPH-O	175.0 mg/Kg	97.5% Chebychev UCL
Acenaphtylene	1.086 mg/Kg	95% Chebychev UCL
Benzo(a)pyrene (TEQ)	0.869 mg/Kg	Max Detect *
Benzo(g,h,l)perylene	0.630 mg/Kg	Max Detect *
Fluoranthene	5.2 mg/Kg	Max Detect *
Napthalene	3.4 mg/Kg	Max Detect *
Pyrene	0.67 mg/Kg	Max Detect *
Dieldrin	1.07 μg/Kg	Students-t UCL
Soil Spreading Area		
Arsenic	4.0 mg/Kg#	Approx. Gamma UCL
Barium	184 mg/Kg#	Students-t UCL
Chromium	12.6 mg/Kg	95% Chebychev UCL
Lead	2,438 mg/Kg	99% Chebychev UCL
Molybdenum	0.64 mg/Kg	Students-t UCL
Zinc	235 mg/Kg	95% Chebychev UCL
TPH-O	49.5 mg/Kg	95% Chebychev UCL
SCS Shop Area		
Barium	159 mg/Kg#	Students-t UCL
Lead	25.2 mg/Kg	95% H-UCL
Molybdenum	0.73 mg/Kg	Students-t UCL
Zinc	65.0 mg/Kg#	Students-t UCL
Waste Oil Area		
Arsenic	15.3 mg/Kg	Students-t UCL
1404 W Weber		
Lead	17.8 mg/Kg	Approx. Gamma UCL
Molybdenum	1.05 mg/Kg	Students-t UCL
Selenium	0.66 mg/Kg	Students-t UCL

TPH-D	22.6 mg/Kg	95% Chebychev UCL
2-Methylnapthalene	0.61 mg/Kg	95% Chebychev UCL
Acenaphtylene	1.31 mg/Kg	95% Chebychev UCL
Anthracene	3.54 mg/Kg	95% Chebychev UCL
Benzo(a)pyrene (TEQ)	1.26 mg/Kg	95% Chebychev UCL
Dibenzofuran	0.73 mg/Kg	95% Chebychev UCL
Fluoranthene	18.5 mg/Kg	99% Chebychev UCL
Fluorine	1.39 mg/Kg	95% Chebychev UCL
Napthalene	0.929 mg/Kg	95% Chebychev UCL
Pyrene	13.53 mg/Kg	99% Chebychev UCL
Bulk Terminal		
Arsenic	8.6 mg/Kg	Approx. Gamma UCL
Barium	173 mg/Kg#	Students-t UCL
Lead	10.7 mg/Kg#	95% Chebychev UCL
Molybdenum	0.8 mg/Kg	Students-t UCL
TPH-D	263 mg/Kg	99% Chebychev UCL
TPH-G	N/A**	N/A**
Phenol	270 mg/Kg	95% Chebychev UCL
n-Butylbenzene	4.1 mg/Kg	Students-t UCL
Sec-Butylbenzene	9.0 mg/Kg	95% Chebychev UCL
Isopropylbenzene	3.0 mg/Kg	Students-t UCL
n-propylbenzene	3.3 mg/Kg	Students-t UCL
1,1,2,2-Tetrachloroethane	8.8 mg/Kg	95% Chebychev UCL
1,1,2 Trichloroethane	26.9 mg/Kg	95% Chebychev UCL
SCS - Building 1		
Total Chrome	51 mg/Kg	Max Detect
Chrome-6	8.8 mg/Kg	Max Detect

* Max Detect is used in cases where UCL exceeds maximum detected concentration
** Gasoline range TPH is a minor constituent of the same samples that contain greater concentrations of diesel. This material is considered diesel that has a light fraction that falls into the gasoline range, and is not considered a separate COPC.
\# 95% UCL is less than background concentration.

In some cases with metals, the 95% UCL exposure point concentration is lower than the established background concentration. In these cases, the chemical drops out as a COPC.

The UCL for the soil spreading area (2,438 mg/Kg) is extremely high due to the presence of 6,000 mg/Kg in a single soil sample. This is not believed to be representative of the area, and the most likely cause of this result is disposal of an automotive battery of other singular item in the immediate area of the sample point in question.

As discussed above, chromium occurs in two valance states. The trivalent state is nearly non-toxic. The screening values for chromium described elsewhere in this report are for the more toxic, hexavalent (chrome-6) form. Hexavalent chromium is a strong oxidizer and is readily reduced to the trivalent form in the presence of electron donors such as ferrous iron. Several soil samples containing chromium were speciated for this ESA, and the limited available data suggest that most of the chromium is in the almost-non-toxic trivalent state. One soil sample contained 1,000 mg/Kg of total chrome, but none of it was hexavalent chrome.

Groundwater

As discussed above, background concentrations of metals in the groundwater remain unknown. In the absence of background information, those metals that exceed MCL limits are considered COPCs. All detected organic chemicals are also considered COPCs. The following lists the COPCs and imputed exposure point concentrations:

Text Table 8.3.2 - Imputed Groundwater Exposure Point Concentrations

Chemical	EPC (mg/Kg)	**Method**
Bulk Terminal		
Dissolved Barium	**2,100**	Max Detect
Dissolved Cobalt	**44**	Max Detect
MTBE	1.6	Max Detect
sec-Butylbenzene	0.8	Max Detect
1,2-Dichloroethane	**0.9**	Max Detect
1,1,2-Trichloroethane	1.2	Max Detect

Soil Vapor

The three soil vapor surveys conducted at three closed leaking UST sites all detected residual gasoline and other volatiles in the interstitial soil vapor. Tank sites 1 and 2 yielded soil vapor analytical results adequate to justify additional modeling to investigate potential human health concerns, although no contaminants at Tank Site 1 reached screening levels. Neither site has adequate samples to constitute a statistically valid sample density, and consequently, the highest measured concentration of each modeled chemical was used as shown in the following table:

