SCREENING HEALTH RISK EVALUATION
2222-2224 SOUTH ESCONDIDO BOULEVARD
ESCONDIDO, CALIFORNIA

Prepared for

Warmington Residential CA
3090 Pullmann Street
Costa Mesa, CA 92626
Hillmann Project #C3-7354

December 27, 2018

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This report has been prepared for Hillmann Consulting, LLC as it pertains to the real estate property located at 2222-2224 South Escondido Boulevard in Escondido, California. Our professional services have been performed using that degree of care and skill ordinarily exercised under similar circumstances by other scientists, geologists and engineers practicing in this field. No other warranty, express or implied, is made as to the professional advice presented in this report.

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Executive Summary

At the request of Hillmann Consulting, LLC (Hillmann), Enviro-Tox Services, Inc. (ETSI) conducted a Screening Health Risk Evaluation (SHRE) for the property located at 2222-2224 South Escondido Boulevard in Escondido, California. The Property is being considered for redevelopment for residential purposes. Therefore, the objective of the SHRE was to determine if the presence of trace concentrations of metals (most notably cadmium and lead), and petroleum hydrocarbons in soil plus a few volatile organic compounds (VOCs) detected in soil gas could pose a health risk to future occupants of the site.

The Property occupies 2.74 acres and includes a commercial building and a residence. The Property has been operated as a welding shop and a junkyard from around 1949 to the present. Environmental investigations conducted at the Property identified the presence of a few metals and petroleum hydrocarbons in soil. Results obtained from a soil gas survey indicated the presence of tetrachloroethylene (PCE) and toluene in soil gas at a depth of 5 feet below ground surface (bgs) within a limited zone. Based on the results of environmental investigations it was determined that shallow soils within a limited area contained lead and cadmium at relatively high concentrations. The vertical extent of soil cadmium and lead contamination was found to be limited to surficial soil (<1.5 feet below grade).

ETSI understands that soils found to contain cadmium and lead at concentrations exceeding the California Department of Toxic Substances Control Screening Levels (DTSC-SLs) will be excavated and removed from the Property. ETSI also understands that following soil excavation and removal, confirmation soil samples will be collected to make sure residual cadmium and lead concentrations remaining in soil at the Property are within acceptable levels.

For purposes of this SHRE, it is assumed that cadmium- and lead-impacted soils have been excavated and removed and that the maximum residual cadmium concentration in soil at the Property is equal to 5.2 mg/kg and the residual soil lead concentration is equal to 80 mg/kg.

The current development plan for the Property involves the construction of a residential complex, in which case future onsite residents will not be in contact with soils while at the site. However, it is conceivable that the residential complex could be surrounded by landscaped areas. Therefore, the incidental ingestion and dermal contact with impacted soil was considered to be an extremely unlikely but complete exposure pathway and was evaluated in this SHRE.

The potential vapor emissions that could result in exposure from VOCs detected in soil gas under the Property were evaluated in the SHRE. The estimated vapor emissions were used to obtain potential indoor air chemical concentrations that could result from subsurface vapor intrusion. The potential health risk associated with VOC vapor intrusion and subsequent residential exposure was evaluated in this SHRE.

Screening-level emission estimation methods were used to predict potential chemical emissions and resulting residential exposures. The estimated exposure point concentrations were then used to estimate potential health risks for on-site residents.

The estimated cancer risk and the estimated total hazard index that could result from residential exposures to onsite soil via incidental ingestion, dermal contact and indoor air inhalation are summarized in Table ES-1.

Results of the evaluation indicate that once the soil containing high levels of cadmium and lead are excavated and removed, the residual chemicals in soil do not represent a significant threat to human health.

Table ES-1. Estimated Cancer Risks and Health Hazards for Future Onsite Residents

	Adult and Child Combined Incremental Cancer Risk (unitless)	Hazard Index Estimated for Children Only (unitless)
Cancer Risk and Hazard Index Estimated to Result from Exposure to Soil and Dust While Outdoors at the Property.	2E-09	1
Maximum Health Risk and Hazard Index Estimated to Result Exclusively from Exposure to Indoor Air.	8E-07	0.01

The assessment results show that after removal of cadmium and lead contamination, further remedial action is not required at the Property. Results of the SHRE indicate that exposure to chemicals detected in soil and soil gas could carry a potential cancer risk of less than one cancer case in an exposed population of one million people (8E-07). The estimated incremental cancer risk is below the cancer risk level considered acceptable to the California Department of Toxic Substances Control (DTSC). The estimated Hazard Index is also at a level considered acceptable for unrestricted land use by California health and environmental protection agencies.

The risk and hazard calculations assumed multiple exposures to chemicals via incidental soil ingestion, dermal contact and inhalation of indoor vapors in accordance with DTSC guidance. The results are based on multiple health-protective assumptions. For example, it was assumed that a VOC reservoir is located under the Property and that this VOC reservoir is large and strong enough to continuously release VOC vapors for up to 26 years. However, no VOC reservoir is known to exist under the Property.

All conclusions and recommendations presented in this report are based on reported chemical concentrations and the proposed future residential land use of the Property. In this risk assessment, all fate-and-transport models, parameters, toxicity data and assumptions were applied in accordance with federal and state regulatory guidelines. These guidelines are meant to protect the public and tend to overestimate potential health risks. As such, this risk assessment

provides an estimate of the upper boundary of potential health risks, rather than an accurate representation of true health risks posed by the Property.

1.0 INTRODUCTION

At the request of Hillmann Consulting, LLC (Hillmann), Enviro-Tox Services, Inc. (ETSI) conducted a Screening Human Risk Evaluation (SHRE) for the property located at 2222-2224 South Escondido Boulevard in Escondido, California (the "Property"). The objective of the SHRE was to determine if the presence of trace concentrations of metals, petroleum hydrocarbons, and volatile organic compounds (VOCs) in soil and a few VOCs in soil gas represent a threat to future occupants of a residential development to be built at the site.

