Attachment 7
Responses to DTSC Comments on HHRA

Draft Responses to DTSC Comments on the AMCO HHRA

General Comment A

A. There are highly elevated levels of VOCs that have been measured in the environmental media at this site, and this report does not include a quantitative assessment of the risks from exposure of workers and hypothetical residents to indoor air contaminated with VOCs intruding from sub-surface soil, non-aqueous phase liquids (NAPLs) or groundwater. Although an explanation is given for why the indoor air pathway is not quantitatively evaluated in this risk assessment, the HERD considers this exclusion from risk calculation a major deficiency.

The HERD used the concentrations of VOCs detected in groundwater, soil gas, and on-facility crawl space air to carry out a screening level risk evaluation of the indoor air exposure pathway of selected VOCs in selected circumstances. Using the DTSC screening groundwater vapor intrusion model (2004), the future residential cancer risk from potential inhalation of vinyl chloride intruding indoors from on-site groundwater is 8×10^{-3}, based on a 95% upper confidence limit (UCL) of the mean concentration 1,627 μg/L. The HERD divided the maximum on-facility soil gas concentrations of benzene, tetrachloroethylene (PCE), and vinyl chloride by their California Environmental Protection Agency (Cal.EPA) California Human Health Screening Levels (CHHSL) and multiplied the ratio by 10^{-6} to get the risk posed by each VOC. These risks were then added to get cumulative residential and industrial worker risks of 9×10^{-4} and 6×10^{-4}, respectively. An industrial worker risk of 2×10^{-4} was calculated in the same manner by comparing the maximum vinyl chloride concentration of 7.6 $\mu g/m^3$ detected in crawl space air of the on-facility office to its Cal/EPA CHHSL for indoor air. The HERD's evaluation clearly shows the significant risk posed by VOCs intruding indoors from groundwater, soil gas, and crawl space air and demonstrates the need for remediation of VOCs.

Response A

Due to the elevated levels of VOCs in the crawlspace and ambient air, as a precautionary measure, mitigation systems have been installed in selected homes located nearest the site. At the time that the RI and HHRA reports were submitted, the crawlspace and ambient air data sets were inadequate for a quantitative vapor intrusion evaluation so a screening level assessment was conducted. Since that time, we have collected sufficient crawlspace and ambient air data to assess potential human health risks and hazards associated with VOCs migrating from the groundwater into the office at the former AMCO facility and into nearby residences using quantitative methods. Nine sampling events from September 2004 through June 2009 have been conducted. The results of the vapor intrusion evaluation are summarized below:

Industrial Exposure Evaluation

Potential cancer risks and noncancer hazards were calculated using industrial worker exposure assumptions for the 1414 3rd Street office. Crawlspace air is used to represent the air that could potentially be inhaled by the workers in their offices. Potential cancer risk from exposure to VOCs in crawlspace air at the office building is 6×10^{-5}, which is within the risk management range of 10^{-6} to 10^{-4}. The main contributors to the cancer risk are carbon tetrachloride (35%) and vinyl chloride (18%). The noncancer HI is below 1 for exposure by an indoor worker.

Residential Exposure Evaluation

All non-facility locations (residential parcels, South Prescott Park, background) were evaluated using residential exposure assumptions. Crawlspace and ambient air is used to represent the air that could potentially be inhaled by the residents inside and outside the living spaces of their homes. Potential cancer risks are within the risk management range at all residences for crawlspace and ambient air with the exception of two of the residential properties for crawlspace (1428 3rd Street and 1432 3rd Street) and one for ambient air (1428 3rd Street). These are also the only locations having noncancer HIs greater than 1.

Potential cancer risks from inhalation of crawlspace air ranged from 5×10^{-5} to 3×10^{-4}. The primary chemical contributors to risk from inhalation of crawlspace air are vinyl chloride, benzene, 1,2-dichloroethane, carbon tetrachloride, and 1,4-dichlorobenzene at the four residences where crawlspace air and ambient air were collected. Crawlspace air HIs range from 0.5 to 8. The primary contributors to the HI in crawlspace air at the two locations that have HIs that exceed 1 are 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene.

Potential cancer risks from inhalation of ambient air ranged from 2×10^{-5} to 2×10^{-4}. The primary contributors to risk from inhalation of ambient air are naphthalene, benzene, carbon tetrachloride, and vinyl chloride. Vinyl chloride is only a primary contributor at one property - 1436 3rd Street. The HI from exposure to ambient air exceeds 1 at 1428 3rd Street (HI=4). Naphthalene (47%), 1,2,4-trimethylbenzene (18%), and 1,3,5-trimethyl-benzene (18%) are the primary contributors to the ambient air HI.

An evaluation of vapor intrusion using groundwater data was not conducted, however, it is acknowledged that in a worst case scenario, the risks and hazards may be as high as when residential use of the groundwater is considered. The cancer risks estimated for future residents using the groundwater as tap water in the home ranges from $1x10^{-4}$ to $7x10^{-2}$, which is significantly above the risk management range and clearly unacceptable. Hazard indices for a child is 628 and for an adult is 262 which are also significantly above the noncancer threshold of 1.

To confirm that the risks for vapor intrusion are similar as the risks from drinking the groundwater, selected VOCs that contribute the most to the risk and hazard estimates were modeled using the DTSC screening groundwater vapor intrusion model. Defaults were used as inputs into the model except the depth to groundwater was adjusted to 5 feet below ground surface and sand was used as the SCS soil type. Below is the table of results:

VOC	Exposure Point Concentration (μg/L)	Incremental Risk from Vapor Intrusion to Indoor Air	Hazard Quotient from Vapor Intrusion to Indoor Air
Vinyl chloride	1,627	2.2×10^{-1}	80
TCE	57	6.0×10^{-6}	0.014
PCE	12	6.2×10^{-6}	0.083
Cis-1,2-DCE	13,700	NA	22
Trans-1,2-DCE	400	NA	0.83
Totals		2×10^{-1}	103

These results show that the risks and hazards related to vapor intrusion are significantly above the risk management range and clearly unacceptable.

General Comment B

B. Arsenic is present on the facility at background concentrations but is a primary risk-driver in this risk assessment, despite the fact that arsenic does not appear to have been released to the site by former facility operations. Therefore, the cumulative risk should be calculated without the inclusion of arsenic and included in this report as representative of the risk from exposure to contaminants released to the environment during manufacturing activities.

Response B

The risk calculations included risk from all inorganic compounds including those present at background concentrations in accordance with EPA's Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (EPA 2002a). This document states, "COPCs that have both release-related and background-related sources should be included in the risk assessment. When concentrations of naturally occurring elements at a site exceed risk-based screening levels, that information should be discussed qualitatively in the risk characterization." In the risk characterization section of the HHRA, whenever arsenic is discussed as a risk driver, a statement will be added comparing concentrations of arsenic found in the exposure area to arsenic concentrations in background. The following table summarizes the arsenic exposure point concentrations at each exposure area and in the background data set.

Exposure Area	Arsenic Exposure Point Concentration	Residential Risk without Arsenic
Former AMCO Facility – shallow soil	7.71 mg/kg	$2x10^{-4}$
Former AMCO Facility – subsurface soil	8.1 mg/kg	$2x10^{-4}$
Parking Lot – shallow soil	20 mg/kg	$1x10^{-4}$
Parking Lot – subsurface soil	12.8 mg/kg	$3x10^{-4}$
Large Vacant Lot – shallow soil	26.9 mg/kg	$1x10^{-4}$
Large Vacant Lot – subsurface soil	18.1 mg/kg	$8x10^{-5}$
Small Vacant Lot – shallow soil	14.2 mg/kg	$1x10^{-4}$
Background	14 mg/kg	$1x10^{-8}$

General Comment C

C. Elevated lead levels are found throughout the facility and, thus, is a primary chemical of concern. The lead concentrations in surface soil represent a real hazard to current and future receptors and this should be highlighted throughout the risk assessment report.

Response C

We agree that lead is a concern at the former AMCO facility and off-facility locations. To address the elevated lead levels, an emergency response was conducted and surface soil (0 to 3 feet) was removed from the exposed areas of the yards of several nearby homes.

These properties include 1428, 1432, and 1436 3rd Street, and 320, 326, 356, 360, and 366/368 Center Street.

Specific Comment 1

Page 4-5 Section 4.2.2.3 Groundwater Monitoring Wells – Sampling Locations; and Page 4-8 Section 4.3 Soil Sampling. A) Section 4.2.2.3 describes the sampling of the groundwater monitoring well network of 29 wells. However, nowhere is the method of collecting groundwater described. Please describe the collection method and verify that the method used is designed to reduce the possibility of VOC loss from the groundwater samples during collection. B) Section 4.3 describes the soil sampling performed on-facility, off-facility, and at adjacent residential properties. However, the method used to collect soils for VOC analysis is equivalent to US EPA Method 5035, designed to reduce VOC loss from soil matrix during collection.

Response 1

Field procedures are presented in Appendix C. References to Appendix C will be added to these sections.

Specific Comment 2

Page 4-25 Section 4.7.1.4 Lithologic Logging/Laboratory Analyses; and, Table 6 Soil Physical Parameter Testing Results. Soil physical properties were measured using methods that have not necessarily been recommended in Appendices H and I of the DTSC *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Ai*r (2005). A) Confirmatory measurement of soil properties using the methods recommended by the DTSC should be performed. Alternatively, justification should be provided to support the methods used for the measurement of all properties except soil air permeability. B) Soil air permeability measurements were made in the laboratory on soil samples, whereas, the DTSC recommends that soil air permeability measurements be made in-situ using the method described in Appendix I of the vapor intrusion guidance. The reason for this recommendation is that the laboratory method involves the use of confining pressure which could collapse soil pore space resulting in an underestimate of air permeability. Future soil gas sampling events should include the in-situ measurement of soil air permeability. The effects of an underestimated soil air permeability measurement on soil vapor modeling should be discussed in the uncertainty section of the human health risk assessment.

Response 2

If soil vapor modeling is conducted in the future, confirmatory sampling using the methods recommended by DTSC will be performed. To evaluate the vapor intrusion pathway, we have elected to use direct measurement to evaluate current risk as opposed to theoretical risks calculated using vapor intrusion modeling. EPA's 2002 OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) Tier 3 recommends the collection of samples from within individual buildings because they are the closest to the exposure point of interest and are likely to be more reflective of VI than samples collected further from indoor air. DTSC's Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air states "*Crawl space air is less affected by the lifestyle choices, such as household product use and smoking, of the building's occupants than indoor air. The evaluation of the* *results of crawl space air sampling is easier to interpret than indoor air sampling results"* (DTSC 2005).

Specific Comment 3

Page 5-3 Section 5.3 Non-aqueous Phase Liquids (NAPLs). Light NAPL (LNAPL) is present on the shallow groundwater at this site and contains many of the chemicals of potential concern (COPCs) for this site. The depth below ground surface where LNAPL is located should be given in this section. A figure should be included showing the approximate boundaries of the LNAPL.

Response 3

LNAPL is present along the surface of the groundwater, and within the zone of groundwater fluctuation, which in several locations extends to the bottom of concrete. The location of the LNAPL has not been delineated well enough to provide a figure; however, LNAPL can generally be considered to be present in the immediate vicinity of monitoring wells MW-13 and MW-14. LNAPL has not been observed in any other wells. Figure 14 shows the locations of all of the wells sampled for the RI report.

Specific Comment 4

Page 5-29 Section 5.5.2.4.4 Lead, and Figure 49A and 49B Lead in Surface Soil and Mid/Deep Soil. This section summarizes the lead concentrations measured in off-facility residential soils. The text should be revised to summarize the soil excavation activities that have already taken place to remove soils with highly elevated lead concentrations. The figures should be revised to include the approximate boundaries of those excavation areas. A note should be added to the figures confirming that the lead concentrations depicted in those figures represent current conditions.