Text Table 8.3.3 - Imputed Mean Soil Vapor Exposure Point Concentrations

Chemical	**EPC** ($\mu g/M^3$)	**Source**
Tank Site 1		
Acetone	33,000	Max Detect
Toluene	1,300	Max Detect
Ethylbenzene	1,000	Max Detect
m,p, Xylene	2,200	Max Detect
o Xylene	530	Max Detect
Tank Site 2		
Ethanol	90	Max Detect
Acetone	660	Max Detect
Carbon Disulfide	40	Max Detect
MethylEthyl Ketone	89	Max Detect
Tetrahydrofuran	150	Max Detect
Cyclohexane	110	Max Detect
Heptane	640	Max Detect
Benzene	83	Max Detect
Toluene	100	Max Detect
Ethylbenzene	56	Max Detect
m,p, Xylene	140	Max Detect
Tank Site 4		

Acetone	490	Max Detect
MethylEthyl Ketone	130	Max Detect
Tetrahydrofuran	82	Max Detect
Cyclohexane	50	Max Detect
Heptane	420	Max Detect
Toluene	47	Max Detect
m,p, Xylene	95	Max Detect

8.4 Toxicity Values, the CalTOX Model, and TPH Risk Assessment

Toxicity Values

The "Annual Average Daily Dose" (AADD) or "Lifetime Average Daily Dose" (LADD) are the general parameters used to quantify exposure doses in site risk assessments. The AADD is used as a standard measure for characterizing long-term non-carcinogenic effects. The LADD addresses exposures that may occur over durations varying from a single event to an average 70-year human lifetime and are used to estimate potential carcinogenic risks.

The equations for calculating AADD and LADD for inhalation exposures are those presented by the U.S. EPA in their 1989 RAGS guidance (U.S. EPA, 1989) and are incorporated in the CalTOX model (Cal-EPA, 1993).

The purpose of the toxicity assessment is twofold (U.S. EPA, 1989):

- Hazard Identification evaluates the potential for a chemical to cause adverse health effects in exposed individuals, based on available information; and
- Dose-Response Assessment estimates the relationship between the extent of exposure and the increased likelihood and/or severity of adverse health effects.

Hazard identification entails determining if a chemical can cause an increase in a particular adverse effect (e.g., cancer) and the likelihood that the adverse effect will occur in humans. The result of hazard identification is a profile of the available toxicological information and its relevance to human exposure under conditions present in the environment.

Dose-response assessment entails quantifying the relationship between the dose of a chemical and the incidence of adverse effects in the exposed population. The results of the dose response assessment are toxicity criteria that are used in the risk characterization to estimate the likelihood of adverse effects occurring in humans at different exposure levels. The toxicity criteria and methods used to evaluate non-carcinogenic and carcinogenic health risks are commonly referred to as reference doses (RfDs) and slope factors (SFs), respectively. The bases for these criteria are described briefly in the following sections.

Cal-TOX Model

The potential health effects of the COPCs in soils identified in the PEA were evaluated using the CalTOX (v.4.0 Beta) health risk-modeling program, which was produced for the State of

California (McKone & Enoch, 2004). The CalTOX software includes toxicity and other information for a number of common contaminants including the majority of chemicals herein identified as COPCs. Several organic chemicals are, however, not in the database. In most of these, a toxicological surrogate has been used as noted in the table. Isopropylbenzene is also known as cumene and is identified as such in the Cal-TOX database. Isoproplbenzene and the butylbenzenes have also been replaced by cumene as a surrogate, and naphthalene is used as a surrogate for 2-methylnapthalene.

In the case of the metals, the maximum background concentration was subtracted from the EPC to derive an estimate of the actual contaminant concentration above background.

The following table summarizes the various exposure point concentrations used in the CalTOX software.

Text Table 8.4.1 – Exposure Point Concentrations Used in CalTOX

Chemical	95% UCL	Over Background	Comment
½ Acre Sample Grid w/o select spls			
Beryllium	15.3 mg/Kg	14.7 mg/Kg	Included in CalTOX
Chromium	9.4 mg/Kg	1.2 mg/Kg	Included in CalTOX
Lead	200 mg/Kg	185 mg/Kg	Included in CalTOX
TPH-O	822 mg/Kg	822 mg/Kg	NOT Included in CalTOX
Rail Spurs w/ Select Spls			
Arsenic	48.0 mg/Kg	38.9 mg/Kg	Included in CalTOX
Chromium	41.1 mg/Kg	32.9 mg/Kg	Included in CalTOX
Lead	36.6 mg/Kg	21.6 mg/Kg	Included in CalTOX
Molybdenum	1.09 mg/Kg	0.59 mg/Kg	Included in CalTOX
TPH-O	175 mg/Kg	175 mg/Kg	NOT Included in CalTOX
Acenapthylene	1.1 mg/Kg	1.1 mg/Kg	Included in CalTOX
Benzo(a)pyrene (TEQ)	0.84 mg/Kg	0.84 mg/Kg	Included in CalTOX
Fluoranthene	5.2 mg/Kg	5.2 mg/Kg	Included in CalTOX
Napthalene	3.4 mg/Kg	3.4 mg/Kg	Included in CalTOX
Pyrene	0.67 mg/Kg	0.67 mg/Kg	Included in CalTOX
Dieldrin	1.07 μg/Kg	1.07 μg/Kg	Included in CalTOX
Soil Spreading Area			
Chromium	12.6 mg/Kg	4.2 mg/Kg	Included in CalTOX
Lead	2,438 mg/Kg	2,423 mg/Kg	Included in CalTOX
Molybdenum	0.64 mg/Kg	0.14 mg/Kg	Included in CalTOX
Zinc	235 mg/Kg	115 mg/Kg	Included in CalTOX
TPH-O	49.5 mg/Kg	49.5 mg/Kg	NOT Included in CalTOX
SCS Shop Area			
Lead	25.2 mg/Kg	10.2 mg/Kg	Included in CalTOX
Molybdenum	0.73 mg/Kg	0.23 mg/Kg	Included in CalTOX
Waste Oil Area			
Arsenic	15.3 mg/Kg	6.4 mg/Kg	Included in CalTOX
1404 W. Weber			
Lead	17.8 mg/Kg	2.8 mg/Kg	Included in CalTOX