2.0 SITE CHARACTERIZATION

2.1 BACKGROUND

The subject Property is located on the east side of South Escondido Boulevard between Brotherton Road and Sherman Way in a mixed-use commercial/residential section of Escondido. The Property occupies 2.74 acres and includes a commercial building and a residence. The Property is being considered for redevelopment for residential purposes.

In October 2018, Hillmann completed a Phase I Environmental Site Assessment for the Property (Hillman, 2018a). Results of the Phase I investigation indicated that the Property has been operated as a welding shop and a junkyard from around 1949 to the present. Hillmann (2018a) identified the potential for soil contamination from heavy metals, total petroleum hydrocarbons (TPH), and VOCs due to past and current operations as a junkyard.

In October 2018, Hillmann completed a Limited Phase II Subsurface Investigation (Hillmann, 2018a) that included soil and soil gas sampling. The results of the initial investigation indicated low levels of tetrachloroethylene (PCE) in soil gas that exceed California Department of Toxic Substances Control screening levels (DTSC-SLs; DTSC 2018a) for residential land use. In addition, two soil samples had high concentrations of cadmium and lead that exceed their corresponding DTSC-SLs. Copies of soil and soil gas analytical data tables collected by Hillmann are presented in Appendix A.

In November 2018, Hillmann completed a Supplemental Investigation (Hillmann, 2018b) that included additional soil and soil gas sampling to attempt to define the vertical and lateral extents of contamination. Results from the Supplemental Investigation revealed that cadmium- and lead-impacted soils were limited to surficial soil (<1.5 feet below grade). Hillmann (2018b) determined that cadmium- and lead-impacted soils would require excavation and removal followed by a confirmation soil sampling program prior to construction of residential development. Soil samples targeted for excavation and removal included samples HB-3-0.5, HB7-0.25, SB3a-0.25, HB3c-0.25, and HB7b-0.25 (see Table 1A in Appendix A).

It is anticipated excavation of soil will be extended to points where the residual cadmium and lead concentrations are found to be equal to or below their corresponding DTSC-SLs, or 5.2 mg/kg for cadmium and 80 mg/kg for lead (DTSC 2018a).

For purposes of this SHRE, it is assumed that cadmium- and lead-impacted soils have been excavated and removed and that the maximum residual cadmium concentration in soil at the Property is equal to 5.2 mg/kg and the residual soil lead concentration is equal to 80 mg/kg.

2.2 GEOLOGY AND HYDROGEOLOGY

Based on Hillmann's (2018a and 2018b) boring logs, shallow soils beneath the site consist primarily of silty clay, silt, and clayey sand in the upper 15 feet of section, the deepest interval explored by drilling in this investigation. Groundwater was not encountered during drilling to 15 feet below grade.

Based on information available on the GeoTracker website, groundwater is present at about 18-36 feet below grade and flows southeast at a site located 500 feet south of the Property (Hillmann, 2018b).

3.0 EXPOSURE ASSESSMENT

California health and environmental protection agencies require the remediation of chemical-impacted soil if the chemicals are found to represent a threat to human health and the environment. Similarly, cleanup of chemical-impacted soil has to be conducted to the extent that the threat posed by the release is reduced to acceptable levels. The purpose of this SHRE was to determine if trace concentrations of metals and TPH in soil, plus a few VOCs in soil gas at the subject Property represent a threat to human health.

3.1 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) shows all potentially complete exposure pathways for a given environmental source. The CSM identifies potential chemical sources, release mechanisms, transport media, routes of chemical migration through the environment, exposure media, and potential receptors. The CSM for the Property is presented in Figure 1. The following paragraphs define the exposure pathways evaluated in this SHRE and the rationale for their inclusion or elimination from consideration.

The current development plan for the property involves the construction of a residential complex. Therefore, future onsite residents will not be in contact with soils while at the site. However, it is conceivable that the residential complex could be surrounded by landscaped areas. If this is the case, future onsite residents could come in contact with soil while outdoors. Therefore, the incidental ingestion of and dermal contact with impacted soil is considered to be an extremely unlikely but complete exposure pathway.

This SHRE assumed that a potential source of VOCs exists under the Property at depths of 5 feet below ground surface (bgs). It was also assumed that this potential VOC source would be active for the next 26 years and that VOC vapors may migrate up to the surface and enter a building through cracks in its foundation. This potential VOC source was also assumed to contain and produce all the VOCs that were identified in soil gas at the Property. Thus, the volatilization and vapor intrusion into onsite buildings is considered to be a potential exposure pathway and is evaluated in this SHRE.

It is safe to assume that future occupants of the subject Property will receive their drinking water from municipal sources and will not depend on onsite groundwater wells for their water needs. Therefore, the groundwater exposure pathway is not considered to be a complete exposure pathway for future onsite receptors.

3.2 POTENTIAL RECEPTORS

Given that current plans for redevelopment of the Property include the construction of several residences, the future onsite receptors are likely to be adult and child residents. The residents of the future development are assumed to be present at the Property for 350 days a year, for up to 26 years. Default exposure parameters that define the potential receptors at the Property are presented in Table 1.

Although offsite residential populations and any potentially sensitive subpopulations located within a one-mile radius of the site may also be exposed to site chemicals, their exposures should be substantially less than those estimated for onsite residential receptors because of wind dispersion and dilution. Therefore, only exposure to future onsite residents are quantitatively evaluated in this assessment.