Response 4

The text on page 5-29 is referring only to "off-facility" locations, which include the large vacant lot, small vacant lot, and the parking lot. No soil was excavated from these locations. Lead in residential soil is discussed in Section 5.5.3 starting on page 5-30. Section 5.5.3 notes that a soil removal action has been performed and that the results discussed are no longer representative of current soil conditions.

The figures are intended to present the results of the Remedial Investigation. The figures ***do not*** represent current conditions. The figures summarize the results of the soil sampling that was performed as part of the RI. In general soil removal occurred in all areas not covered with concrete or a structure. Removal was generally limited to 3 feet bgs. Removal actions were completed at 1428, 1432, and 1436 3rd Street, and 320, 326, 356, 360, and 366/368 Center Street.

Specific Comment 5

Page 5-35 Section 5.5.4 Summary of Nature and Extent of Contamination in Soil. Under the seventh bullet, the text states that arsenic was detected across the area at background concentrations. This text should be revised to include the background range of arsenic concentrations for this area. The text should also be revised to state that elevated arsenic was measured in a soil sample from 326 Center Street (451 mg/kg at one foot below ground surface in Sample 326SSd).

Response 5

The information regarding Sample 326SSd is presented on page 5-33, but will be added to this section. The bullet in Section 5.5.4 now reads:

- Key metals arsenic, lead, and iron were widely detected in soil samples collected from on-facility, off-facility, and residential locations.
  - Arsenic was detected above the screening level in every soil sample collected; however, concentrations detected across the RI Study Area are generally less than or equal to background concentrations typical of the San Francisco Bay Area with the exception of the sample collected location 326SSd. Arsenic was detected at concentrations greater than background in shallow (451 mg/kg) and deeper (125 mg/kg) soil at this location.

Specific Comment 6

Page 7-4 Section 7.2.2 Exposure Assessment; and Tables 33 and 34 Exposure Point Concentrations for Soil Exposure Areas and Groundwater, respectively. Exposure to dioxins/furans is evaluated in a congener-specific manner in this risk assessment. Add dioxins/furans concentrations in dioxin toxicity equivalents (TEQs) to the tables in order to compare dioxin concentrations at other sites.

Response 6

Tables 33 and 34 Exposure Point Concentrations for Soil Exposure Areas and Groundwater have been modified to include the dioxin toxicity equivalents so the reader may compare dioxin concentrations with those at other sites.

Specific Comment 7

Page 7-8 Section 7.2.4 Risk Characterization. Risks were estimated from exposure intakes calculated from concentration of chemicals in soil matrix and groundwater. A) Soil gas, crawl-space air and ambient air data were evaluated by comparing these data to generic screening levels. Screening levels for soil gas were calculated by multiplying US EPA Region 9 ambient air Preliminary Remediation Goals (PRGs) by a default attenuation factor of 10. This comparison does not include any quantitative risk estimation from the potential exposure to VOCs intruding indoors from soil gas. B) In addition, VOCs in groundwater are not evaluated for volatilization into overlying soil and subsequent migration into indoor air. Therefore, the estimates of risks to current and potential on-facility and off-facility residents and workers are greatly underestimated. The subject report should include a screening level risk assessment for VOCs intruding indoors using the soil gas data obtained to date and the most recent groundwater data. The resulting risk from this pathway should be added to the risks calculated from the other complete exposure pathways. C) The potential effect of the LNAPL on shallow groundwater on indoor air risk estimation and as a long-term source of VOCs must be discussed in detail in the uncertainty section. D) The lack of any risk evaluation of the indoor air pathway at a site with such high VOC concentrations in soil matrix, soil gas, and groundwater represents a major deficiency in this health risk assessment. There are further specific comments on this issue below.

Response 7

Part A) At the time that the RI and HHRA reports were submitted, the crawlspace and ambient air data sets were inadequate for a quantitative vapor intrusion evaluation so a screening level assessment was conducted. Since that time, we have collected sufficient crawlspace and ambient air data to assess potential human health risks and hazards associated with VOCs migrating from the groundwater into the office at the former AMCO facility and into nearby residences using quantitative methods. Due to the elevated levels of VOCs in the crawlspace and ambient air, as a precautionary measure, mitigation systems have been installed in selected homes located nearest the site. See response to comment A for a summary of the vapor intrusion evaluation using the crawlspace and ambient air data.

Part B) An evaluation of vapor intrusion using groundwater data was not conducted, however, it is acknowledged that in a worst case scenario, the risks and hazards may be as high as when residential use of the groundwater is considered. The cancer risks estimated for future residents using the groundwater as tap water in the home ranges from $1x10^{-4}$ to $7x10^{-2}$, which is significantly above the risk management range and clearly unacceptable. Hazard indices for a child is 628 and for an adult is 262 which are also significantly above the noncancer threshold of 1.

Part C) The LNAPL on the groundwater will be remediated so the source of the VOCs will be removed and there will be no long-term effects on residents and workers.

Part D) Please refer to the response to Part A of this comment.

Specific Comment 8

Tables 20 and 21 Results Summary – Groundwater and Soil, respectively. For several chemicals of particular toxicological interest, the highest reporting limits are much greater than their respective screening levels. For example, the reporting limit for benzene in groundwater ranged up to 500 µg/L, whereas the screening level for this chemical is 1 µg/L. Similarly, the reporting limit for carcinogenic polycyclic aromatic hydrocarbons (PAHs) in soil ranged up to 23 mg/kg, whereas the screening level for benzo(a)pyrene is 0.062 mg/kg. It is important to acknowledge that the data sets have been examined to verify that elevated reporting limits have not significantly biased the calculation of exposure point concentrations and that the data sets are useable for health risk assessment purposes. These issues are discussed in Appendix H – Human Health Risk Assessment, Section 6.1.2 Reporting Limits; and, therefore, Section 6.1.2 should be cited in a footnote on these tables.

Response 8

The data sets have been examined to verify that the reporting limits have not significantly biased the calculation of exposure point concentrations and that the data sets are useable for health risk assessment purposes. A footnote will be added to Tables 20 and 21 citing Section 6.1.2. A detailed discussion of the reporting limits for the compounds noted above is presented below.

- Benzene was detected in 55 out of 122 groundwater samples. The exposure point concentration (99% Chebyshev UCL) for benzene is 400 µg/L. The reporting limits for benzene in the groundwater data set that was used in the risk calculation included only one sample result for a nondetect at 500 µg/L out of 122 samples. Two other nondetect samples had reporting limits greater than the screening level of 1 µg/L for benzene.

These were reporting limits of 5 and 10 μg/L. These few samples have not significantly biased the calculation of the exposure point concentration for benzene in groundwater.

- For the PAHs in soil, at the former AMCO facility and Parking Lot, the maximum detected concentration was used as the exposure point concentration for the majority of PAHs so the elevated reporting limits have not significantly biased the EPC calculation. For the Large Vacant Lot shallow soil, benzo(a)pyrene was detected in 5 out of 14 samples, and the maximum detected concentration is 1,400 mg/kg. The shallow soil EPC is 651 mg/kg. In deep soil, benzo(a)pyrene was detected in 7 out of 23 samples, with a maximum concentration of 1,400 mg/kg. The deep soil EPC is 617 mg/kg.

Specific Comment 9

Table 30 Soil Exposure Assumptions. The particulate emission factor (PEF) for the construction worker should not be the same as the PEF used for residential and worker scenarios, since it would be expected that a construction site could potentially generate significant amounts of dust. A default PEF of 1.0 x 10^6 m^3/kg as listed in the DTSC Human Health Risk Assessment (HHRA) Note Number 1 (October 2005), should be used for the construction worker. This PEF corresponds to a respirable dust concentration of one mg/m^3.

Response 9

We agree that the PEF for the construction and trench worker scenarios should be higher than for residential and industrial worker scenarios. The inhalation of particulate pathway contributes less than one percent of total risk/hazard contribution for the construction worker at three of the four exposure areas (including the parking lot and large and small vacant lots) so an increase in the particulate emission factor (PEF) would not be detectable in the final risk/hazard estimates for those areas. However, at the Former AMCO Chemical Facility exposure area, the inhalation pathway contributes 16 percent of the total cancer risk and 30 percent of the total noncancer HI. The construction worker PEF of 1.0 x 10^{-6} m^3/kg was applied to the risk/hazard calculations to assess the impacts on inhalation risk results. The revised cancer risk estimate is 7 x 10^{-5} increased from 2 x 10^{-5} which is still within EPA's target risk range. The revised noncancer HI is 20 increased from 5, which still exceeds the noncancer threshold of 1. The risk assessment has been updated using the suggested PEF for construction and trench workers.

Specific Comment 10

Table 33 Exposure Point Concentrations for Soil Exposure Areas, and Table 34 Exposure Point Concentrations for Groundwater. The exposure point concentrations for dioxins/furans in dioxin TEQ should be included in these tables.

Response 10

As noted in Response 6, TEQs have been added to the tables.

Specific Comment 11

Table 37 Summary of Cancer Risks and Noncancer Hazards – Soil. This table summarizes the risks and hazards for each facility exposure area. This table should be expanded or an additional summary table should be included that identifies the risk-driving chemicals and exposure pathways, as shown in the detailed summary tables of risk drivers presented in Appendix H – Human Health Risk Assessment. Alternatively, footnotes should be added to this table that identify the five to ten chemicals responsible for the majority of the risks/hazards and the primary exposure pathways.

Response 11

The primary risk drivers have been added to Table 37.

Specific Comment 12

Appendix H – Human Health Risk Assessment. Page 2-1 Section 2.2.1 Soil. Shallow soil samples are defined as samples taken between zero and two feet below concrete. Deep soil samples are defined as samples taken between two and seven feet below concrete. Please provide the rationale for these depth ranges and any supporting citations.

Response 12

As discussed with DTSC and the City of Oakland prior to collection of data, shallow oil samples were collected between zero and two feet below concrete because of site-specific conditions described in Section 4.3.1.

Due to the water table at the site ranging from 3 to 8 feet bgs, the deepest soil sample that could be collected was at 7 feet bgs.

This text has been added to Section 2.2.1 to explain the sample depths: A non-engineered concrete cap exists over the majority of the former AMCO facility and varies from 6 to more than 40 inches thick. In accordance with the SAP, shallow soil samples were generally collected from between 1 and 2 feet below the concrete or below ground surface in unpaved areas.

Specific Comment 13

Appendix H – Human Health Risk Assessment. Page 3-4 Section 3.2 Exposure Point Concentrations. A separate, supplemental health risk assessment should be carried out for the "hot spot" west and adjacent to the existing warehouse and office building. This hot spot area should be the approximate size of the existing residential lots near the facility.

Response 13

The cancer risks for a potential future resident on the Main Property exceed the risk management range, as shown on Table 37 and the noncancer hazard index exceed the threshold of 1 which are unacceptable conditions for residential lots without remediation. The "hot spot" west and adjacent to the existing warehouse and office building will be remediated so a supplemental health risk assessment was not conducted.

As discussed in EPA's Re-use Assessment for the AMCO Chemical Superfund Site (EPA 2010), re-use considerations may help selection of a remedial alternative:

- Targeted use restrictions may be required on the Site to ensure protection of human health and the environment
- Long-term remedial features may create some constraints on future use at the Site.