Molybdenum	1.05 mg/Kg	0.55 mg/Kg	Included in CalTOX
Selenium	0.66 mg/Kg	0.16 mg/Kg	Included in CalTOX
TPH-D	22.6 mg/Kg	22.6 mg/Kg	NOT Included in CalTOX
2-Methylnapthalene	0.61 mg/Kg	0.61 mg/Kg	Use Napthalene as surrogate
Acenaphtylene	1.31 mg/Kg	1.31 mg/Kg	Included in CalTOX
Anthracene	3.54 mg/Kg	3.54 mg/Kg	Included in CalTOX
Benzo(a)pyrene (TEQ)	1.26 mg/Kg	1.26 mg/Kg	Included in CalTOX
Dibenzofuran	0.73 mg/Kg	0.73 mg/Kg	Use 2,3,7,8 TCDF as Surrogate
Fluoranthene	18.5 mg/Kg	18.5 mg/Kg	Included in CalTOX
Fluorine	1.39 mg/Kg	1.39 mg/Kg	Included in CalTOX
Napthalene	0.93 mg/Kg	0.93 mg/Kg	Included in CalTOX
Pyrene	13.53 mg/Kg	13.53 mg/Kg	Included in CalTOX
Bulk Terminal			
Molybdenum	0.8 mg/Kg	0.3 mg/Kg	Included in CalTOX
TPH-D	263 mg/Kg	263 mg/Kg	NOT Included in CalTOX
Phenol	270 mg/Kg	270 mg/Kg	Included in CalTOX
n-Butylbenzene	4.1 mg/Kg	4.1 mg/Kg	Use Cumene as Surrogate
Sec-Butylbenzene	9.0 mg/Kg	9.0 mg/Kg	Use Cumene as Surrogate
Isopropylbenzene	3.0 mg/Kg	3.0 mg/Kg	Same as Cumene in CalTOX
n-propylbenzene	3.3 mg/Kg	3.3 mg/Kg	Use Cumene as Surrogate
1,1,2,2-Tetrachloroethane	8.8 mg/Kg	8.8 mg/Kg	Included in CalTOX
1,1,2 Trichloroethane	26.9 mg/Kg	26.9 mg/Kg	Included in CalTOX
SCS - Building 1			
Total Chrome	51 mg/Kg	42.8 mg/Kg	Included in CalTOX
Chrome-6	8.8 mg/Kg	0.6 mg/Kg	Included in CalTOX

TPH Risk Assessment

As suggested in the preceding table, the Cal-TOX does not include toxicity information for Total Petroleum Hydrocarbons (TPH). This is due primarily to the fact the TPH is not a chemical, but rather a complex, and highly variable mixture of hundreds of chemicals. The variability and complexity is such that assigning health risk has generally been considered impossible. This situation is, however, changing although TPH treatment is still in a state of flux. The DTSC has developed guidance documents on TPH risk assessment, but it is in draft form and has not been released to the public. On an interim basis, the agency has recommended consideration of a guidance document offered by the Massachusetts Department of Environmental Protection (MADEP) entitled Characterization Risks Posed by Petroleum Contaminated Sites (MADEP, 2002). The document provides a rational for semi-quantitative risk-based assessment of risk due to TPH contamination. The vast range of TPH contaminants are broken into a small number of general classes of hydrocarbons. First, distinction is made between aliphatic and aromatic hydrocarbons and then further divided in to groups based on the length of the hydrocarbon chains. Each of these groups is said to contain a family of hydrocarbons with approximately similar risk characteristics. The authors describe the basis for their assertion and develop a series of risk-based screening concentrations for each TPH family and these have been adopted for use by the State of Massachusetts. The MADEP guidance document is based on earlier work completed in 1999

by the TPH Criteria Working Group (TPHCWG, 1999). This work offers a much more detailed and in-depth exploration of the various TPH groupings and their toxicity characteristics. It also provides a basis for calculating Hazard Quotients for contaminated sites, whereas the MADEP document is lacking in this area. In general, the TPH Working Group describes estimation of hazard quotients using an approach very similar that summarized in the first paragraphs of this sub-section.

The general methodology first requires identification of the TPH groups that comprise the contamination at a given site. The recommendation is made that this be accomplished with the aid of laboratory testing, but guidelines are offered for cases where the analytical data are not adequate to provide group identification, but some information regarding the source of the contamination is known. This is indeed the situation at the West Weber site. As described above, most of the identified TPH contamination is classified as in the "motor oil" range, but "diesel range" TPH is also present at one locality. The particular source of TPH contamination at the site remains uncertain, but is likely to be from a mixture of fuel oil used to power locomotives (diesel #2), and to a lesser degree from crankcase oil from trucks. These materials are actually somewhat similar in composition and consist largely of the same TPH subgroups. In considering TPH health risks, the shorter chain hydrocarbons generally carry a higher risk. The conservative approach is this to assume the lighter hydrocarbon class in cases where doubt may exist. In this case, this entails making the informed assumption that the TPH contamination is actually weathered diesel fuel.