3.3 VAPOR INHALATION OF CHEMICALS IN INDOOR AIR

The potential for chemical volatilization and building intrusion was modeled using the USEPA (2015) spreadsheet program for the Johnson and Ettinger (1991) vapor intrusion model as modified by DTSC (SG-SCREEN version 2.0; last modified December 2014).

The method selected to estimate chemical volatilization and migration was obtained from the DTSC's *"Guidance for the Evaluation and Migration of Subsurface Vapor Intrusion to Indoor Air"* (DTSC 2011). This method is consistent with USEPA (2015) vapor intrusion risk assessment guidance. The method used the following assumptions:

- The potential VOC source occurs at a constant depth of 5 feet bgs.
- The gas-phase chemical migrates vertically through soil pore space up to the ground surface by advection and steady-state diffusion.

- The soil between the chemical sources and the ground surface is assumed to be homogeneous.
- Vapor diffusion is described by a single chemical-specific effective diffusion coefficient.
- No retardation of the soil vapor occurs as the chemical migrates from its source to the ground surface.
- Vapor migrates through cracks in the building foundations and mixes instantaneously with indoor air, resulting in an ambient indoor air concentration.
- Future buildings at the site will be slab on grade construction.
- The potential source chemical concentration does not decrease over time.
- Site-specific soil chemical properties are unknown. Therefore, default soil physical parameters recommended by the DTSC were used in the evaluation.

The point of departure for chemical volatilization modeling was the soil gas data collected at the Property at 5 feet bgs (Table 2, Appendix A). Soil gas data represent volatile chemicals that are found in soil-pore spaces and that have the potential to migrate from their subsurface soil up to indoor air.

4.0 TOXICITY ASSESSMENT

In order to evaluate the potential adverse effects associated with exposure to chemicals, the relationship between the dose of each chemical and the incidence or potential of an adverse health effect in an exposed population must be determined. This is known as dose-response assessment and is based on data collected from animal studies and theoretical precepts about what might occur in humans.

This risk assessment considers both carcinogenic and noncarcinogenic health effects associated with chemical exposures based on dose-response criteria published by various regulatory agencies.

In this assessment, chronic toxicity criteria were selected (in order of preference) from the following sources: (1) Cal/EPA Toxicity Criteria Database (DTSC 2018b), (2) USEPA's Regional Screening Level (RSL) tables (USEPA 2018).

4.1 NONCARCINOGENIC DOSE-RESPONSE CRITERIA

It is widely accepted that most biological effects of chemical substances occur only after a threshold dose is reached. For the purpose of establishing noncarcinogenic criteria levels, this threshold dose is usually derived from either the no observed adverse effect level (NOAEL) or the lowest observed adverse effect level (LOAEL), as determined in chronic animal exposure studies. The NOAEL is defined as the highest dose at which no adverse effects occur, while the LOAEL is defined as the lowest dose at which adverse effects begin to appear. NOAELs and LOAELs are used by the USEPA to establish reference doses (RfDs) for acceptable levels of human intake.

A RfD is the dose of a chemical that is not expected to cause adverse health effects over a lifetime of daily exposure in the most sensitive population. Uncertainty factors are used to set RfDs, representing an attempt to account for limitations in the quality or quantity of available data. Most RfDs include a 100-fold safety factor that is based on 1) a factor of 10 to account for uncertainties in extrapolating animal data to human health effects, and 2) another 10-fold safety factor to account for differences in sensitivity within the human population. Furthermore, if an available database is incomplete, or if the involved chemical is persistent or bioaccumulative,

additional 10-fold safety factors may be applied. Reference doses for all COPCs are compiled in Table 2.

4.2 CARCINOGENIC DOSE-RESPONSE CRITERIA

The currently accepted regulatory approach assumes that all potentially carcinogenic chemicals should be treated as if they do not have thresholds. This regulatory approach, which was used to evaluate carcinogenic risks for this document, assumes that the dose-response curve for carcinogens allows for zero risk at zero dose (i.e., for all doses, some cancer risk is assumed to be present). Since animal testing is performed at relatively high doses for the purposes of eliciting a carcinogenic response, various mathematical models are used to estimate the theoretically plausible response at low doses. The accuracy of the projected risk depends on how well the model predicts the true relationship between dose and risk at levels where this relationship cannot actually be measured.

Health risks for exposures to carcinogens are defined in terms of probabilities. The probabilities quantify the likelihood of a carcinogenic response in an individual that receives a given dose of a particular compound. These probabilities are calculated based on the potential dose and the carcinogenic slope factor (SF) for a chemical.

The SF, which is expressed in units of inverse milligrams per kilogram-day $(mg/kg\text{-}day)^{-1}$, is the 95 percent upper confidence limit of the probability of carcinogenic response per unit daily intake of a chemical over a lifetime. The SF multiplied by the lifetime average daily intake of the chemical (dose) provides an estimate of the 95 percent upper confidence limit of the theoretical cancer risk for the specific dose. The SFs used in this risk assessment to estimate carcinogenic dose-assessment risks are presented in Table 2.

5.0 RISK CHARACTERIZATION

Risk characterization combines information obtained in the exposure assessment and fate and transport modeling with toxicological parameters to obtain an estimate of potential health effects. Risk characterization is conducted in two distinct steps. First, quantification of the daily intake (dose) of the chemical is estimated. Intake assumptions including absorption and bioavailability factors, frequency and duration of exposure, age of receptor, body weight, and exposure rates are used to calculate the dose. The second step in the risk characterization process compares the estimated daily dose to cancer potency factors and reference doses to obtain an estimate of potential health risks and hazards.