Specific Comment 14

Appendix H – Human Health Risk Assessment. Page 3-7 Section 3.3.4 Exposure Parameters and Equations for Inhalation of Particulates and Volatiles form Soil –

Particulate-emission and Volatilization Factors. The exposure to outdoor air contaminated by vapors diffusing from soil is calculated using soil matrix concentrations and the standard methodology described in the U.S. EPA *Soil Screening Guidance: User's Guide* (April 1996). Since soil vapor concentration values are available, the exposure concentration of outdoor air should also be determined using these data. This may be done for each VOC by calculating the emission flux from the soil vapor concentration, multiplying the flux by the exposure area to get the emission rate, and then applying a box model or dispersion factor to get an exposure point concentration. The exposure point concentration and resulting risks calculated from soil matrix and soil vapor concentrations, respectively, should be compared. If the differences are significant, the reasons for the differences should be discussed in the uncertainty section. The most conservative exposure point concentrations should be evaluated in this health risk assessment.

Response 14

Risks and hazards were estimated using ambient air data (direct measurement) so we did not estimate ambient air concentrations from soil gas data (theoretical modeling).

Specific Comment 15

Appendix H – Human Health Risk Assessment. Page 4-5 Section 4.2.3 Toxicity Values for Lead. For workers exposed to lead in soil, the US EPA Region 9 industrial lead PRG of 800 mg/kg is utilized. This PRG is based on the US EPA Adult Lead Model (ALM). Please confirm that this PRG is protective of all ethnic groups.

Response 15

The evaluation of lead in soil has been updated to compare site lead concentrations to the CalEPA's residential and industrial CHHSLs of 80 mg/kg and 320 mg/kg, respectively. The Revised California Human Health Screening Levels for Lead (CalEPA 2009) states that the Geometric Standard Deviation for Blood Lead Levels (GSD) used in the Adult Lead Model for calculation of the industrial CHHSL is 1.8 based on an EPA recommended value for relatively homogeneous populations.

Specific Comment 16

Appendix H – Human Health Risk Assessment. Page 5-6 Section 5.4.5 Background Soil Risk Evaluation, and Table 1-06 Soil Exposure Point Concentrations for City of Oakland Background. For all on-facility exposure areas, arsenic is a predominant risk-driving chemical, despite the fact that the arsenic exposure point concentrations, ranging from 7.7 mg/kg to 26.9 mg/kg, could be considered present at background levels at some exposure areas. No local background soil samples were collected. Instead, background soil concentrations as reported by the City of Oakland (*Survey of Background Metal Concentration Studies*, 1996) were used to determine background risk. The background risk to industrial workers is reported in the text to be 6 x 10^{-5}, with arsenic as the primary risk-driver. The background soil arsenic concentration that results in that risk is not, but should be, presented in the text of this section. The range of background soil arsenic concentrations in Oakland should be presented in this section. Table 1-96 should be cited in this section. Comparison of background arsenic soil concentrations with facility-related arsenic soil concentrations should be done so that arsenic may be included or excluded as a COPC.

Response 16

A citation for Table 1-96 will be added in Section 5.4.5. The arsenic value used to calculate risk is 14.0 mg/kg. We used the most relevant arsenic background concentration from the City of Oakland Survey of Background Metal Concentration Studies (colluvium and fill). The arsenic background concentration has been added to the text. See Response B regarding exclusion of arsenic from facility-related arsenic soil concentrations.

Specific Comment 17

Appendix H – Human Health Risk Assessment. Page 5-7 Section 5.6 Residential Soil Gas, Ambient Air, and Crawl Space Air; and, Attachment 3 Table 3-8 Residential Air Results Summary. A quantitative risk evaluation of the indoor air exposure pathway has not been included in this risk assessment for either on-facility or off-facility receptors. Instead, a screening evaluation was done to determine if there is an immediate health threat to residents. The HERD recommends that the risk and hazards posed by VOCs intruding from the subsurface into indoor air be quantitatively evaluated in a supplement to this risk assessment, because VOCs at the site are present at highly elevated levels in soil gas and groundwater. There are sufficient soil gas, groundwater, ambient air, and crawlspace air data to perform such an evaluation for on-facility exposure areas and adjacent residences. The HERD expects that indoor air exposure would be the dominant, risk-driving pathway; thus, this human health risk assessment is incomplete and misleading without including the risks form this pathway. A) In order to perform a quantitative risk evaluation of soil vapor concentrations, the maximum soil gas concentrations for each exposure area, including each residence, should be utilized. The DTSC Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (January 2005) describes several acceptable evaluation methods. B) The ten VOCs responsible for the majority of the risk should be carried through this supplemental risk assessment. C) Maximum soil gas concentrations should similarly be used to quantify on-facility risks from vapor intrusion, although soil gas concentrations above the known LNAPL locations should be avoided, since the vapor intrusion models acceptable to the DTSC do not include NAPL as a continuing source. D) For groundwater VOC concentrations, the 95% upper confidence limits (UCLs) of mean values may be used in the latest DTSC screening level groundwater model. E) Target groundwater concentrations that would be protective of vapor intrusion into indoor air should be calculated for the primary risk-driving VOCs and compared to their respective maximum contaminant levels (MCLs) to make sure that the MCLs are sufficiently protective. F) At residences, backyard air levels may be compared to neighborhood background air levels, as shown in Table 3-8, to identify VOCs that may not be related to contamination coming from the facility.

Response 17

Part A) To evaluate the vapor intrusion pathway, we have elected to use direct measurement (crawlspace and ambient air data) to evaluate current risk as opposed to theoretical risk calculated using vapor intrusion modeling. EPA's 2002 OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) Tier 3 recommends the collection of samples from within individual buildings because they are the closest to the exposure point of interest and are likely to be more reflective of VI than samples collected further from indoor air. DTSC's Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air states "Crawl space air is less affected by the lifestyle choices, such as household product use and smoking, of the building's occupants than indoor air. The evaluation of the results of crawl space air sampling is easier to interpret than indoor air sampling results" (DTSC 2005).

Part B) All detected VOCs have been carried through in the quantitative risk evaluation. As shown on Table 3, the majority of VOCs detected in groundwater and soil gas were also detected in crawlspace air and ambient air.

Part C) Risks and hazards were not quantitatively evaluated using soil gas data. We used the crawlspace and ambient air data for evaluating the vapor intrusion pathway.

Part D) An evaluation of vapor intrusion using groundwater data was not conducted, however, it is acknowledged that in a worst case scenario, the risks and hazards may be as high as when residential use of the groundwater is considered. The cancer risks estimated for future residents using the groundwater as tap water in the home ranges from $1x10^{-4}$ to $7x10^{-2}$, which is significantly above the risk management range and clearly unacceptable. Hazard indices for a child is 628 and for an adult is 262 which are also significantly above the noncancer threshold of 1.

Part E) Target groundwater concentrations that would be protective of vapor intrusion into indoor air were calculated using the Regional Screening Levels for Resident Air, Henry's Law Constant, and an Attenuation Factor of 0.001 from groundwater to indoor air (EPA 2010) as cited in EPA's Vapor Intrusion Database for the VOCs that contribute the most to the risk/hazard. The results compared with the California drinking water standards (MCLs) are presented below:

VOC	**Target Groundwater Concentrations Protective of Vapor Intrusion into Indoor Air (μg/L)**	**California MCL (μg/L)**
Vinyl chloride	1.4	0.5
Cis-1,2-DCE	231	6
Trans-1,2-DCE	171	10

For the VOCs that contribute the most to the total cancer risk and noncancer hazard index, the California MCLs are more protective than the vapor intrusion target groundwater concentrations.

Part F) The air concentrations found at residences near the site in comparison with the air concentrations found at the background location are presented in Tables 27a through 27f of the RI Report.

Specific Comment 18

Appendix H – Human Health Risk Assessment. Page 5-9 Section 5.6 Residential Soil Gas, Ambient Air, and Crawlspace Air. As previously, stated, target soil gas concentrations were calculated by multiplying US EPA Region 9 ambient air PRGs by a default attenuation factor of 10. The HERD does not agree that these calculated screening levels should be used, because empirical evidence has not supported the use of an attenuation factor of 10 for

California sites. Instead, the HERD recommends that the Cal/EPA California Human Health Screening Levels (CHHSLs) be used as preliminary target soil gas concentrations.

Response 18

The screening level evaluation has been replaced with a quantitative risk evaluation of the vapor intrusion pathway. Using an attenuation factor of 10 for soil gas is recommended in the OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (EPA 2002b) and supported in the materials from the EPA/AEHS Workshop, March 16, 2010 – Update on Vapor Intrusion at U.S. EPA. For all compounds detected in the soil gas, these screening values are ***more conservative*** than the shallow soil gas CHHSLs.

Specific Comment 19

Appendix H – Human Health Risk Assessment. Page 5-7 through 5-14 Section 5.6 Residential Soil Gas, Ambient Air, and Crawlspace Air. A) Crawlspace air concentrations should be considered equivalent to indoor air concentrations. Therefore, crawlspace air concentrations could be compared to ambient air US EPA PRGs to obtain a screening level risk estimate using the methodology described in the Users' Guide and Background Technical Document for USEPA Region 9's Preliminary Remediation Goals (PRG) Table (October 2004). This risk estimate may be identified as a measure of current risk, as opposed to the theoretical risks calculated using vapor intrusion models. B) The comparison of crawlspace to ambient air concentrations, as is carried out in this risk assessment, is an appropriate method for excluding those concentrations in air that are likely not related to environmental media contamination.

Response 19

Part A) We agree that crawlspace air concentrations should be considered equivalent to indoor air concentrations.

Part B) Comment noted.

Specific Comment 20

Appendix H – Human Health Risk Assessment. Page 5-10 through 5-13 Section 5.6 Residential Soil Gas, Ambient Air, and Crawlspace Air. A qualitative discussion of air data obtained from adjacent residences is provided in the text. As discussed elsewhere in this memorandum, the HERD recommends a quantitative evaluation of these data. In addition, a summary table of the risks and hazards posed by the COPCs found in the air at these residences should be presented in order to establish the risk contours surrounding the facility.

Response 20

We agree that a quantitative evaluation of the crawlspace and ambient air data is appropriate. As discussed in previous responses, a quantitative evaluation has been performed. A summary table of the risks and hazards for the residences as well as the office workers is provided in Table 2.

Specific Comment 21

Appendix H – Human Health Risk Assessment. Page 7-1 Section 7.0 Summary and Discussion of Human Health Risk Assessment Results. This section discusses on-site soil and groundwater risk estimates, irrigation well results, and qualitative screening level evaluation of results obtained on environmental media on residential properties. This summary is deficient because it does not include a discussion on: the presence of VOCs in shallow groundwater as a continuing source of VOCs to ambient and indoor air, the limited identification of COPCs because of the lack of a critical evaluation of VOCs in soil gas, and presence of COPCs in the LNAPL as a continuing source at this site.

Response 21

A summary discussion of the results of the vapor intrusion evaluation has been added to this section. We disagree that there is a "limited identification" of COPCs. As shown on Table 3, the majority of VOCs detected in groundwater and soil gas were also detected in the crawlspace air and ambient air samples. All detected VOCs were quantitatively evaluated in the risk assessment.

Conclusions

The human health risk assessment contained in this remedial investigation report is deficient in several major aspects, as discussed in the comments above. The assessment should be revised to include a quantitative evaluation of the risks and hazards posed by the presence of VOCs in soil vapor and groundwater. The risk assessment should also include an in depth discussion of the health effects that may be associated with the presence of LNAPL.

Response 22

The assessment has been revised to include a quantitative evaluation of the risks and hazards posed by the presence of VOCs in crawl space air and ambient air. Soil vapor and groundwater data have been used as lines of evidence that vapor intrusion is occurring but not quantitatively evaluated. An evaluation of vapor intrusion using groundwater data was not conducted, however, it is acknowledged that in a worst case scenario, the risks and hazards may be as high as when residential use of the groundwater is considered. The cancer risks estimated for future residents using the groundwater as tap water in the home ranges from $1x10^{-4}$ to $7x10^{-2}$, which is significantly above the risk management range and clearly unacceptable. Hazard indices for a child is 628 and for an adult is 262 which are also significantly above the noncancer threshold of 1.