Based on information in TPHCWG (1999), weathered diesel oil is comprised mostly of two hydrocarbon groups as follows:

HC Group	Content
C9 – C18 Aliphatics	40%
C11 – C22 Aromatics	60%

The TPH EPCs set forth above in Table 8.4.1, were distributed among these two HC groups on a weight basis as follows:

HC Group	Content/EPC
½ Acre Sample Grid w/o select spls	822 mg/Kg
C9 – C18 Aliphatics	329 mg/Kg
C11 – C22 Aromatics	493 mg/Kg
Rail Spurs w/ Select Spls	175 mg/Kg
C9 – C18 Aliphatics	70 mg/Kg
C11 – C22 Aromatics	105 mg/Kg
Soil Spreading Area	49.5 mg/Kg
C9 – C18 Aliphatics	20 mg/Kg
C11 – C22 Aromatics	30 mg/Kg
Waste Oil Area	22.6 mg/Kg
C9 – C18 Aliphatics	9.0 mg/Kg

C11 – C22 Aromatics	13.6 mg/Kg
Bulk Terminal	263 mg/Kg
C9 – C18 Aliphatics	105 mg/Kg
C11 – C22 Aromatics	158 mg/Kg

Calculations were then applied to these concentrations as suggested by the documents described above, to arrive at estimates of health risk.

8.5 Toxicity Values and the Johnson-Ettinger Model

The U.S.EPA has developed an Excel-based computer program that can model indoor vapor intrusion from contaminated sites based on measured soil gas concentrations of volatile organic chemicals from soil gas survey. The California DTSC Human and Ecological Risk Division (HERD) has modified the program to reflect California toxicity values. The Program, known as "HERD Soil Gas Screening Model, 2005" is illuminated in a guidebook published by the U.S. EPA, 2003. Conceptually, the Johnson-Ettinger model is a 1-dimensional representation of the soil, its entrained organic vapor, and building that may be situated above the impacted soil. The model assumes steady state, isotropic conditions in the soil, and makes certain assumptions regarding soil-dependant, infiltration rates. The soil gas infiltration model is combined with toxicity information for a variety of organic chemicals to generate an assessment of health impact from residual volatile contaminant that may occur from inhalation of vapors that may intruded into the spaced contained inside structural. This calculation is somewhat similar to that described in the Cal-TOX model for soils described in the preceding sub-section.

The potential health effects of the COPCs identified from the soil gas surveys were evaluated using the HERD Soil Gas Screening Model (v.2). The maximum measured concentration of chemicals that were identified in the soil gas surveys were input to the program for Tank Sites 1, 2 and 4.

Not all chemicals detected are available for use in the Johnson-Ettinger model. Based on molecular similarity, the surrogates were used for several detected chemicals. These are, furan for tetrahydrofuran, and hexane for heptane. Ethanol is not listed in the Johnson-Ettinger modeling software, and no surrogate was found for it, the chemical was therefore not modeled. Given, however, that ethanol is a chemical commonly used for human consumption, it is unlikely to represent a significant health risk in the concentrations found at this site.

The following table summarizes the various exposure point concentrations used in the HERD Johnson-Ettinger soil gas screening model software.

Text Table 8.4.2 – Exposure Point Concentrations Used in J-E Model

Chemical	EPC ($\mu g/M^3$)
Tank Site 1	
Acetone	33,000
Toluene	1,300
Ethylbenzene	1,000
m,p, Xylene	2,200
o Xylene	530
Tank Site 2	
Ethanol	90
Acetone	660
Carbon Disulfide	40
MethylEthyl Ketone	89
Furan, surrogate for Tetrahydrofuran	150
Cyclohexane	110
Hexane, surrogate for Heptane	640
Benzene	83
Toluene	100
Ethylbenzene	56
m,p, Xylene	140
Tank Site 4	
Acetone	490
MethylEthyl Ketone	130
Tetrahydrofuran	82
Cyclohexane	50
Heptane	420
Toluene	47
m,p, Xylene	95

8.6 Risk Characteristics and Summary Tables

Risk characterization represents the final step in the risk assessment process. In this step, the results of the exposure and toxicity assessments are integrated into quantitative or qualitative estimates of potential health risks. Potential non-carcinogenic health effects and carcinogenic health risks are characterized separately.

8.6.1 Non-Carcinogenic Health Effects

Potential adverse non-carcinogenic health effects are evaluated using the hazard quotient approach as recommended by U.S. EPA (1989). The general approach is to compare the AADD for each chemical to the appropriate RfD. This comparison is expressed in terms of a "hazard quotient," which is calculated as follows:

$$\text{Hazard Quotient}_i = \frac{\text{AADD}_i}{\text{RfD}_i}$$

A hazard quotient less than or equal to 1 indicates that the predicted exposure to that chemical should not result in an adverse non-carcinogenic health effect (U.S. EPA, 1989). In cases where individual chemicals potentially act on the same organs or result in the same health endpoint (e.g., respiratory irritants), potential additive effects may be addressed by summing the several hazard quotients (Hq) to derive a calculated hazard index (HI).

A hazard index of less than or equal to 1 indicates acceptable levels of exposure for chemicals having an additive effect. In this HHRA, a screening-level hazard index was calculated by summing the hazard quotients for all chemicals, regardless of toxic endpoint, as recommended by agency guidance (U.S. EPA, 1989). This approach is generally believed to overestimate the potential for non-carcinogenic health effects due to simultaneous exposure to multiple chemicals because it does not account for different toxic endpoints (U.S. EPA, 1989). It can, however, be used as a screening tool to identify those exposure scenarios for which exposure to multiple chemicals do not pose a non-carcinogenic health risk.

It should be noted that hazard quotients or hazard indices greater than 1 do not necessarily mean that adverse health effects will be observed. As discussed above, a substantial margin of safety has been incorporated into some of the RfDs developed for the COPCs. Therefore, for these chemicals, adverse health effects may not be observed even if the hazard quotient or hazard index is much larger than 1.