5.1 AVERAGE DAILY DOSE / LIFETIME DAILY DOSE

This section discusses the methods used to quantify the average daily dose (ADD) of COPCs that may be received by the potential receptors from the ingestion, dermal contact, and inhalation of chemicals detected in soil and soil gas at the Property. An ADD is calculated to estimate non-carcinogenic health hazards. A lifetime daily dose (LDD) is calculated to obtain the potential lifetime doses of carcinogenic chemicals that are received by the potential receptors.

The general equation used to estimate the average daily dose is:

$$ADD = \frac{CR \bullet EPC \bullet CF \bullet EF \bullet ED}{BW \bullet AT \bullet 365}$$

where:

ADD = Average daily intake (mg/kg/day)
CR = Contact rate; the amount of medium contacted per unit of time or event (e.g., soil ingestion rate [mg/hour])
EPC = Exposure point concentration (e.g., mg/kg soil or mg/m^3 vapor or airborne dust particles)
CF = Unit conversion factor (e.g., 1E-06 kg/mg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (years)

The LDD is estimated using the same equation. The only difference is that the averaging time (AT) is assumed to be a human average lifetime (70 years).

As the parameters used in this SHRE involve hypothetical residential receptors, default parameters that approximate typical exposure conditions were used (Table 1).

5.2 SOIL EXPOSURE NON-CARCINOGENIC HEALTH HAZARDS

Non-carcinogenic chemical doses were estimated and compared to the chemical-specific RfDs presented in Table 2. A ratio of the dose to RfD was calculated to derive a hazard quotient (HQ), as shown below.

$$HQ = \frac{ADD}{RfD}$$

where:

HQ = Hazard quotient; ratio of estimated dose to reference dose (unitless)
ADD= Estimated dose for non-carcinogenic chemicals (mg/kg-day)
RfD = Chronic reference dose for chemical (mg/kg-day)

The HQs for each chemical and all exposure pathways were summed to estimate the hazard index (HI) for each receptor, as follows:

$$HI = \sum_{n}^{1} HQ_i$$

where:

HI = Hazard index, unitless
HQi = as defined above, unitless

Since children are known to be more sensitive to chemical exposures, HQs and HIs estimated for children are higher than those estimated for adult receptors. Therefore, it is customary in risk assessments to report only HQs and HIs estimated for child receptors. This reporting convention is followed in this SHRE.

The estimated HIs are compared to an acceptable hazard level. Implicit in the HI is the assumption of a threshold level of exposure below which no adverse effects are expected to occur. For example, if the HI exceeds unity (because site-specific exposure exceeds the RfD), then the potential for noncancer adverse effects may exist. In general, the greater the value above 1.0, the greater the potential hazard. In contrast, HIs of less than 1.0 indicate that no adverse health effects are expected to occur from exposure to chemicals at the site.

For purposes of this SHRE, it is assumed that: (1) soil samples HB-3-0.5, HB7-0.25, SB3a-0.25, HB3c-0.25, and HB7b-0.25 (see Table 1A in Appendix A) have been excavated and removed from the Property; and, (2) the maximum residual cadmium and lead concentrations in soil are equal to their corresponding DTSC-SLs values, or 5.2 mg/kg for cadmium and 80 mg/kg for lead (DTSC 2018a).

The total Hazard Index from residential exposures to onsite soil via incidental ingestion and dermal contact was estimated to be 1 (Table 3). Supporting calculations presented in Tables B-1 through B-4 of Appendix B.

Health Risk Evaluation for Lead Exposure

The criteria described in previous section do not apply to inorganic lead. Reference doses and cancer slope factors are not applicable because of incomplete knowledge of the complex physiological dynamics of lead in the body (DTSC 2018a). Alternative methods have been developed to evaluate potential health risks from exposures to inorganic lead. These methods are based on establishing a target blood-lead level that is not expected to result in toxicity. The target level approach is considered appropriate because lead toxicity effects are typically only observed above certain blood-lead levels.

The DTSC (2018a) recommends comparing detected soil lead concentrations to published soil screening levels. For this evaluation, the DTSC-SL for lead was used as the soil screening concentration. The DTSC-SL for residential exposure scenarios has been set at 80 mg/kg (DTSC 2018a).

For purposes of this SHRE, it is assumed that soil samples HB-3-0.5, HB7-0.25, SB3a-0.25, HB3c-0.25, and HB7b-0.25 (see Table 1A in Appendix A) are excavated and removed from the

Property prior to construction of the residential development. It is also assumed all confirmation soil samples collected following excavation will contain lead at concentrations equal to or below 80 mg/kg.

5.3 SOIL EXPOSURE CANCER RISK ESTIMATES

This section discusses the calculation of the lifetime dose estimate and resulting carcinogenic risks from exposures to COPCs detected at the Property.

Cancer risks are expressed as the upper-bound, increased likelihood of an individual developing cancer as a result of exposure to a particular chemical. For example, a cancer risk of 1E-04 refers to an upper-bound increased chance of one in ten thousand of developing cancer over a lifetime (0.01 percent risk). The potential increase in cancer risk from exposure to the chemicals detected in soil at the site is in addition to a background risk of Americans developing cancer. The background risk is one chance in three (0.3 or 3E-01) for every American female, and one chance in two (0.5 or 5E-01) for every American male, of eventually developing cancer (ACS, 1997). The chemical-specific exposure estimates (i.e., the lifetime average daily dose or LADD) are multiplied by the chemical- and route-specific slope factor to arrive at a unitless probability (e.g., 1E-05) of an individual developing cancer.