Responses to DTSC Comments from September 2010

September 16, 2010

Rose Marie Caraway
Remedial Project Manager/Environmental Scientist
U.S. Environmental Protection Agency
75 Hawthorne Street, SFD 7-2
San Francisco, CA 94105

Dear Ms. Caraway:
Thank you for the opportunity to review the Draft Final Human Health Risk Assessment and response to comments dated August 2010 for the AMCO Chemical Site located in Oakland, California. DTSC previously provided comments on the risk assessment to US EPA in April 2008. DTSC's Human and Ecological Risk Office (HERO) reviewed both the revised risk assessment and response to comments that were provided via email on August 24, 2010. Based upon that review, please find attached HERO's comments to both the responses provided as well as comments to the revised report. Please note that DTSC did not conduct an editorial review of the accompanying tables, but assumes that US EPA or its contractor has done this review.

If you have any questions, please contact Lynn Nakashima of my staff at (510) 540-3839 or Lnakashi@dtsc.ca.gov.

Sincerely,
Barbara J. Cook, PE
Acting Assistant Deputy Director
Brownfields & Environmental Restoration Program
Department of Toxic Substances Control

Enclosure

cc: Ms. Lynn Suer
U.S. Environmental Protection Agency
75 Hawthorne Street, SFD 7-2
San Francisco, CA 94105

Dr. Kimiko Klein
Human and Ecological Risk Office
Department of Toxic Substances Control
700 Heinz Avenue
Berkeley, CA 94710

TO: Lynn Nakashima
Brownfields and Environmental Restoration Program
700 Heinz Avenue
Berkeley, CA 94710-2721

FROM: Kimiko Klein, Ph.D.
Staff Toxicologist Emeritus
Human and Ecological Risk Office (HERO)

DATE: September 15, 2010

SUBJECT: Draft Final Human Health Risk Assessment
AMCO CHEMICAL SUPERFUND SITE, OAKLAND
PCA 14125 Site Code: 200687-62

Background

This one-acre property was formerly the site of a chemical repackaging business and scrap metal yard. The facility property is separated into four exposure areas: the facility, parking lot, large vacant lot, and small vacant lot. The property is surrounded by residential and industrial properties. The community is interested in a wide range of reuse options for the facility and nearby properties, including single and multi-family residential, commercial, office, a park and playground.

A dual-phase groundwater and soil vapor extraction and treatment system operated on-site from 1997 to 1998 during which time 7,000 pounds of volatile organic compounds (VOCs) were removed, including 40 pounds of vinyl chloride. The site was listed as a Superfund site by the U. S. Environmental Protection Agency (US EPA) in 2003. The Human and Ecological Risk Office (HERO) has been requested to provided technical support and has reviewed a previous draft health risk assessment in a memorandum, dated April 8, 2008. The HERO has participated in several meetings with US EPA staff to discuss human health risk issues specific to this property and the surrounding area.

Document Reviewed

The HERO reviewed a red-line version of a document entitled "Draft Final Report, Human Health Risk Assessment, AMCO Chemical Superfund Site", dated August, 2010, and prepared for the US EPA, Region 9, by CH2M HILL. The document was transmitted to the HERO via e-mail on August 24, 2010.

General Comments

This updated, complex baseline risk assessment evaluates the exposure, risks, and hazards posed by a very large array of chemicals detected in multiple environmental and exposure media including, air, soil, groundwater and home-grown produce both on the facility properties and nearby residences. Multiple land-use scenarios are considered.

In the review by the HERO of the previous human health risk assessment report for this site contained in the memorandum, dated April 8, 2008, major deficiencies were identified. These deficiencies included: the lack of a quantitative assessment of the risks from exposure of workers and hypothetical residents to indoor air contaminated with VOCs intruding from sub-surface soil, non-aqueous phase liquids (NAPLs) and/or shallow groundwater; and, the inclusion of arsenic as a primary risk-driver even though it may be present on the facility property at background concentrations. In addition, elevated lead levels in soils were found throughout the facility, representing a hazard to current and future receptors.

The HERO read the entire revised report but focused on the revisions made to address the previous comments of the Department of Toxic Substances Control (DTSC) and the responses to those comments that appear as Attachment 7 to this report. The HERO did not review any other attachments and only cursorily reviewed the tables because of time constraints. The HERO assumes that other DTSC staff has reviewed the data sets used to support this health risk assessment for adherence to data quality objectives and assurance.

A. With respect to the assessment of risks from vapors intruding from the sub-surface, extensive crawlspace and ambient air sampling data have been incorporated in this subject report as an adjunct to the original health risk assessment. The risk assessment has been revised to include a quantitative evaluation of the indoor air inhalation pathway using crawlspace and ambient air data. Risks and hazards from exposure to indoor air were calculated using crawlspace rather than indoor air data, as indoor air data were considered to more likely be affected by lifestyle. Risks and hazards from exposure to ambient air were also calculated, as ambient air data indicated the presence of many air pollutants in this neighborhood. The risks calculated from crawlspace air range from 5×10^{-5} to 3×10^{-4} at the residences near the property.

The industrial risk calculated from crawlspace air of the on-facility office is 6×10^{-5}. Ambient air risks near the facility property range from 2×10^{-5} to 2×10^{-4}.

Groundwater and soil vapor data are included in a qualitative weight-of-evidence evaluation of VOCs in ambient air, crawlspace air, groundwater and soil vapor. The evaluation of these data indicates a complex relationship between crawlspace air, indoor air, the sub-surface, and ambient air. The HERO has three comments on the vapor intrusion risk discussion in this revised report. First, the air data indicate that vinyl chloride is a primary chemical of concern in crawlspace and ambient air on the property and at nearby residences but was never detected in the up-wind background location, indicating that vinyl chloride is likely a site-related chemical of concern, and this should be acknowledged in the text.

> The following text has been added to Section 5.6.2: The air data indicate that vinyl chloride is a primary chemical of concern in crawlspace and ambient air on the facility property and at one nearby residence. Because it was never detected in the up-wind background locations, vinyl chloride is likely a site-related chemical of concern.

Second, quantitative and qualitative evaluation of air data in this report addresses only exposure and risks in existing buildings. Vapor intrusion into future buildings that may be located in the parking lot, small vacant lot, and large vacant lot sections of the property have not been evaluated, because groundwater and soil vapor data are not quantitatively evaluated for vapor intrusion. This represents a risk evaluation gap for future development of those exposure areas, and this should be either addressed or acknowledged.

> Potential risks and hazards from vapor intrusion into future buildings from VOCs in groundwater may be as high as when residential use of the groundwater is considered, in a worst case scenario. The cancer risks estimated for future residents using the groundwater as tap water in the home is approximately 7×10^{-2}, which is significantly above the risk management range. Hazard indices for an adult (262) and child (628) resident are also significantly above the non-cancer threshold of 1.
>
> Evaluation of future vapor intrusion risk from the soil gas data into future buildings at the parking lot, small vacant lot, and large vacant lot was not conducted because of the following uncertainties:
>
> a) Subslab soil gas samples were not collected – only exterior soil gas was collected in residential yards.
> b) Exterior soil gas samples may underestimate the concentrations found beneath a building because there is no floor covering the ground surface.
> c) Soil gas samples could not be collected at the DTSC recommended depth because the groundwater is less than 5 feet from the ground surface.
> d) Use of a generic attenuation factor may over/underestimate the VOC concentrations in indoor air.

The uncertainty of potential vapor intrusion risk in the future is acknowledged in the uncertainties section (6.2) as follows:

"Potential risks and hazards from vapor intrusion into future buildings that may be located in the parking lot, small vacant lot, and large vacant lot exposure areas have been evaluated and are exceedingly high. This represents an uncertainty for future development. If future buildings are constructed in these areas, vapor mitigation systems are recommended."

Third, groundwater is present at between 2.5 to 6.5 feet below ground surface (bgs) and is highly contaminated with VOCs. The main body of the report in Section 5.5.1 Shallow Groundwater has been revised to state that risks from VOCs in groundwater intruding indoors may be as high as the risks calculated from the residential use of groundwater as tap water. A vapor intrusion screening evaluation of VOCs in groundwater is presented in Attachment 7 Response to DTSC Comments on the HHRA which clearly shows the overwhelming risk posed by the vinyl chloride in that medium. This screening evaluation should be referenced in Section 5.5.1.

The results of the screening evaluation summarized in Attachment 7 (Response to Comments from DTSC) has been added to Section 5.5.1 as follows:

"To confirm that the risks for vapor intrusion are similar as the risks from drinking the groundwater, selected VOCs that contribute the most to the risk and hazard estimates were modeled using the DTSC screening groundwater vapor intrusion model. Default values were used in the model except the depth to groundwater was adjusted to 5 feet below ground surface and sand was used as the SCS soil type. Below is the table of results:

VOC	Exposure Point Concentration (µg/L)	Incremental Risk from Vapor Intrusion to Indoor Air	Hazard Quotient from Vapor Intrusion to Indoor Air
Vinyl chloride	1,627	2.2×10^{-1}	80
TCE	57	6.0×10^{-6}	0.014
PCE	12	6.2×10^{-6}	0.083
Cis-1,2-DCE	13,700	NA	22
Trans-1,2-DCE	400	NA	0.83
Totals		2×10^{-1}	103

These results show that the risks and hazards related to vapor intrusion are significantly above the risk management range and clearly unacceptable."

B. In its memorandum of April 8, 2008, the HERO questioned why arsenic was included as a chemical of concern in the previous health risk assessment even though this element appeared to be present at the facility at background concentrations. The risk assessment report was revised to include statements that arsenic detected in the facility exposure areas are similar to background concentrations and, thus, may not be site related. A further evaluation of arsenic is presented in the response to DTSC General Comment B in Attachment 7 in which arsenic exposure point concentrations and residential risks without arsenic are given. This evaluation suggests that arsenic concentrations may be elevated over background in shallow soil of the parking lot and in the large vacant lot exposure areas perhaps due to the past use of those areas as a scrap metal yard. This should be stated in the main body of the risk assessment in Sections 5.4.2 Parking Lot and 5.4.3 Large Vacant Lot.

At this point in time, the source of the elevated arsenic levels in the shallow soil of the parking lot and the large vacant lot is unknown and cannot be attributed to the scrap metal yard.

C. Highly elevated soil lead levels have been detected throughout the facility and on nearby properties. Surface soil was removed from exposed areas of yards of eight residences as an emergency response. In Section 5.7 Residential Screening Level Soil Evaluation, the report states that residual lead concentrations are below the screening level at those residences. However, the lead screening level used in that emergency response is not given in this section, nor are the areas of excavation shown on any figure in the revised report. A site-specific lead action level of 390 mg/kg is given in the Executive Summary 4 Results for Screening Level Risk Evaluation, and, if this was used as the screening level in the emergency response, it should be identified and so stated in Section 5.7. The basis for that action level should also be briefly described in Section 5.7. No soil excavation has taken place on the facility, thus the HERO assumes that the reported soil lead concentrations, ranging from 605 to 2170 mg/kg, still remain on-site and will be the subject of future remedial activities.

The following text has been added to Section 5.7 to clearly state the action level for the lead cleanup:

"The soil was excavated until the confirmation sampling indicated that the remaining soil was below the EPA residential screening level of 400 mg/kg, or to a 3-foot maximum depth. The excavation depth was generally between one and three feet. Small areas were excavated to a depth of less than 1 foot in locations where valuable trees or plants might have been damaged by deeper excavation."

The HERO has the following comments on the subject report. The first comments address the response to DTSC comments: Following this set of comments are comments on the revised report.