The CalTox model uses this general approach to estimate the non-carcinogenic risk for the receptors evaluated, but the estimate is more complex and sophisticated (Cal-EPA, 1993). Full details of the assumptions and toxicity information used in the health assessment are included in the tables in Appendix G. This appendix also includes details regarding soil, chemical, landscape, and exposure criteria used in the CalTOX model.

8.6.2 Carcinogenic Health Effects

Carcinogenic health risks are defined in terms of the increased probability of developing cancer as the result of exposure to a chemical at a given concentration. As required by Cal-EPA (1992) and U.S. EPA (1989), lifetime cancer risks are estimated as follows:

$$\text{Lifetime Excess Cancer Risk} = LADD_i \times SF_i$$

The CalTOX model uses this general approach to estimate the non-carcinogenic risk for the receptors evaluated, but the estimate is more complex and sophisticated (Cal-EPA, 1993). As with hazard indices, the estimated excess cancer risks for each chemical and exposure route are summed regardless of toxic endpoint to estimate the total excess cancer risk for the exposed individual.

Regulatory agencies such as Cal-EPA and U.S. EPA have defined what is considered an acceptable level of risk in generally similar ways. The U.S. EPA considers 1x10E-6 to 1x10E-4 (i.e. 1 in 1-million to 1 in 10,000) to be the target range for acceptable risks at sites where remediation is considered. Estimates of lifetime excess cancer risk associated with

exposure to chemicals of less than one-in-one-million (1x10E-6) are considered to be so low as to not warrant any further investigation or analysis. Within the State of California, Cal-EPA also tends to work within the same target range for acceptable risks. Pursuant to the California Safe Drinking Water & Toxic Enforcement Act of 1986, the Office of Environmental Health Hazard Assessment has established a no significant risk level at 1x10E-5 (CCR Division 21.5, Title 22, Sec. 12703).

It should be noted that cancer risks in the 1x10E-6 to 1x10E-4 range or higher do not necessarily mean that adverse health effects will be observed. Current methodology for estimating the carcinogenic potential of chemicals is believed to not underestimate the true risk, but could overestimate the true risk by a considerable degree. In fact, the range of possible risks includes zero.

8.6.3 CalTOX Model Results

Individual CalTOX runs (see Appendix G) were made for each chemical and associated exposure point concentration shown in Table 8.6.3 below. Except for these variables, all other inputs such as landscape properties, and exposure factors were held constant. In general, all soil contamination was deemed to reside in the root zone, which was set at the upper 1.4 meters of soil, while the vadose zone was set at 2-meter thickness. In the case of the former bulk terminal, the soil samples were all collected from borings at a depth of at least 4 feet, and in this area, the soil samples are considered to have been collected from the vadose zone. For purposes of comparison, the table also reflects Hazard Quotients attributed to Total Petroleum Hydrocarbons (TPH) even though these were not developed using Cal-TOX. See the next sub-section for a discussion, however. The following table summarizes the results of the risk analysis for each chemical:

Text Table 8.6.3 – Summary of CalTOX Model Results

Chemical	Increased Cancer Risk	Hazard Quotient (non-Cancer)
½ Acre Sample Grid w/o Select Spls		
Beryllium	1.7E-7	4.1E+0
Chromium	8.4E-8	6.7E-2
Lead	2.4E-6	9.7E+0
Zinc	0	3.0E-1
TPH (see Table 8.6.4)	0	4.6E-2
Semi-Totals – ½ Acre Grid	2.7E-6	1.4E+1
Rail Spurs w/ Select Grid Spls		
Arsenic	9.4E-4	1.0E+1
Chromium	2.3E-6	1.8E+0
Lead	2.8E-7	1.1E+0
Molybdenum	0	1.3E-2
Acenapthylene	0	6.6E-5
Benzo(a)pyrene (TEQ)	6.2E-7	0
Fluoranthene	0	1.2E-02
Napthalene	0	3.4E-2
Pyrene	0	1.4E-3
Dieldrin	3.1E-4	9.4E+0

TPH	0	9.6E-3
Semi-Totals – Rail Spurs	1.3E-3	2.3E+1
Soil Spreading Area		
Chromium	2.9E-7	2.4E-1
Lead	3.1E-5	1.3E+2
Molybdenum	0	3.2E-3
TPH	0	2.8E-3
Semi-Totals – Soil Spreading Area	3.1E-5	1.3E+2
SCS Shop Area		
Lead	1.3E-7	5.4E-1
Molybdenum	0	5.2E-3
Semi-Totals – SCS Shop Area	1.3E-7	5.5E-1
Waste Oil Area		
Arsenic*	1.5E-4	1.6E+0
TPH	0	1.2E-3
Semi-Totals – Waste Oil Area	1.5E-4	1.6E+0
1404 W. Weber		
Lead	3.6E-8	1.5E-1
Molybdenum	0	1.2E-2
Selenium	0	1.0E-2
Acenaphtylene	0	7.9E-5
Anthracene	0	1.1E-3
Benzo(a)pyrene (TEQ)	9.4E-7	0
2,3,7,8 TCDD (TEQ)	8.9E-3	0
Fluoranthene	0	4.2E-2
Fluorine	0	2.5E-5
Napthalene (TEQ) (see table 8.4.1)	0	1.5E-2
Pyrene	0	2.8E-2
Semi-Totals – 1404 W. Weber	8.9E-3	2.6E-1
Bulk Terminal		
Molybdenum	0	<1.0E-10
Phenol	0	<1.0E-10
Cumene TEQ (see table 8.4.1)	0	<1.0E-10
1,1,2,2-Tetrachloroethane	<1.0E-10	<1.0E-10
1,1,2 Trichloroethane	<1.0E-10	<1.0E-10
TPH	0	1.4E-2
Semi-Totals – Bulk Terminal	<1.0E-10	1.4E-2
SCS - Building 1		
Chrome-6	4.2E-8	3.4E-2

* Arsenic in the shallow soil of the Waste Oil Area is attributed to the adjacent former rail spur.