The LDD estimated for each COPC represents the estimated amount of chemical absorbed daily over a lifetime. The LDD is used to calculate a carcinogenic risk as follows:

$$CR = LDD \bullet SF$$

where:

CR = Upper-bound excess lifetime carcinogenic risk (unitless)
LDD = Lifetime Daily Dose (mg/kg/day)
SF = Slope factor $(mg/kg/day)^{-1}$

Under the assumption that soil samples HB-3-0.5, HB7-0.25, SB3a-0.25, HB3c-0.25, and HB7b-0.25 (see Table 1A in Appendix A) have been excavated and removed from the Property, the total cancer risk from residential exposures to onsite soil via incidental ingestion and dermal contact was estimated to be 2E-09 (Table 3). The estimated cancer risk is lower than the DTSC

benchmark value of 1E-06. Supporting calculations presented in Tables B-5 through B-8 of Appendix B.

The estimated excess cancer risks were compared to the risk level considered acceptable by federal and state regulatory agencies. The target cancer risk level identified by the DTSC (2015) in the PEA Guidance Manual is one in one million (1E-06). However, the USEPA has established acceptable incremental cancer risk levels to be within the risk range of one in 10,000 (1E-04) and 1E-06; risks greater than 1E-04 are generally considered unacceptable. Cal-EPA has defined a risk of one in 100,000 (1E-05) as the "no significant level" for carcinogens under California's Safe Water and Toxic Enforcement Act (Proposition 65). Further, most California air districts use the 1E-05 risk level as the notification trigger level under California's AB2588 Toxic Hot Spots Program. Thus, although agencies will exercise caution in determining whether risks within the range of 1E-04 and 1E-06 require additional investigation or some form of risk management, there is a general precedent that predicted cancer risks that are on the low end of this range will generally be considered acceptable and not warrant further evaluation. Cancer risks estimated in this SHRE are below the 1E-06 benchmark and therefore considered to be acceptable.

5.4 VAPOR INTRUSION RISK CHARACTERIZATION

The J&E model contains a module for estimating potential doses as well as cancer risks and health hazards associated with a given dose. For this assessment, the J&E model was used to estimate the potential health risks and hazards associated with indoor VOC exposures.

The indoor air chemical concentrations estimated to result from the volatilization of VOCs could be considered to represent a "worst-case" estimate. In the calculations it was assumed that single chemical compounds are volatilizing, traveling alone through the vadose zone and escaping to ambient air. In reality, all chemicals detected at the Property are competing with each other for available soil-pore space. It is well known that chemical volatilization and migration is limited by the vapor saturation in the vadose zone.

Using maximum VOC concentrations detected in soil gas, the Hazard Index estimated from residential exposure to VOCs in indoor air was estimated to be 0.01 (Table 4). This estimated

Hazard Index is below 1.0, the benchmark level for non-cancer effects and therefore acceptable to the DTSC.

Using maximum VOC concentrations detected in soil gas, the cancer risk from residential exposure to VOCs in indoor air was estimated to be 8E-07 (Table 4). This estimated cancer risk is well within levels considered acceptable by California health and environmental protection agencies. Supporting calculations are presented in Appendix C.

The results are based on multiple health-protective assumptions. For example, it was assumed that a VOC source is located under a residential building at the Property. The existing source of VOC was also assumed to be large and strong enough to continuously release VOC vapors for up to 26 years.

6.0 SUMMARY AND CONCLUSIONS

The SHRE presented in this report evaluated the potential health risks posed by the presence of trace concentrations of metals (most notably cadmium and lead) and TPH in soil plus a few VOCs in soil gas at the Property.

Environmental investigations conducted at the Property revealed the presence of trace quantities of man-made chemicals in soil and soil gas under the Property. The only chemicals detected in soil were a few metals and TPH. Chemicals detected in soil gas included traces of PCE and toluene.

The potential vapor emissions that could be produced by detected VOCs were evaluated in the SHRE. The estimated vapor emissions were used to obtain potential indoor air chemical concentrations that could result from subsurface vapor intrusion. The potential health risk associated with VOC vapor intrusion and subsequent residential exposures were evaluated in this SHRE.

The current development plan for the Property involves the construction of a residential complex in which case, future onsite residents will not be in contact with soils while at the site. However, it is conceivable that the residential complex could be surrounded by landscaped areas. Therefore, the incidental ingestion and dermal contact with impacted soil was considered to be an extremely unlikely but complete exposure pathway.

Screening-level emission estimation methods were used to predict potential chemical emissions and resulting residential exposures. The estimated exposure point concentrations were then used to estimate potential health risks for on-site residents.

In an effort to be protective of future occupants of the site, the SHRE evaluated health risks for the most sensitive and highly exposed individuals. The SHRE included the evaluation of adults and children exposed to soil and dust for 20 and 6 years, respectively. The child receptors evaluated were assumed to be exposed to high levels of dust and soil, 350 days a year for up to six years of their early lives. If residual chemicals do not pose a health risk to children (at an age when humans are more sensitive and vulnerable), then it is safe to say that exposure to soils does

not pose a health risk to other human receptors (such as construction and maintenance workers) who are not as sensitive and who will have shorter exposure durations.

For purposes of this SHRE, it is assumed that: (1) soil samples HB-3-0.5, HB7-0.25, SB3a-0.25, HB3c-0.25, and HB7b-0.25 (see Table 1A in Appendix A) have been excavated and removed from the Property; and, (2) the maximum residual cadmium and lead concentrations in soil are equal to their corresponding DTSC-SLs values, or 5.2 mg/kg for cadmium and 80 mg/kg for lead (DTSC 2018a).

Results of the SHRE indicate that exposure to residual chemicals in soil and soil gas would not pose a health threat to future onsite residents as the estimated Hazard Indices are below 1.0. Results of the SHRE also indicate that exposure to residual chemicals in soil and soil gas could carry a potential cancer risk of less than one cancer case in an exposed population of one million people (8E-07). The estimated incremental cancer risk is below the benchmark value of 1E-06 and therefore considered acceptable to the DTSC.