Specific Comments

1. Response to DTSC Specific Comment 1. The HERO requested that the method for sampling groundwater and soil be briefly described in order to verify that appropriate sampling methods were used to reduce the possibility of VOC loss. The response states that field procedures are presented in Appendix C and that this reference will be included in the text of Section 4.2.2.3. Adding a citation without including a description in the text is not useful to the reader. In addition, these appendix and section designations do not correspond to what is contained in the risk assessment report. The HERO requests that this description be included in the risk assessment report in Sections 2.1.1 Soil and 2.1.2 Groundwater.

Sampling procedures have been extracted from Appendix C of the RI Report and inserted into the Sections 2.1.1 Soil and 2.1.2 Groundwater to describe the appropriate method for sampling soil and groundwater to reduce the possibility of VOC loss.

2. Response to DTSC Specific Comment 2. The HERO recommended specific methods to measure soil physical properties. The response states that these methods will be used if soil vapor modeling

is conducted in the future. As stated above, soil vapor modeling using soil vapor and/or groundwater data should be performed in those exposure areas where no current buildings exist.

> As discussed in the response to general comment A, it has been acknowledged that risks and hazards from exposure to VOCs via the vapor intrusion pathway in future buildings at the parking lot and small and large vacant lots could be as high as the risks and hazards when residential use of the groundwater is considered, which is significantly above levels as which action will be taken.

3. Response to DTSC Specific Comment 3. The HERO requested that a figure be included in the risk assessment showing the approximate boundaries of the light non-aqueous phase liquids (LNAPL). The response states that the LNAPL is not yet delineated but is likely present in the vicinity of monitoring wells MW-13 and MW-14. Figure 14 is cited as having the locations of all the wells sampled. This figure designation does not correspond to the figure showing the monitoring well locations in the risk assessment report. Figure 3 Grab and Monitoring Well Sample Locations for Shallow Wells used in the Risk Assessment should be cited in the response. In addition, Figure 3 appears to be incomplete, since MW-14 is not shown, and the facility office address is not given. The figure should be reviewed for other omissions and corrected to include all grab and monitoring well locations.

> Figure 3 of the HHRA only shows those wells that were included in the HHRA data set. As described in Section 2.1.2, groundwater samples were not collected from monitoring wells with floating NAPL (MW-13 and MW-14). It was not an omission that these wells are not shown on the figure. It's important to note that Figure 14 of the RI report was cited in the original response to DTSC Specific Comment 3.

4. Response to DTSC Specific Comment 4. This comment requested a summary and clarification of the soil excavation activities to remove surface soil with elevated lead concentrations. As stated in the general comments above, the HERO requests that the action level for lead used in that soil removal activity be given in Section 5.7 along with the rationale for that level.

> Section 5.7 has been revised to identify the EPA residential screening level of 400 mg/kg.

5. Response to DTSC Specific Comment 5. This comment requested clarification on specific arsenic sampling data, and the response refers to Section 5.5.4 which does not correspond to the appropriate section in the risk assessment report. The information contained in the revised bullet should be included in Section 5.7.4 326 Center Street.

> The original DTSC comment was on Section 5.5.4 of the RI report, not the HHRA. Section 5.7.4 of the HHRA has been revised to include the revision. The following text has been added to Section 5.7.4:
>
> "Arsenic was detected above the screening level in every soil sample collected; however, concentrations detected across the RI Study Area are generally less than or equal to background concentrations typical of the San Francisco Bay Area with the exception of the

sample collected location 326SSd. Arsenic was detected at concentrations greater than background in shallow (451 mg/kg) and deeper (125 mg/kg) soil at this location."

6. Response to DTSC Specific Comment 6. The HERO requested that dioxins/furan concentrations be presented as dioxin toxicity equivalents (TEQs) in the exposure point concentration tables. The response states that the tables have been so modified. Tables 8 Exposure Point Concentrations for Soil Exposure Areas and 9 Exposure Point Concentrations for Groundwater contain congener-specific data but do not include TEQ concentrations. The tables should be revised.

The DTSC's April 2008 comment 6 referred to Tables 33 and 34 of the RI report. Tables 8 and 9 of the HHRA have been modified to include the TEQ concentrations for dioxins.

7. Response to DTSC Specific Comment 7. This comment further discusses the deficiencies related to the lack of risk evaluation of the vapor intrusion pathway in the original risk assessment. General Comment A above presents the major concerns of the HERO on this issue. The HERO further notes that the potential effect of LNAPL in shallow groundwater on vapor intrusion and as a long-term source of VOCs is not addressed in this revised risk assessment. The response to this concern is that the LNAPL will be remediated to remove it as a source of VOCs. The HERO requests clarification on how it will be determined that LNAPL has been adequately remediated without a risk evaluation. In addition, it may be necessary to evaluate the risks and hazards from the continued presence of LNAPL, if the remediation of LNAPL does not take place in the near future.

The uncertainty of the potential effect of the LNAPL on the shallow groundwater on indoor air risk estimation and as a long-term source of VOCs is discussed in the uncertainties section as follows:

The potential effect of the LNAPL on the shallow groundwater on indoor air risk estimation and as a long-term source of VOCs has not been addressed. However, it is acknowledged that risks and hazards would be unacceptable if buildings were to be located over the LNAPL before remediation takes place.

8. Response to DTSC Specific Comment 8. The HERO requested examination of the groundwater and soil data sets to verify that elevated reporting limits have not significantly biased the exposure point concentration calculations. The response is clarifying, but the table designations no longer correspond to the tables in the revised report. Please correct the table designations given in the response.

Tables 20 and 21 (as cited in the April 2008 DTSC comments) are part of the RI report. Tables 1-1 in Attachment 1 and 2-1 in Attachment 2 have been footnoted to refer to Section 6.1.2 for a discussion of the reporting limits.

9. Response to DTSC Specific Comment 9. In this comment, the HERO recommended that the particulate emission factor (PEF) for the construction worker should be that listed in the DTSC Human Health Risk Assessment (HHRA) Note Number 1 (October 2005). The response states that the PEF recommended by DTSC is used in this updated assessment. However, Table 4 Soil Exposure Assumptions lists identical PEFs for all exposure scenarios evaluated. Please explain or correct.

Table 4 has been revised to show the corrected PEF for the construction worker. The risk and hazard results for the construction worker shown in the subsequent tables and discussed use the corrected PEF.

10. Response to DTSC Specific Comment 10. This comment recommends again that dioxin/furan congener concentrations be converted to a single dioxin TEQ concentration and included as an exposure point concentration. As stated above, the relevant tables have not yet been modified in this revised assessment report.

Tables 8 and 9 have the dioxin/furan congener concentrations converted into TEQ concentrations and a row to show the total dioxin TEQ concentration has been added.

11. Response to DTSC Specific Comment 11. The HERO recommended that the risk drivers be listed in the summary tables of risks and hazards. The tables have been satisfactorily revised, but, as with the other responses, the table and section designations do not, but should, correspond with the sections and tables of this revised report.

Table 37 Summary of Cancer Risks and Noncancer Hazards for Soil is part of the RI Report. Primary risk drivers have been identified for each media in Tables 12 and 13 of the HHRA.

12. Response to DTSC Specific Comment 12. A rationale was requested for the depth of soil samples taken. The rationale and revision of the risk assessment to address this comment is adequate.
No response required.

13. Response to DTSC Specific Comment 13. The HERO requested that a supplemental risk evaluation be performed for the hot spot adjacent to the existing warehouse and office building. No supplemental evaluation is included in this revised report, because the response states that the entire "main property" will be remediated. This response is adequate as long as it is explicitly stated in all future cleanup work plans that all hot spots will be included in remedial activities; and risk-based cleanup goals are developed for any interim hot spot removal actions.
Comment acknowledged.

14. Response to DTSC Specific Comment 14. The HERO recommended that ambient outdoor air exposure concentrations be calculated from site soil vapor concentrations for use in the facility property risk evaluation. The response states that such calculations are not necessary, since ambient air sampling was performed and the data obtained input directly as exposure point concentrations. However, there are no ambient air concentrations for the facility itself (1414 3rd Street) listed in Table 10 Exposure Point Concentrations for Crawlspace and Ambient Air, and no risk or hazard for the facility is given in Table 14 Risk and Hazards Summary for Vapor Intrusion Evaluation. This represents a data evaluation gap and should be so stated. Ambient air risks on the facility property may be greater than the ambient air risks on nearby properties.

Ambient air samples were not collected at the facility (1414 3rd Street) because at the time the samples were being collected, solvents were in use.

15. Response to DTSC Specific Comment 15. The HERO questioned the use of the US EPA industrial lead Preliminary Remedial Goal (PRG) of 800 mg/kg as adequately protective. The assessment

report has been satisfactorily revised to compare the site soil lead data to the residential and industrial California Environmental Protection Agency (Cal/EPA) California Human Health Screening Level (CHHSLs) for lead of 80 mg/kg and 320 mg/kg, respectively.
Comment noted. No response required.

16. Response to DTSC Specific Comment 16. The HERO requested additional discussion and evaluation of arsenic in soil at the facility, and the report has been revised to include such a discussion. In the revised report, Table 1-96 is cited, as requested. However, this table is not part of the risk assessment, so the citation should be further clarified by identifying the remedial investigation report as the location of the table.

Table 1-96 is in Attachment 1 of the risk assessment appendix. This clarification has been added to the text of Section 5.4.5.

17. Response to DTSC Specific Comment 17. This comment identifies additional deficiencies in the original risk assessment with respect to the indoor air exposure pathway. All of these issues are addressed in the comments and responses above, except for HERO's recommendation that target groundwater concentrations that would be protective of vapor intrusion into indoor air should be calculated for the risk-driving VOCs and compared to their respective maximum contaminant levels (MCLs) to make sure that the MCLs are sufficiently protective as goals in any remedial activity. The response includes the requested calculation and comparison, and the comparison indicates that remediation of groundwater to MCLs would be protective of the indoor air exposure pathway. This response should be included as part of any future report that details groundwater cleanup goals to be applied at this site.
Comment noted. No response required.

18. Responses to DTSC Specific Comments 18 through 21. These DTSC specific comments have all been satisfactorily addressed.
Comment noted. No response required.

19. Page xxi, Abbreviations and Acronyms. For your information, the Human and Ecological Risk Division (HERD) at DTSC has been renamed the Human and Ecological Risk Office (HERO).

Renamed acronym for HERD has been incorporated in the document.

20. Page 2-2, Section 2.1.2 Groundwater. It would be informative to add the range of depths to groundwater, the presumed extent of the contaminant plume, and general direction of groundwater flow to this section.

The following text has been added to Section 2.1.2:

"During the RI, the shallow water table fluctuated from approximately 2.5 to 6.5 feet below ground surface (bgs). In the dry season (May through October), flow generally appears to be toward the southwest; in the wet season (November through April), flow is generally to the south. The highest concentration of contaminants is observed in shallow groundwater (less than 25 feet bgs) in the central and south-central areas of the former AMCO facility, west of the warehouse and office. Contaminant concentrations beneath the central and south-central portions of the former facility decrease rapidly with increasing depth."

21. Page 2-3, Section 2.1.4 Residential Soil and Homegrown Produce; and Figure 4 Residential Ambient Air, Crawlspace Air, Produce and Soil Gas Sample Locations. Soil and produce samples were collected at several nearby residences and the results evaluated in this assessment. Figure 4 should be cited in this section. The title of Figure 4 should be revised to include "soil samples". Also a footnote should be added to the figure stating that not all soil vapor sample locations are shown on this figure. The HERO recommends that a new figure be included that shows the locations of all soil gas samples on the facility and at nearby properties, including 337/339 Center Street.

> The title of Figure 4 has been revised to include soil samples and a footnote added. The figure has been renumbered as Figure 4b. Figure 4a has been added that includes locations of all soil gas samples and nearby properties, including 337/339 Center Street.