Increased cancer risks of less than one in one million (i.e. 1.0E-6) is considered so low as not to require additional evaluation. Non-cancer hazard quotients of less than one are similarly considered so low as to not require additional assessment. Chemical risk factors from multiple sources are considered to be approximately additive, so the over all risk associated with each source area is estimated by adding the various risk factors.

The following table abbreviates and summarizes the preceding table to reflect the areas with elevated human health risks:

	Increased Cancer Risk	Hazard Index (non-Cancer)
Semi-Totals – ½ Acre Grid	2.7E-6	1.4E+1
Semi-Totals – Rail Spurs w/ Select Spls	1.3E-3	2.3E+1
Semi-Totals – Soil Spreading Area	3.1E-5	1.3E+2
SCS Shop Area	1.3E-7	5.5E-1
Semi-Totals – Waste Oil Area	1.5E-4	1.6E+0
Semi-Totals – 1404 W. Weber	8.9E-3	2.6E-1
Semi-Total - SCS - Building 1	4.2E-8	3.4E-2

The following points summarize the potential health risks associated with exposure to the COPCs in the soil by a hypothetical future on-site resident:

- Lead associated with the ½-grid poses and increased cancer risk of 2.4 per million, and the non-cancer hazard index is about 10. Yet all but one sample (SCR-F8) contains lead concentrations lower than the screening level. It is possible that a limited mitigation measure would reduce the risk of this area to acceptable levels.

- The soils in the area of rail spurs clearly pose the most significant health risk on the peninsula, primarily from arsenic, but with a significant lead contribution. The increased cancer risk is 1.3E-3 (or in 1.3 in 1,000) and the non-cancer hazard index is 23.

- The elevated hazard index of 13 in the SCS soil spreading area is almost entirely due to the concentration of 6,200 mg/Kg at a single sample point (SS-12). This point is so anomalous that it may be due to the improper disposal of some lead-containing item, such as a lead-acid battery.

- Soil contamination in the waste oil storage area is due to arsenic attributed to the adjacent rail spur.

- The soil borings at 1404 W. Weber yielded one sample (1404 B1-4-5) with semi-volatile organics and diesel-range TPH, which is responsible for most of the health risk. This material appears to be from the use of contaminated fill material. Mitigation in the form of excavation and disposal may be needed.

- The soil under SCS Building 1 contains a somewhat elevated concentration of chromium, which for purposes of initial risk assessment, was treated as hexavalent chromium. Speciation shows, however, that most of the material is actually trivalent chrome. The risk factors in this case, and probably other chromium risk

factors, are therefore significantly exaggerated.

8.6.4 TPH Risk Results

A table in MADEP (2002) provides reference doses and absorption factors for each group. These were then applied to each EPC on a weight-fraction basis to derive a hazard quotient for each area TPH was detected in the soil. The primary health risk associated with these long chain TPH groups is from toxic exposure. There appears to be little cancer risk and neither MADEP (2002), nor does TPGCWH (1999) offer significant guidance on estimating cancer risk. Moreover, these relatively heavy hydrocarbon chains are essentially non-volatile.

The calculations are summarized in the TPH Work Sheet attached as Appendix I. The following table summarizes the hazard quotients derived from the TPH risk analysis:

Text Table 8.6.4 – Summary of TPH Risk Results

½ Acre Sample Grid w/o select spls	EPC	Hq
C9 – C18 Aliphatics	329	0.0230
C11 – C22 Aromatics	493	0.0230
Rail Spurs w/ Select Spls		
C9 – C18 Aliphatics	70	0.0048
C11 – C22 Aromatics	105	0.0048
Soil Spreading Area		
C9 – C18 Aliphatics	20	0.0014
C11 – C22 Aromatics	30	0.0014
Waste Oil Area		
C9 – C18 Aliphatics	9.0	0.0006
C11 – C22 Aromatics	13.6	0.0006
Bulk Terminal		
C9 – C18 Aliphatics	105	0.0072
C11 – C22 Aromatics	158	0.0072

8.6.5 Johnson-Ettinger Model Results

Individual HERD Soil Gas Screening Model runs (Appendix G) were made for each chemical and associated exposure point concentration shown in Table 8.6.3 below. Except for these variables, all other inputs such as landscape properties, and exposure factors were held constant. In general, all soil contamination was deemed to reside in the root zone, which was set at the upper 1.4 meters of soil, while the vadose zone was set at 2-meter thickness. (See printouts in Appendix H for details.) The following table summarizes the results of the risk analysis for each chemical:

Text Table 8.6.4 – Summary of J-E Model Results

Chemical	EPC ($\mu g/M^3$)	Increased Cancer Risk	Hazard Quotient (non-Cancer)
Tank Site 1			
Acetone	33,000	N/A	1.0E-1
Toluene	1,300	N/A	3.8E-3
Ethylbenzene	1,000	N/A	8.0E-4
m,p, Xylene	2,200	N/A	1.7E-2
o Xylene	530	N/A	4.7E-3
Totals – TS1		**None**	**1.3E-1 (= 0.13)**
Tank Site 2			
Ethanol	90	Not modeled	Not modeled
Acetone	660	N/A	2.0E-3
Carbon Disulfide	40	N/A	5.6E-5
MethylEthyl Ketone	89	N/A	1.5E-5
Furan for Tetrahydrofuran	150	N/A	4.2E-2
Cyclohexane	110	N/A	2.9E-5
Hexane for Heptane	640	N/A	4.4E-3
Benzene	83	9.1E-7	2.4E-3
Toluene	100	N/A	2.0E-4
Ethylbenzene	56	N/A	4.5E-5
m,p, Xylene	140	N/A	1.1E-3
Totals – TS2		**9.1E-7**	**5.2E-2 (= 0.52)**
Tank Site 4			
Acetone	490	N/A	1.5E-3
MethylEthyl Ketone	130	N/A	2.2E-5
Furan for Tetrahydrofuran	82	N/A	2.3E-2
Cyclohexane	50	N/A	1.3E-5
Hexane for Hexane	420	N/A	2.9E-3
Toluene	47	N/A	1.4E-4
m,p, Xylene	95	N/A	7.2E-4
Totals – TS4		**None**	**2.8E-2 (= 0.28)**

Based on this analysis, and with the assumption made, both the cancer and non-cancer risk factors associated with the former UST sites do not pose a significantly increased risk for residential use.