The risk and hazard calculations assumed multiple exposures to chemicals via incidental soil ingestion, dermal contact and inhalation of indoor vapors in accordance with DTSC guidance. The results are based on multiple health-protective assumptions. For example, it was assumed that a VOC reservoir is located under the Property and that this VOC reservoir is large and strong enough to continuously release VOC vapors for up to 26 years. However, no VOC reservoir is known to exist under the Property.

All conclusions and recommendations presented in this report are based on reported chemical concentrations and the proposed future land use of the Property. In this risk assessment, all fate-and-transport models, parameters, toxicity data and assumptions were applied in accordance with federal and state regulatory guidelines. These guidelines are meant to protect the public and tend to overestimate potential health risks. As such, this risk assessment provides an estimate of the upper boundary of potential health risks, rather than an accurate representation of true health risks posed by the Property.

7.0 UNCERTAINTY ANALYSIS

The frequency and duration of soil contact activities are a significant factor affecting the potential for adverse human health impacts from the site. In addition, the chemical distribution in site soils can significantly affect the interpretation of risk results based on maximum concentrations. These factors are discussed in more detail below.

This SHRE was based on the application of conservative methods and assumptions in all phases of the assessment. Because exposure point concentrations were derived from fate and transport modeling, conservative assumptions and methodology were necessarily employed to eliminate the possibility of underestimating risks. This practice, although commonly used in the risk assessment process to eliminate the possibility of underestimating risk, necessarily introduces a significant level of conservatism in the conclusions derived from the assessment. Examples of some of the conservatism in this assessment include:

- It was assumed that future receptors at the Property would be exposed to chemicals in soil, dust and indoor air 100 percent of the time while at the Property. In reality, future receptors are not likely to be there for more than twelve hours a day, for no more than 10 years.

- It was assumed that future occupants of the Property would have contact with soil. However, it is known that most, if not all, the surface area will be occupied by buildings, asphalt or landscaped areas. Thus, future contact with soil will be minimal.

- Carcinogenic risks for all pathways were based on a residential exposure of 350 days per year for 26 years. A more realistic exposure scenario for a resident of an apartment complex would be to assume an exposure frequency of 350 days per year for a duration of no more than seven years.

A risk evaluation that relies upon conservative input values can be used as a valuable tool when risks are shown to be *de minimus*, as reported in this risk assessment. The reader of this risk assessment can confidently interpret the reported risk as a conservative overestimate of any site-related risks.

8.0 REFERENCES

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TABLES

Table 1
Exposure Parameters for Onsite Receptors
2222-2224 South Escondido Boulevard
Escondido, California

Exposure Parameters	Units	Residential Scenario		
		Adult	Child	Source
Soil Ingestion Rate (IR-S)	mg/day	100	200	USEPA, 2019
Skin Surface Area (SA)	cm^2/day	6,032	2,900	CalEPA, 2014
Skin Adsorption Factor (ABS)	unitless	chem-specific	chem-specific	USEPA, 2017
Adherence Factor (AF)	mg/cm^2	0.07	0.20	CalEPA, 2014
Fraction of Soil Exposed (FE)	unitless	1.0	1.0	CalEPA, 2014
Exposure Frequency (EF)	days/year	350	350	CalEPA, 2014
Exposure Frequency (dermal; EFd)	days/year	350	350	CalEPA, 2014
Exposure Duration (ED)	years	20	6	CalEPA, 2014
Exposure Time (ET)	hours/day	24	24	CalEPA, 2014
Conversion Factor (CF)	kg/mg	1.0E-06	1.0E-06	--
Body Weight (BW)	kg	80	15	CalEPA, 2014
Averaging Time for Noncarcinogens (AT_n)	days	7,300	2,190	USEPA, 1989 (ED*365 dys/yr)
Averaging Hours for Noncarcinogens (AT_n)	hours	175,200	52,560	USEPA, 1989
Averaging Time for Carcinogens (AT_c)	days	25,550	25,550	USEPA, 1989
Averaging Hours for Carcinogens (AT_c)	hours	613,200	613,200	USEPA, 1989

Table 2
Toxicity Criteria for Chemicals of Potential Concern
2222-2224 South Escondido Boulevard
Escondido, California

Chemical	Chronic Oral Reference Dose (RfDo) [mg/kg/day]		Inhalation Reference Concentration (RfCi) [ug/m^3]		Oral Cancer Slope Factor (CSFo) [mg/kg/day]$^{-1}$		Inhalation Unit Risk (IUR) [ug/m^3]$^{-1}$		Soil-to-Skin Absorption Factor (unitless)
Metals									
Cadmium	6.3E-06	c	1.0E-02	e	NA	e	1.8E-03	e	1.0E-03
TPH									
TPH-d	1.0E-02	e	1.0E+02	e	NA	e	NA	e	1.0E-01
VOCs									
Tetrachloroethylene	NA		4.0E-02	e	NA		6.1E-06	c	NA
Toluene	NA		3.0E-01	e	NA		NA	c	NA

Notes:

mg/kg/day = Milligrams per kilogram per day

ug/m^3 = Micrograms per cubic meter

c = Cal/EPA Cancer Potency Database 2018

e = U.S. EPA Region 9, Regional Screening Levels tables

Table 3
Estimated Cumulative Risks and Hazards that Could Result from
Multi-Pathway Exposure to Soil and Dust
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Residential Exposure Scenario		
	Maximum Detected Concentration (mg/kg)	Cancer Risk Adult & Child	Hazard Index Child
Metals			
Cadmium	5.2	2E-09	1E+00
TPH			
TPH-d	18	--	3E-02
TOTAL RISKS and HAZARDS		2E-09	1E+00