22. Page 3-10, Section 3.3.7 Exposure Parameters and Equations for Inhalation of Vapors from Groundwater; and, Attachment 8 Response to TAG Advisor Comments on the HHRA. This section includes a description of the approach and equations used to evaluate the trench worker scenario, assuming the presence of standing water in the trench. The response to the TAG Advisor states that the trench model recommended by the Virginia Department of Environmental Quality is used. However, all the citations in this section given for the trench model are from the US EPA. Please clarify.

> The Virginia Trench model was used to provide the response to the TAG Advisor comment to evaluate the exposure to VOCs in groundwater by a construction worker without a wind factor. We calculated risk using the Virginia Department of Environmental Quality's trench worker model which assumes no wind velocity in the trench and the results show a risk greater than 10^{-4} (6×10^{-4}) and an HI that exceeds 1 (34). This discussion has been added to Section 6.2 Exposure Pathway and Assumption Uncertainties.

23. Page 5-8 Section 5.6.1 Comparison of VOC Data Between Crawlspace and Ambient Air. This section provides an overview of the VOCs detected in crawlspace and ambient air at residential properties near the facility. The VOCs detected in crawlspace air at levels greater than five times the levels measured in ambient air are identified. It is stated that chemicals were detected in crawlspace air with no obvious correlations with ambient air concentrations. These chemicals should be identified in this section, and a comparison made between these chemicals and chemicals detected in soil gas and/or groundwater.

> Attached tables RTC-1a through RTC-1g contain comparisons between detected concentrations of VOCs in soil gas, crawlspace air, ambient air, and background air. Ratios have been calculated between the different media. In addition, a discussion of the comparison of VOC data between groundwater, soil gas and crawlspace air data is presented in Section 5.6.3.

Conclusions

This complex risk assessment has been extensively revised to include an evaluation of VOCs detected in crawlspace air, indoor air, subsurface samples and ambient air. Some of the deficiencies previously identified by the HERO have been addressed by revisions made in the body of the report.

Other deficiencies have been addressed within the context of the response to DTSC comments in Attachment 7. The remaining major concerns of the HERO are: the risk evaluation gap for future buildings that may be sited in the parking lot, small vacant lot, and large vacant lot sections of the facility property; the lack of a risk evaluation basis for any future remediation of the LNAPL; and the lack of a risk evaluation of on-facility ambient air that could be used to inform the facility's role in ambient air risks at nearby properties. A number of the deficiencies described in the comments above may be easily addressed by updating the table, section and figure designations cited in the responses.

Any recommendations provided in this memorandum are intended for use only at this site. If you have any further questions, please contact me at (510) 540-3762 or via electronic mail at kklein @dtsc.ca.gov.

Reviewed by:

I I, c/n-

Claudio Sorrentino, Ph.D.
Senior Toxicologist
Human and Ecological Risk Office

TABLE RTC-1a

Comparison of Maximum Soil Gas Concentrations to Crawl Space and Ambient Air EPCs for 1428 3rd Street

AMCO Chemical Superfund Site, Oakland, California

Address	1428 3rd Street									
Analyte	Maximum Soil Gas Concentration ($\mu g/m^3$)	Crawl Space Air EPC ($\mu g/m^3$)	Ambient Air EPC ($\mu g/m^3$)	Neighborhood Background EPC ($\mu g/m^3$)	Ratio of Soil Gas/Crawl Space Air	Ratio of Soil Gas/Ambient Air	Ratio of Crawl Space/Ambient Air	Ratio Ambient/ Background	Ratio Crawl space/ Background	Ratio Soil gas/Background
1,1,1-Trichloroethane	58	0.116	0.0913	0.0824	**500.00**	**635.27**	1.27	1.11	1.41	**703.88**
1,1,2,2-Tetrachloroethane	0.032	0.074	0.162	ND	0.43	0.20	0.46	NA	NA	NA
1,1,2-Trichloroethane	0.36	0.065	ND	ND	**5.54**	NA	NA	NA	NA	NA
1,1-Dichloroethane	47	0.026	ND	0.011	**1807.69**	NA	NA	NA	2.36	**4272.73**
1,1-Dichloroethene	ND	ND	ND	0.0397	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	0.13	11.9	14.8	0.862	0.01	0.01	0.80	**17.17**	**13.81**	0.15
1,2-Dibromoethane	ND	0.034	ND	ND	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.029	2.2	0.123	0.0525	0.01	0.24	**17.89**	2.34	**41.90**	0.55
1,2-Dichloropropane	ND	0.0908	0.0514	0.0449	NA	NA	1.77	1.14	2.02	NA
1,3,5-Trimethylbenzene	0.18	4.82	4.92	0.283	0.04	0.04	0.98	**17.39**	**17.03**	0.64
1,3-Dichlorobenzene	ND	ND	51	ND	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	ND	0.578	1.37	0.0949	NA	NA	0.42	**14.44**	**6.09**	NA
1,4-Dioxane (p-dioxane)	ND	ND	ND	0.391	NA	NA	NA	NA	NA	NA
Acetone	8.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	0.94	0.615	2.71	0.832	1.53	0.35	0.23	3.26	0.74	1.13
Bromomethane	ND	0.143	0.195	0.209	NA	NA	0.73	0.93	0.68	NA
Carbon tetrachloride	ND	0.507	0.569	0.531	NA	NA	0.89	1.07	0.95	NA
Chlorobenzene	ND	0.0373	0.3	0.0269	NA	NA	0.12	**11.15**	1.39	NA
Chloroethane	0.22	0.166	0.0897	0.0485	1.33	2.45	1.85	1.85	3.42	4.54
Chloroform	22	1.71	0.214	0.155	**12.87**	**102.80**	**7.99**	1.38	**11.03**	**141.94**
Chloromethane	0.79	14.1	1.34	1.19	0.06	0.59	**10.52**	1.13	**11.85**	0.66
cis-1,2-Dichloroethene	160	ND	ND	0.025	NA	NA	NA	NA	NA	**6400.00**
cis-1,3-Dichloropropene	ND	ND	0.052	0.0594	NA	NA	NA	0.88	NA	NA
Ethylbenzene	0.34	0.93	5.42	0.645	0.37	0.06	0.17	**8.40**	1.44	0.53
Freon 11	14	2.44	2.26	1.97	**5.74**	**6.19**	1.08	1.15	1.24	**7.11**
Freon 113	1	0.661	0.7	0.671	1.51	1.43	0.94	1.04	0.99	1.49
Freon 114	ND	ND	0.13	0.12	NA	NA	NA	1.08	NA	NA
Freon 12	2.2	2.57	2.83	2.59	0.86	0.78	0.91	1.09	0.99	0.85
Freon 134a	29	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl tert-butyl ether	ND	ND	0.023	0.231	NA	NA	NA	0.10	NA	NA
Methylene chloride	0.95	3.05	21	ND	0.31	0.05	0.15	NA	NA	NA
Naphthalene	ND	0.619	6.58	0.378	NA	NA	0.09	**17.41**	1.64	NA
n-Heptane	17	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	ND	0.514	6.8	0.187	NA	NA	0.08	**36.36**	2.75	NA
Tetrachloroethene	210	1.73	1.39	0.308	**121.39**	**151.08**	1.24	4.51	**5.62**	**681.82**
Toluene	16	11	15.7	4.91	1.45	1.02	0.70	3.20	2.24	3.26
Total hexanes	46	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	47	ND	0.042	ND	NA	**1119.05**	NA	NA	NA	NA
trans-1,3-Dichloropropene	ND	0.018	0.041	0.056	NA	NA	0.44	0.73	0.32	NA
Trichloroethene	480	3.29	0.197	0.0947	**145.90**	**2436.55**	**16.70**	2.08	**34.74**	**5068.64**
Vinyl chloride	0.0094	1.75	0.0424	ND	0.01	0.22	**41.27**	NA	NA	NA
Xylenes, m & p	0.62	3.9	21	2.72	0.16	0.03	0.19	**7.72**	1.43	0.23
Xylenes, o	ND	1.94	11.2	0.718	NA	NA	0.17	**15.60**	2.70	NA

Notes:

Red font indicates that first media shown are greater than 5 times second media concentrations.

Blue font indicates that the first media shown are less than 5 times second media concentrations.

Yellow highlighted cells indicate chemical contributed greater than 1E-05 to cancer risk or HQ greater than 1 to cumulative risk or hazard index, respectively

Orange highlighted cells indicate chemical contributed greater than 1E-06 to cancer risk

TABLE RTC-1b
Comparison of Maximum Soil Gas Concentrations to Crawl Space and Ambient Air EPCs for 1432 3rd Street
AMCO Chemical Superfund Site, Oakland, California

Address	1432 3rd Street										
Analyte	Maximum Soil Gas Concentration (µg/m³)	Crawl Space Air EPC (µg/m³)	Ambient Air EPC (µg/m³)	Neighborhood Background EPC (µg/m³)	Ratio of Soil Gas/Crawl Space Air	Ratio of Soil Gas/Ambient Air	Ratio of Crawl Space/Ambient Air	Ratio of Background/ Ambient Air	Ratio Ambient/ Background	Ratio Crawl space/ Background	Ratio Soil gas/Background
1,1,1-Trichloroethane	4	0.103	0.0878	0.0824	**38.83**	**45.56**	1.17	0.94	1.07	1.25	**48.54**
1,1-Dichloroethane	0.23	ND	ND	0.011	NA	NA	NA	NA	NA	NA	**20.91**
1,1-Dichloroethene	ND	ND	ND	0.0397	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	6.5	13.8	0.84	0.862	0.47	**7.74**	**16.43**	1.03	0.97	**16.01**	**7.54**
1,2-Dichlorobenzene	ND	0.148	0.13	ND	NA	NA	1.14	NA	NA	NA	NA
1,2-Dichloroethane	0.16	0.757	0.0558	0.0525	0.21	2.87	**13.57**	0.94	1.06	**14.42**	3.05
1,2-Dichloropropane	ND	0.062	0.0441	0.0449	NA	NA	1.41	1.02	0.98	1.38	NA
1,3,5-Trimethylbenzene	6	11	0.405	0.283	0.55	**14.81**	**27.16**	0.70	1.43	**38.87**	**21.20**
1,3-Dichlorobenzene	15	63	0.092	ND	0.24	**163.04**	**684.78**	NA	NA	NA	NA
1,4-Dichlorobenzene	ND	2.01	0.191	0.0949	NA	NA	**10.52**	0.50	2.01	**21.18**	NA
1,4-Dioxane (p-dioxane)	ND	0.26	ND	0.391	NA	NA	NA	NA	NA	0.66	NA
4-Ethyltoluene	4.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	0.99	7.28	0.913	0.832	0.14	1.08	**7.97**	0.91	1.10	**8.75**	1.19
Bromomethane	1	0.375	0.199	0.209	2.67	**5.03**	1.88	1.05	0.95	1.79	4.78
Carbon tetrachloride	0.43	0.545	0.543	0.531	0.79	0.79	1.00	0.98	1.02	1.03	0.81
Chlorobenzene	ND	0.16	0.022	0.0269	NA	NA	**7.27**	1.22	0.82	**5.95**	NA
Chloroethane	ND	0.156	0.0998	0.0485	NA	NA	1.56	0.49	2.06	3.22	NA
Chloroform	12	0.412	0.236	0.155	**29.13**	**50.85**	1.75	0.66	1.52	2.66	**77.42**
Chloromethane	0.92	3.05	1.3	1.19	0.30	0.71	2.35	0.92	1.09	2.56	0.77
cis-1,2-Dichloroethene	0.11	ND	ND	0.025	NA	NA	NA	NA	NA	NA	4.40
cis-1,3-Dichloropropene	ND	0.036	0.051	0.0594	NA	NA	0.71	1.16	0.86	0.61	NA
Ethanol	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	0.38	13.2	0.78	0.645	0.03	0.49	**16.92**	0.83	1.21	**20.47**	0.59
Freon 11	12	2.3	2.25	1.97	**5.22**	**5.33**	1.02	0.88	1.14	1.17	**6.09**
Freon 113	0.88	0.685	0.668	0.671	1.28	1.32	1.03	1.00	1.00	1.02	1.31
Freon 114	ND	0.23	0.13	0.12	NA	NA	1.77	0.92	1.08	1.92	NA
Freon 12	2.2	2.63	2.62	2.59	0.84	0.84	1.00	0.99	1.01	1.02	0.85
Freon 134a	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropanol	88	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl tert-butyl ether	ND	0.019	0.019	0.231	NA	NA	1.00	**12.16**	0.08	0.08	NA
Methylene chloride	0.37	2.63	3.7	ND	0.14	0.10	0.71	NA	NA	NA	NA
Naphthalene	1.6	0.887	0.74	0.378	1.80	2.16	1.20	0.51	1.96	2.35	4.23
Styrene	ND	6.7	0.175	0.187	NA	NA	**38.29**	1.07	0.94	**35.83**	NA
Tetrachloroethene	11	2.03	0.274	0.308	**5.42**	**40.15**	**7.41**	1.12	0.89	**6.59**	**35.71**
Toluene	4.7	56.9	4.87	4.91	0.08	0.97	**11.68**	1.01	0.99	**11.59**	0.96
trans-1,3-Dichloropropene	ND	0.04	0.046	0.056	NA	NA	0.87	1.22	0.82	0.71	NA
Trichloroethene	0.55	0.977	0.103	0.0947	0.56	**5.34**	**9.49**	0.92	1.09	**10.32**	**5.81**
Vinyl chloride	1.1	0.973	ND	ND	1.13	NA	NA	NA	NA	NA	NA
Xylenes, m & p	8.2	55	2.6	2.72	0.15	3.15	**21.15**	1.05	0.96	**20.22**	3.01
Xylenes, o	3.4	14.5	0.874	0.718	0.23	3.89	**16.59**	0.82	1.22	**20.19**	4.74