8.6.6 Heath Risk From Groundwater

As described elsewhere, in order for a human health risks to be present, a complete exposure path must be available. Insofar as there are no groundwater production wells on the site or anywhere nearby, and all potable water is provided by the municipal water system, there is no pathway for human exposure to the shallow groundwater. Since there is no exposure pathway, there is no human health risk associated with the rather minimal groundwater contamination documented in this investigation.

There is a low potential for impacted groundwater to migrate into the adjacent water bodies, but complete evaluation of this risk is beyond the scope of this PEA. In any case, the elevation of the groundwater is generally lower than the surface of the surface water, and there would therefore appear to be a limited potential for low concentrations of shallow groundwater contamination to leave the peninsula.

9.0 ECOLOGICAL SCREENING EVALUATION

In addition to obvious human receptors, potential receptors include plant and animal life. The site provides limited habitat for such species as lizards and small mammals such as ground squirrels, field mice and jackrabbits. Other small animals such as lizards, snakes, and a variety of insects will also be present. Avian fauna will include a variety of common birds that typically inhabit the area. Fish and other aquatic species inhabit ship channel and Old Mormon Slough.

Two reports were prepared for Mr. Voorhees that addressed sensitive biological resources in the vicinity of the W. Weber peninsula. Copies of the reports are attached as Appendix D. In 2000, a biologist completed a field survey and also accessed California Natural Diversity Database to gather information on habitat and threatened and endangered species. The resultant brief reports (Moore, 2000 & Moore, 2003), indicate that most of the area has been disturbed by past construction and demolition activities, and no wetlands are present. Common plant species found on the peninsula include yellow star thistle (Centaurea solstitalis), morning glory (Convolvulus arvensis), Turkey mullein (Eremocarpus setigerus), black mustard (Brassica nigra), bristly ox-tongue (Picris echiodes), and tumbleweed (Amaranthus albus). A few common bird species nest in scattered trees and reptiles and small mammals are present in small numbers due to human disturbance. No oaks are present that would be classified as Heritage Oaks. Due to the presence of rip-rap, there are is no significant growth of emergent aquatic plants along the levees surrounding the peninsula.

Regarding sensitive species, the report indicates that due to the disturbance of the area, habitat quality of sensitive species is low, and no sensitive species were observed nor were burrows or other evidence of such species observed. A federally listed fish, the delta smelt, may be present in the adjacent waterways, however. Other sensitive fish species inhabit the delta, and some may be present in the ship channel or Old Mormon Slough. Swainson's hawks are unlikely to be present, but they do inhabit the area with the nearest documented territory being about ½ mile north. Other sensitive species in the area include the burrowing owl, giant garter snake and California tiger salamander, but these occurrences are more than ½ mile away.

10.0 COMMUNITY PROFILE

Description of Surrounding Land Uses and Environmental Resources
The site is in a primarily industrial-use area of Stockton, and adjacent sites are also mostly industrial. The Stockton Deepwater Ship Channel and Old Mormon Slough bound the study area on thee sides and the I-5 interchange is on the fourth side. Therefore, no businesses or residences directly abut the West Weber peninsula. The nearest occupied facilities are an apartment complex on the opposite (east) side of the freeway overpass, and the McCormick and Baxter superfund site on the south side of Old Mormon slough. The Port of Stockton Cargo loading facility is on the east side of the confluence of the ship channel and Old Mormon Slough. Other residential areas are north of the ship channel slightly less ¼ mile north the study area. Most areas within ¼ to the north are in light industrial and commercial use. The edge of a residential neighborhood lies just under ¼ mile southwest of the site.

Between ¼ and ½ mile of the site are a substantial number of residences and businesses. In general, residential areas are north and south, commercial areas are east and industrial sites are west.

A search for highly sensitive receptors (such as schools, hospitals, nursing homes) indicates the presence of schools and a hospital. Washington Schools is in a small residential area slightly less than ½ mile southwest of the study area, while Victory School, and Annunciation School are between ½ and ¾ of a mile north respectively. Dameron Hospital also is about ¾ mile north, and three nursing homes are near the hospital, between ¾ and 1 mile form the site. To the east, the Alternative Education Center is slightly more than ½ mile from the study area, and Hazelton School is slightly less than one mile southeast.

North
The Stockton Deep Water Ship Channel bounds the site. On the opposite side are various industrial and commercial sites, and residential sites lie inland.

South
The Old Mormon Slough bounds the site, and on the opposite side is the McCormick and Baxter superfund site as well as other industrial facilities. A small residential neighborhood is about ¼ to ¼ mile southwest of the study area.

West
The mouth of Old Mormon Slough bounds the site, and beyond that is the turning basin and the Port of Stockton cargo-handling facilities and grain elevator.

East
The I-5 freeway bounds the site, and beyond that is vacant land being redevoped and a multi-family residential property.

Visibility of the Site to Neighbors
The site is open and clearly visible to persons who may venture to the dead end of Weber Avenue.

Community Demographics
The following information is from websites operated by the City of Tracy and San Joaquin County. The respective URLs are http://www.ci.stockton.ca.us/ and http://www.sjpnet.org/.

	Stockton	S. J. County
Total Population	286,000	653,000
White	53%	47%
Hispanic	37%	32%
Asian	23%	11%
African-American	11%	6%
Native American	<1%	1%
Other	<1%	3%

The median age is 29.6 years and median annual household income is $57,100.