Notes:
" -- " Not Applicable
Includes Incidental Soil Ingestion, Dermal Contact, and Fugitive Dust Inhalation.
EPC: Exposure Point Concentration in milligrams per kilogram used in the risk and hazard calculations

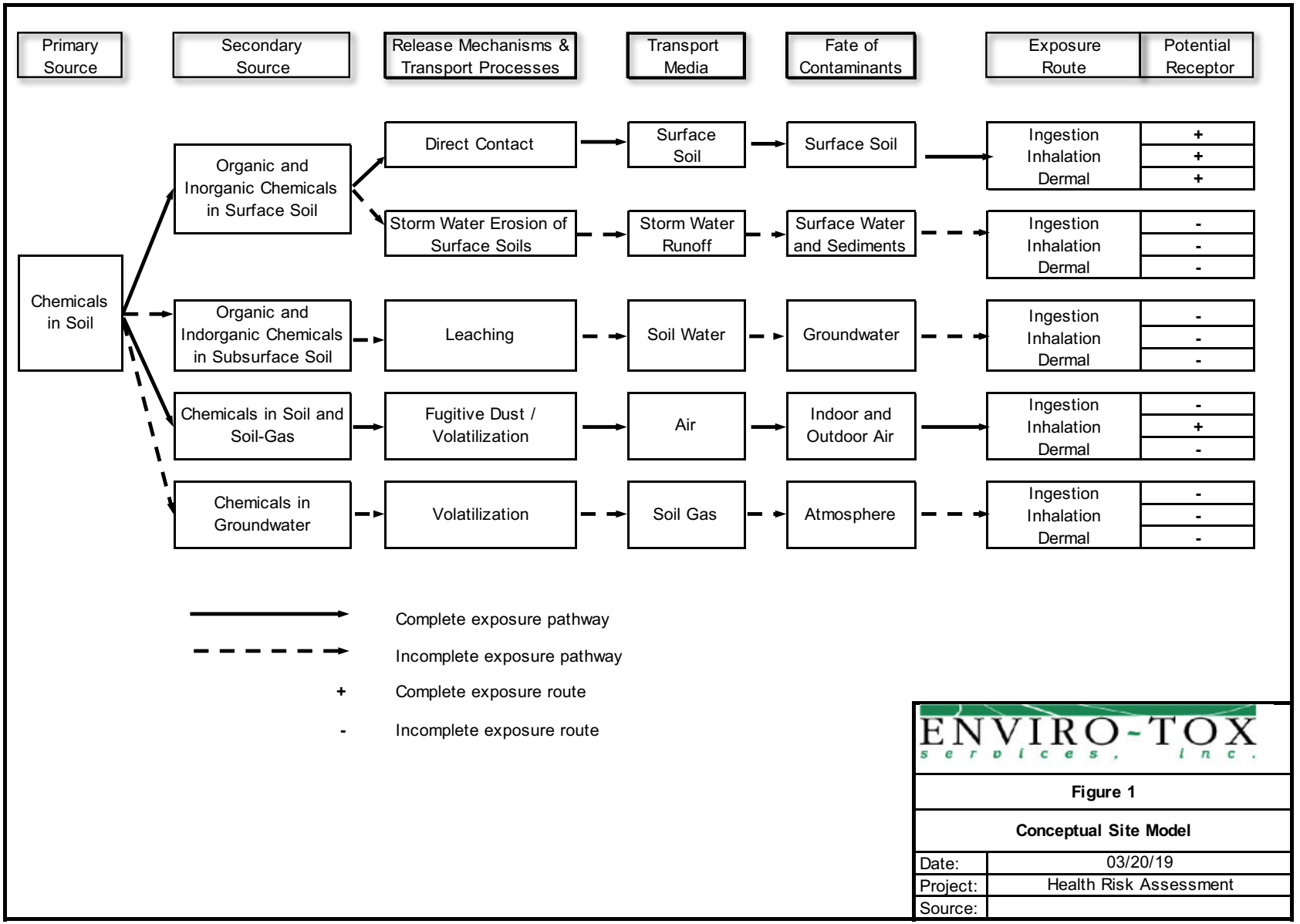
Table 4
Estimated Cumulative Risks and Hazards that Could Result from
Exposure to Indoor Air
2222-2224 South Escondido Boulevard
Escondido, California

Chemical of Potential Concern (COPC)	CAS Number	Maximum Detected Soil Gas Concentration (µg/L)	Cancer Risk (unitless)	Hazard Index (unitless)
Tetrachloroethylene	127184	0.84	8.E-07	9.E-03
Toluene	108883	0.38	NA	8.E-04
TOTAL RISKS and HAZARDS			8.E-07	**1.E-02**

Notes:

µg/L = micrograms per liter
NA = Not applicable or not available

FIGURE



ENVIRO-TOX services, inc.