Notes:
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Blue font indicates that the first media shown are less than 5 times second media concentrations.
Yellow highlighted cells indicate chemical contributed greater than 1E-05 to cancer risk or HQ greater than 1 to cumulative risk or hazard index, respectively
Orange highlighted cells indicate chemical contributed greater than 1E-06 to cancer risk

TABLE RTC-1c
Comparison of Maximum Soil Gas Concentrations to Ambient Air EPCs for 1436 3rd Street
AMCO Chemical Superfund Site, Oakland, California

Address	1436 3rd Street					
Analyte	Maximum Soil Gas Concentration ($\mu g/m^3$)	Ambient Air EPC ($\mu g/m^3$)	Neighborhood Background EPC ($\mu g/m^3$)	Ratio of Soil Gas/Ambient Air	Ratio Ambient/ Background	Ratio Soil gas/Background
1,1,1-Trichloroethane	0.46	0.103	0.0824	4.47	1.25	**5.58**
1,1-Dichloroethane	0.045	ND	0.011	NA	NA	4.09
1,1-Dichloroethene	ND	ND	0.0397	NA	NA	NA
1,2,4-Trimethylbenzene	1	1.87	0.862	0.53	2.17	1.16
1,2-Dichlorobenzene	ND	0.1	ND	NA	NA	NA
1,2-Dichloroethane	0.098	0.061	0.0525	1.61	1.16	1.87
1,2-Dichloropropane	ND	ND	0.0449	NA	NA	NA
1,3,5-Trimethylbenzene	0.36	0.634	0.283	0.57	2.24	1.27
1,3-Dichlorobenzene	ND	0.074	ND	NA	NA	NA
1,4-Dichlorobenzene	ND	0.207	0.0949	NA	2.18	NA
1,4-Dioxane (p-dioxane)	0.67	0.22	0.391	3.05	0.56	1.71
Acetone	6.6	NA	NA	NA	NA	NA
Benzene	1.2	1.49	0.832	0.81	1.79	1.44
Bromomethane	1.4	0.33	0.209	4.24	1.58	**6.70**
Carbon tetrachloride	0.54	0.588	0.531	0.92	1.11	1.02
Chlorobenzene	0.12	0.048	0.0269	2.50	1.78	4.46
Chloroethane	ND	0.0698	0.0485	NA	1.44	NA
Chloroform	2.9	0.36	0.155	**8.06**	2.32	**18.71**
Chloromethane	2.6	8	1.19	0.33	**6.72**	2.18
cis-1,2-Dichloroethene	ND	ND	0.025	NA	NA	NA
cis-1,3-Dichloropropene	ND	ND	0.0594	NA	NA	NA
Ethylbenzene	0.73	1.85	0.645	0.39	2.87	1.13
Freon 11	16	2.11	1.97	**7.58**	1.07	**8.12**
Freon 113	0.87	0.693	0.671	1.26	1.03	1.30
Freon 114	ND	0.14	0.12	NA	1.17	NA
Freon 12	3.2	2.89	2.59	1.11	1.12	1.24
Freon 134a	350	NA	NA	NA	NA	NA
Methyl ethyl ketone	4.1	NA	NA	NA	NA	NA
Methyl tert-butyl ether	ND	ND	0.231	NA	NA	NA
Methylene chloride	0.59	8.68	ND	0.07	NA	NA
Naphthalene	1.3	0.62	0.378	2.10	1.64	3.44
Styrene	0.14	0.322	0.187	0.43	1.72	0.75
Tetrachloroethene	5.2	0.285	0.308	**18.25**	0.93	**16.88**
Toluene	4.8	14	4.91	0.34	2.85	0.98
trans-1,3-Dichloropropene	ND	ND	0.056	NA	NA	NA
Trichloroethene	0.21	0.217	0.0947	0.97	2.29	2.22
Vinyl chloride	1.1	0.7	ND	1.57	NA	NA
Xylenes, m & p	2	6.53	2.72	0.31	2.40	0.74
Xylenes, o	0.74	1.96	0.718	0.38	2.73	1.03

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Orange highlighted cells indicate chemical contributed greater than 1E-06 to cancer risk

TABLE RTC-1d

Comparison of Maximum Soil Gas Concentrations to Crawl Space and Ambient Air EPCs for 320 Center St

AMCO Chemical Superfund Site, Oakland, California

Address	320 Center St								
Analyte	Maximum Soil Gas Concentration (µg/m^3)	Crawl Space Air EPC (µg/m^3)	Ambient Air EPC (µg/m^3)	Neighborhood Background EPC (µg/m^3)	Ratio of Soil Gas/Crawl Space Air	Ratio of Soil Gas/Ambient Air	Ratio of Crawl Space/Ambient Air	Ratio Ambient/ Background	Ratio Crawl space/ Background
1,1,1-Trichloroethane	ND	0.12	0.096	0.0824	NA	NA	1.25	1.17	1.46
1,1-Dichloroethane	0.17	ND	ND	0.011	NA	NA	NA	NA	NA
1,1-Dichloroethene	ND	ND	ND	0.0397	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	0.9	2	2.4	0.862	0.45	0.38	0.83	2.78	2.32
1,2-Dichloroethane	0.026	1.2	0.09	0.0525	0.02	0.29	**13.33**	1.71	**22.86**
1,2-Dichloropropane	ND	0.14	ND	0.0449	NA	NA	NA	NA	3.12
1,3,5-Trimethylbenzene	0.2	0.74	0.83	0.283	0.27	0.24	0.89	2.93	2.61
1,4-Dichlorobenzene	ND	1.4	0.19	0.0949	NA	NA	**7.37**	2.00	**14.75**
1,4-Dioxane (p-dioxane)	ND	ND	ND	0.391	NA	NA	NA	NA	NA
Benzene	1.1	2	1.8	0.832	0.55	0.61	1.11	2.16	2.40
Bromomethane	1.4	0.18	0.18	0.209	**7.78**	**7.78**	1.00	0.86	0.86
Carbon tetrachloride	ND	0.6	0.56	0.531	NA	NA	1.07	1.05	1.13
Chlorobenzene	ND	0.032	0.02	0.0269	NA	NA	1.60	0.74	1.19
Chloroethane	ND	0.029	ND	0.0485	NA	NA	NA	NA	0.60
Chloroform	1.1	0.56	0.35	0.155	1.96	3.14	1.60	2.26	3.61
Chloromethane	1.1	1	1.1	1.19	1.10	1.00	0.91	0.92	0.84
cis-1,2-Dichloroethene	ND	ND	ND	0.025	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	ND	0.053	0.046	0.0594	NA	NA	1.15	0.77	0.89
Ethylbenzene	0.28	1.8	1.8	0.645	0.16	0.16	1.00	2.79	2.79
Freon 11	1.3	3.5	3.5	1.97	0.37	0.37	1.00	1.78	1.78
Freon 113	0.55	0.72	0.8	0.671	0.76	0.69	0.90	1.19	1.07
Freon 12	1.5	2.7	2.8	2.59	0.56	0.54	0.96	1.08	1.04
Methyl tert-butyl ether	ND	0.022	ND	0.231	NA	NA	NA	NA	0.10
Methylene chloride	ND	4.4	4.2	ND	NA	NA	1.05	NA	NA
Naphthalene	ND	ND	ND	0.378	NA	NA	NA	NA	NA
Styrene	ND	0.51	0.35	0.187	NA	NA	1.46	1.87	2.73
Tetrachloroethene	5.5	0.71	0.27	0.308	**7.75**	**20.37**	2.63	0.88	2.31
Toluene	1.4	17	11	4.91	0.08	0.13	1.55	2.24	3.46
trans-1,3-Dichloropropene	ND	0.047	0.037	0.056	NA	NA	1.27	0.66	0.84
Trichloroethene	0.19	1.8	0.1	0.0947	0.11	1.90	**18.00**	1.06	**19.01**
Vinyl chloride	4.4	ND	ND	ND	NA	NA	NA	NA	NA
Xylenes, m & p	0.79	6.3	6.4	2.72	0.13	0.12	0.98	2.35	2.32
Xylenes, o	0.29	2.2	2.2	0.718	0.13	0.13	1.00	3.06	3.06

Notes:

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Orange highlighted cells indicate chemical contributed greater than 1E-06 to cancer risk

TABLE RTC-1e
Comparison of Maximum Soil Gas Concentrations to Crawl Space and Ambient Air EPCs for 326 Center St
AMCO Chemical Superfund Site, Oakland, California