Community Contacts
No inquiries are known to have been received from community members or groups.

Community Interactions
No meetings, events, or presentations have been conducted with, or for, the community or local government.

Media Coverage
There has been no known news media coverage.

Government Contacts
The DTSC and the San Joaquin Environmental Health Department have been involved in this, current and former environmental investigations. The Stockton Planning Department is involved in the redevelopment planning of the site.

Key Contact List
Below is a list of elected State and local government officials, regulatory agencies, and residents / businesses within a ½ mile radius of the site.

Federal Elected Officials	
US Senator Barbara Boxer 112 Hart Senate Office Building Washington DC 20510 (202) 224-2552	US Senator Diane Feinstein 331 Hart Senate Office Building Washington DC 20510 (202) 224-3841
US Representative Dennis Cardoza The Honorable Dennis Cardoza 435 Cannon Building	

Washington, DC 20515 (202) 225-6131	
State Elected Officials	
State Assemblywoman Cathleen Galgiani State Capitol Room 2170 Sacramento, CA 94249-0017 (916) 319-2017	State Senator Michael Machado 5th District 31 E. Channel, Rm 440 Stockton 95202 (209) 948-7930
San Joaquin County	
Leroy Ornellas, Supervisor, District 5 222 E. Weber, Room 701 Stockton, CA 95202 (209) 468-3113	

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

Based on the information developed for this PEA, the following conclusions are drawn:

1. The soils of the area have been adversely impacted by past activities as summarized in the following bullet points.

   - Lead associated with the ½-grid poses and increased cancer risk of 2.4 per million, and the non-cancer hazard index is about 10. Yet all but one sample (SCR-F8) contains lead concentrations lower than the screening level. It is possible that a limited mitigation measure would reduce the risk of this area to acceptable levels.

   - The soils in the area of rail spurs clearly pose the most significant health risk on the peninsula primarily from arsenic, but with a significant lead contribution. The increased cancer risk is 1.3E-3 (or in 1.3 in 1,000) and the non-cancer hazard index is 23.

   - The elevated hazard index of 13 in the soil spreading area is almost entirely due to the concentration of 6,200 mg/Kg at a single sample point (SS-12). This point is so anomalous that it may be due to the improper disposal of some lead-containing item, such as a lead-acid battery.

   - Contamination in the waste oil storage area is due to arsenic attributed to the adjacent rail spur.

   - The soil borings at 1404 W. Weber yielded one sample (1404 B1-4-5) with semi-volatile organics and diesel-range TPH, which is responsible for most of the risk. This material appears to be from the use of contaminated fill material.

   - The soil under SCS Building one contains a somewhat elevated concentration of chromium, which was treated as hexavalent chromium. Speciation shows, however that most of the material is actually trivalent chrome. The risk factors in this case, and probably other chromium risk factors, are therefore significantly exaggerated.

2. The groundwater does not appear to have been impacted by the releases at the former bulk fuel plant or the hazardous fill material at 1404 W. Weber, except for trace concentrations of VOCs at the bulk terminal. Several metals are also present at greater than MCL limits, but since the background concentrations are largely unknown, it is possible that these metals may not be a result of a hazardous release.

3. The former closed underground fuel tank sites were investigated, and residual volatile organic compounds and gasoline hydrocarbons are resident in the shallow soil. Tank Site 1 holds the greatest concentrations of these vapors. Base on the results of Johnson-Ettinger vapor intrusion modeling, the sites do not appear likely to pose a significantly elevated health risk.

4. Other areas on the site, including areas associated with former chromium-treated brine coolant system on the Stockton Cold Storage facility, and the shop area of that facility do not appear to have impacted the site with material increased health risk. In general, un-speciated chromium is to be treated as hexavalent, but limited speciation suggests that most of the chromium is trivalent and therefore almost non-toxic.

5. There appears to be very limited likelihood that contaminants on the site will significantly impact sensitive ecosystems. There are no known threatened or endangered species on the peninsula and human disturbance has rendered it a poor habitat for wildlife. On the other hand, sensitive species such as Delta Smelt are much more likely to be present in the surrounding waterways, the peninsula is internally drained and storm water runoff does not impact the waterways except for runoff from the outboard sides of the surrounding levees, which are largely covered with rip-rap.

11.2 Recommendations

Based on the above conclusions, the following recommendations are made to further investigate/mitigate the health risk associated with this site:

1. The arsenic in the shallow soil will require mitigation, most likely in the form of excavation and removal. Associated with this, additional work to profile the rail spurs at several points is needed. This would take the form of establishing three or more rows of borings that transect a spur (preferably where the tracks are still in place), and collecting soil samples at various distances from the tracks and depth below the surface. Analytical testing for arsenic, lead, and other chemicals will provide valuable information regarding the volume of soil that may need to be removed.

2. More laboratory work to speciate chromium is needed to assess whether chromium mitigation measures may be needed.

3. Excavation and removal or contaminated soil in the vicinity of 1404 W. Weber will be appropriate to mitigate past use of contaminated fill material.

11.3 Preliminary Scoping Recommendation

Normally, contaminated sites enter the Remedial Investigation / Feasibility Study (RI/FS) process as the next step after the PEA is completed. In this case, limited additional

assessment is needed as described in the preceding sub-section. In addition, it appears that much of the contamination is the result of the past presence and use of rail spurs. The possibility of obtaining the financial assistance of the railroad in completing additional investigation and mitigation could also be explored.

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13.0 SIGNATURE AND CERTIFICATION

Geo-Phase Environmental Inc. was performed in accordance with accepted geologic and hydrologic standards of the State of California including the DTSC document entitled Preliminary Endangerment Assessment, Guidance Manual. Geo-Phase Environmental Inc. is not responsible for undisclosed conditions.

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