Address	326 Center St									
Analyte	Maximum Soil Gas Concentration (µg/m^3)	Crawl Space Air EPC (µg/m^3)	Ambient Air EPC (µg/m^3)	Neighborhood Background EPC (µg/m^3)	Ratio of Soil Gas/Crawl Space Air	Ratio of Soil Gas/Ambient Air	Ratio of Crawl Space/Ambient Air	Ratio Ambient/ Background	Crawl space/ Background	Ratio Soil gas/Background
1,1,1-Trichloroethane	0.66	0.0894	0.0861	0.0824	7.38	7.67	1.04	1.04	1.08	8.01
1,1,2,2-Tetrachloroethane	0.032	0.424	ND	ND	0.08	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	ND	0.076	ND	ND	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	11	0.015	ND	0.011	733.33	NA	NA	NA	1.36	1000.00
1,1-Dichloroethene	ND	ND	ND	0.0397	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	0.3	0.923	0.612	0.862	0.33	0.49	1.51	0.71	1.07	0.35
1,2-Dichlorobenzene	ND	0.13	0.083	ND	NA	NA	1.57	NA	NA	NA
1,2-Dichloroethane	0.054	1.33	0.0526	0.0525	0.04	1.03	25.29	1.00	25.33	1.03
1,2-Dichloropropane	ND	0.103	ND	0.0449	NA	NA	NA	NA	2.29	NA
1,3,5-Trimethylbenzene	0.97	0.221	0.511	0.283	4.39	1.90	0.43	1.81	0.78	3.43
1,3-Dichlorobenzene	ND	0.096	0.047	ND	NA	NA	2.04	NA	NA	NA
1,4-Dichlorobenzene	ND	2.71	0.85	0.0949	NA	NA	3.19	8.96	28.56	NA
1,4-Dioxane (p-dioxane)	ND	0.18	ND	0.391	NA	NA	NA	NA	0.46	NA
Acetone	14	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	0.58	1.05	1.01	0.832	0.55	0.57	1.04	1.21	1.26	0.70
Bromomethane	0.55	0.215	0.269	0.209	2.56	2.04	0.80	1.29	1.03	2.63
Carbon disulfide	3.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.46	0.521	0.516	0.531	0.88	0.89	1.01	0.97	0.98	0.87
Chlorobenzene	ND	0.033	0.015	0.0269	NA	NA	2.20	0.56	1.23	NA
Chloroethane	ND	0.0611	0.0629	0.0485	NA	NA	0.97	1.30	1.26	NA
Chloroform	32	0.291	0.255	0.155	109.97	125.49	1.14	1.65	1.88	206.45
Chloromethane	0.65	1.09	1.19	1.19	0.60	0.55	0.92	1.00	0.92	0.55
cis-1,2-Dichloroethene	ND	0.018	ND	0.025	NA	NA	NA	NA	0.72	NA
cis-1,3-Dichloropropene	ND	0.039	0.052	0.0594	NA	NA	0.75	0.88	0.66	NA
Ethylbenzene	0.15	1.08	1.06	0.645	0.14	0.14	1.02	1.64	1.67	0.23
Freon 11	4.7	2.27	1.58	1.97	2.07	2.97	1.44	0.80	1.15	2.39
Freon 113	0.45	0.673	0.66	0.671	0.67	0.68	1.02	0.98	1.00	0.67
Freon 114	ND	0.11	ND	0.12	NA	NA	NA	NA	0.92	NA
Freon 12	2.4	2.9	2.61	2.59	0.83	0.92	1.11	1.01	1.12	0.93
Hexachlorobutadiene	ND	0.68	ND	ND	NA	NA	NA	NA	NA	NA
Isopropanol	6.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	4.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl tert-butyl ether	ND	0.016	0.023	0.231	NA	NA	0.70	0.10	0.07	NA
Methylene chloride	0.43	5.4	3.14	ND	0.08	0.14	1.72	NA	NA	NA
Naphthalene	0.9	ND	0.036	0.378	NA	25.00	NA	0.10	NA	2.38
Styrene	ND	0.92	0.0831	0.187	NA	NA	11.07	0.44	4.92	NA
Tetrachloroethene	680	0.512	0.26	0.308	1328.13	2615.38	1.97	0.84	1.66	2207.79
Toluene	0.93	17.7	10	4.91	0.05	0.09	1.77	2.04	3.60	0.19
trans-1,3-Dichloropropene	ND	ND	0.048	0.056	NA	NA	NA	0.86	NA	NA
Trichloroethene	52	1.87	0.0761	0.0947	27.81	683.31	24.57	0.80	19.75	549.10
Vinyl chloride	0.26	0.0391	ND	ND	6.65	NA	NA	NA	NA	#VALUE!
Xylenes, m & p	0.47	4.13	3.99	2.72	0.11	0.12	1.04	1.47	1.52	0.17
Xylenes, o	0.25	1	1.31	0.718	0.25	0.19	0.76	1.82	1.39	0.35

Notes:
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Yellow highlighted cells indicate chemical contributed greater than 1E-05 to cancer risk or HQ greater than 1 to cumulative risk or hazard index, respectively
Orange highlighted cells indicate chemical contributed greater than 1E-06 to cancer risk

TABLE RTC-1f
Comparison of Maximum Soil Gas Concentrations to Ambient Air EPCs for 360 Center St
AMCO Chemical Superfund Site, Oakland, California

Address	360 Center St					
Analyte	Maximum Soil Gas Concentration (μg/m^3)	Ambient Air EPC (μg/m^3)	Neighborhood Background EPC (μg/m^3)	Ratio of Soil Gas/Ambient Air	Ratio Ambient/ Background	Ratio Soil gas/Backg round
1,1,1-Trichloroethane	ND	0.107	0.0824	NA	1.30	NA
1,1,2,2-Tetrachloroethane	0.34	ND	ND	NA	NA	NA
1,1-Dichloroethane	0.066	ND	0.011	NA	NA	6.00
1,1-Dichloroethene	ND	ND	0.0397	NA	NA	NA
1,2,4-Trimethylbenzene	5.7	4.05	0.862	1.41	4.70	6.61
1,2-Dichlorobenzene	0.71	ND	ND	NA	NA	NA
1,2-Dichloroethane	0.14	0.066	0.0525	2.12	1.26	2.67
1,2-Dichloropropane	ND	ND	0.0449	NA	NA	NA
1,3,5-Trimethylbenzene	0.69	1.35	0.283	0.51	4.77	2.44
1,3-Dichlorobenzene	26	ND	ND	NA	NA	NA
1,4-Dichlorobenzene	0.32	0.246	0.0949	1.30	2.59	3.37
1,4-Dioxane (p-dioxane)	ND	ND	0.391	NA	NA	NA
4-Ethyltoluene	4.9	NA	NA	NA	NA	NA
Acetone	51	NA	NA	NA	NA	NA
Benzene	3.6	1.71	0.832	2.11	2.06	4.33
Bromomethane	1.4	0.18	0.209	7.78	0.86	6.70
Carbon disulfide	14	NA	NA	NA	NA	NA
Carbon tetrachloride	0.73	0.713	0.531	1.02	1.34	1.37
Chlorobenzene	ND	0.052	0.0269	NA	1.93	NA
Chloroethane	1.4	0.075	0.0485	18.67	1.55	28.87
Chloroform	9.4	0.278	0.155	33.81	1.79	60.65
Chloromethane	10	1.2	1.19	8.33	1.01	8.40
cis-1,2-Dichloroethene	ND	ND	0.025	NA	NA	NA
cis-1,3-Dichloropropene	ND	ND	0.0594	NA	NA	NA
Ethanol	210	NA	NA	NA	NA	NA
Ethylbenzene	1.1	2.75	0.645	0.40	4.26	1.71
Freon 11	4.5	1.7	1.97	2.65	0.86	2.28
Freon 113	0.76	0.621	0.671	1.22	0.93	1.13
Freon 114	ND	0.12	0.12	NA	1.00	NA
Freon 12	3.2	2.6	2.59	1.23	1.00	1.24
Freon 134a	4400	NA	NA	NA	NA	NA
Isopropanol	83	NA	NA	NA	NA	NA
Methyl ethyl ketone	10	NA	NA	NA	NA	NA
Methyl tert-butyl ether	ND	ND	0.231	NA	NA	NA
Methylene chloride	0.43	4.34	ND	0.10	NA	NA
Naphthalene	1.3	0.041	0.378	31.71	0.11	3.44
Styrene	0.77	0.46	0.187	1.67	2.46	4.12
Tetrachloroethene	1.7	0.368	0.308	4.62	1.19	5.52
Toluene	10	24.1	4.91	0.41	4.91	2.04
Total hexanes	0.98	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	0.09	ND	ND	NA	NA	NA
trans-1,3-Dichloropropene	ND	ND	0.056	NA	NA	NA
Trichloroethene	0.2	0.199	0.0947	1.01	2.10	2.11
Vinyl chloride	2	ND	ND	NA	NA	#VALUE!
Xylenes, m & p	8.3	9.63	2.72	0.86	3.54	3.05
Xylenes, o	3	3.4	0.718	0.88	4.74	4.18

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Orange highlighted cells indicate chemical contributed greater than 1E-06 to cancer risk

TABLE RTC-1g
Comparison of Maximum Soil Gas Concentrations to Ambient Air EPCs for Prescott Park
AMCO Chemical Superfund Site, Oakland, California

Address	Prescott Park					
Analyte	Maximum Soil Gas Concentration (μg/m^3)	Ambient Air EPC (μg/m^3)	Neighborhood Background EPC (μg/m^3)	Ratio of Soil Gas/Ambient Air	Ratio Ambient/ Background	Ratio Soil gas/Background
1,1,1-Trichloroethane	7.8	0.11	0.0824	**70.91**	1.33	**94.66**
1,1,2,2-Tetrachloroethane	0.17	0.024	ND	**7.08**	NA	NA
1,1-Dichloroethane	1	ND	0.011	NA	NA	**90.91**
1,1-Dichloroethene	ND	ND	0.0397	NA	NA	NA
1,2,4-Trimethylbenzene	8.9	0.91	0.862	**9.78**	1.06	**10.32**
1,2-Dichloroethane	0.21	0.061	0.0525	3.44	1.16	4.00
1,2-Dichloropropane	ND	ND	0.0449	NA	NA	NA
1,3,5-Trimethylbenzene	1.9	0.27	0.283	**7.04**	0.95	**6.71**
1,3-Butadiene	1.7	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	0.31	ND	0.0949	NA	NA	3.27
1,4-Dioxane (p-dioxane)	ND	0.96	0.391	NA	2.46	NA
2,2,4-Trimethylpentane	4.3	NA	NA	NA	NA	NA
Acetone	53	NA	NA	NA	NA	NA
Benzene	14	1.3	0.832	**10.77**	1.56	**16.83**
Bromomethane	2.3	0.15	0.209	**15.33**	0.72	**11.00**
Carbon disulfide	32	NA	NA	NA	NA	NA
Carbon tetrachloride	0.56	0.64	0.531	0.88	1.21	1.05
Chlorobenzene	ND	0.034	0.0269	NA	1.26	NA
Chloroethane	0.35	0.1	0.0485	3.50	2.06	**7.22**
Chloroform	590	0.51	0.155	**1156.86**	3.29	**3806.45**
Chloromethane	1.4	1.2	1.19	1.17	1.01	1.18
cis-1,2-Dichloroethene	20	0.038	0.025	**526.32**	1.52	**800.00**
cis-1,3-Dichloropropene	ND	ND	0.0594	NA	NA	NA
Cyclohexane	52	NA	NA	NA	NA	NA
Ethanol	6.1	NA	NA	NA	NA	NA
Ethylbenzene	1.4	0.86	0.645	1.63	1.33	2.17
Freon 11	11	2	1.97	**5.50**	1.02	**5.58**
Freon 113	0.83	0.73	0.671	1.14	1.09	1.24
Freon 114	ND	ND	0.12	NA	NA	NA
Freon 12	2.3	3	2.59	0.77	1.16	0.89
Freon 134a	460	NA	NA	NA	NA	NA
Isopropanol	3.8	NA	NA	NA	NA	NA
Methyl ethyl ketone	14	NA	NA	NA	NA	NA
Methyl tert-butyl ether	ND	0.0097	0.231	NA	0.04	NA
Methylene chloride	5.8	ND	ND	NA	NA	NA
Naphthalene	29	ND	0.378	NA	NA	**76.72**
n-Heptane	20	NA	NA	NA	NA	NA
Styrene	0.85	0.24	0.187	3.54	1.28	4.55
Tetrachloroethene	60	0.42	0.308	**142.86**	1.36	**194.81**
Toluene	38	4.4	4.91	**8.64**	0.90	**7.74**
Total hexanes	25	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	0.14	ND	ND	NA	NA	NA
trans-1,3-Dichloropropene	ND	ND	0.056	NA	NA	NA
Trichloroethene	4.5	0.13	0.0947	**34.62**	1.37	**47.52**
Vinyl chloride	2.7	ND	ND	NA	NA	NA
Xylenes, m & p	11	2.7	2.72	4.07	0.99	4.04
Xylenes, o	2.4	0.92	0.718	2.61	1.28	3.34

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