Figure 1

Conceptual Site Model

Date:	03/20/19
Project:	Health Risk Assessment
Source:	

APPENDIX A

Soil and Soil Gas Data Summary Tables

TABLE 1
Summary of Soil Sampling Results (mg/Kg)

Sample ID	Heavy Metals Above Screening Levels	PCBs	TPHg C4-C12	TPHd C13-C22	TPH-Oil C23-C40
Sampled October 24, 2018					
HB1-0.5	None	--	ND<0.20	ND<10	ND<20
HB2-0.5	None	--	ND<0.20	ND<10	ND<20
HB3-0.5	Lead, Cadmium	--	ND<0.20	15	ND<20
HB3-2.5	None	--	--	--	--
HB4-0.25	None	--	ND<0.20	ND<10	ND<20
HB5-0.5	None	--	ND<0.20	ND<10	ND<20
HB6-0.5	None	--	ND<0.20	18	ND<20
HB7-0.25	Lead	--	ND<0.20	ND<10	ND<20
HB7-2.5	None	--	--	--	--
HB8-0.25	None	--	ND<0.20	ND<10	ND<20
Sampled November 6, 2018					
HB3a-0.25	Cadmium	--	--	--	--
HB3a-1.5	None	--	--	--	--
HB3b-0.25	None	--	--	--	--
HB3b-1.5	None	--	--	--	--
HB3c-0.25	Lead, Cadmium	--	--	--	--
HB3c-1.5	None	--	--	--	--
HB7a-0.25	None	--	--	--	--
HB7a-1.5	None	--	--	--	--
HB7b-0.25	Cadmium	--	--	--	--
HB7b-1.5	None	--	--	--	--
HB7c-0.25	None	--	--	--	--
HB7c-1.5	None	--	--	--	--
SFRWQCB Tier 1 ESL	**--**	***Var.***	***100***	***230***	***5,100***

Notes: ND - Not Detected. San Francisco Regional Water Quality Control Board Environmental Screening Levels (SFRWQCB ESLs) are human health risk based screening levels based on a generic site conceptual model designed for use at residential sites (Tier 1). The heavy metal results are fully summarized in Table 1A. Please refer to lab report for complete results.

TABLE 1A
Summary of Heavy Metal Results (mg/Kg)

Sample ID	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Vanadium	Zinc
Sampled October 24, 2018										
HB1-0.5	ND<1	75.6	ND<0.5	38.7	8.72	16.8	19.4	6.23	53.6	44.2
HB2-0.5	ND<1	73.9	ND<0.5	50.2	9.08	38.6	70.1	7.42	58.9	51.9
HB3-0.5	3.53	195	22.9	163	21.7	175	394	52.0	56.0	1,480
HB3-2.5	-	--	ND<0.5	--	--	--	2.28	--	--	--
HB4-0.25	3.33	336	1.36	70.3	6.42	65.0	23.0	36.6	27.9	256
HB5-0.5	ND<1	78.2	ND<0.5	19.1	6.76	11.0	13.1	4.28	28.4	29.8
HB6-0.5	ND<1	76.7	ND<0.5	37.5	8.51	13.8	20.8	6.07	52.0	224
HB7-0.25	ND<1	69.7	2.94	45.0	7.55	22.7	146	8.14	51.3	129
HB7-2.5	--	--	ND<0.5	--	--	--	3.61	--	--	--
HB8-0.25	ND<1	82.0	0.557	42.7	8.48	20.0	10.5	8.59	50.4	46.0
Sampled November 6, 2018										
HB3a-0.25	--	--	26.3	--	--	--	65.4	--	--	--
HB3a-1.5	--	--	ND<0.5	--	--	--	18.9	--	--	--
HB3b-0.25	--	--	4.26	--	--	--	78.1	--	--	--
HB3b-1.5	--	--	ND<0.5	--	--	--	2.94	--	--	--
HB3c-0.25	--	--	9.99	--	--	--	83.6	--	--	--
HB3c-1.5	--	--	ND<0.5	--	--	--	3.18	--	--	--
HB7a-0.25	--	--	0.586	--	--	--	15.6	--	--	--
HB7a-1.5	--	--	ND<0.5	--	--	--	1.96	--	--	--
HB7b-0.25	--	--	7.38	--	--	--	25.4	--	--	--
HB7b-1.5	--	--	ND<0.5	--	--	--	3.11	--	--	--
HB7c-0.25	--	--	0.860	--	--	--	17.2	--	--	--
HB7c-1.5	--	--	ND<0.5	--	--	--	2.94	--	--	--
Residential RSL	***0.11***	***15,000***	***5.2****	***36,000***	***23***	***3,100***	***80****	***490****	***390****	***23,000***
Industrial RSL	***0.36***	***220,000***	***7.3****	***170,000***	***350***	***47,000***	***320****	***3,100****	***1,000****	***350,000***
DTSC Bkgrnd	***12***	***--***	***--***	***--***	***--***	***--***	***--***	***--***	***--***	***--***

Notes: ND - Not Detected. EPA Regional Screening Levels (RSLs) are human health risk based screening levels used by EPA and DTSC in residential and commercial settings. DTSC Background Concentration is based on statistical study of sites throughout southern California. This concentration may be used as a screening level for anthropogenic and naturally occurring levels of arsenic in soil in southern California. - Values modified by DTSC HERO Note 3. Please refer to lab report for complete results.*

TABLE 2
Summary of Soil Gas Sampling Results (ug/L)

Sample ID	Benzene	Toluene	Ethylbenzene	Xylenes	TCE	PCE	Other VOC
Sampled October 24, 2018							
HSG1-3	ND<0.05	0.14	ND<0.1	ND<0.2	ND<0.1	0.81	ND
HSG2-3	ND<0.05	0.10	ND<0.1	ND<0.2	ND<0.1	0.80	ND
HSG3-4	ND<0.05	0.13	ND<0.1	ND<0.2	ND<0.1	0.84	ND
HSG4-4	ND<0.05	0.11	ND<0.1	ND<0.2	ND<0.1	ND<0.1	ND
HSG5-4	ND<0.05	ND<0.1	ND<0.1	ND<0.2	ND<0.1	ND<0.1	ND
Sampled November 6, 2018							
HSG6-15	ND<0.05	ND<0.1	ND<0.1	ND<0.2	ND<0.1	0.50	ND
HSG7-4	ND<0.05	0.13	ND<0.1	ND<0.2	ND<0.1	ND<0.1	ND
HSG8-4	ND<0.05	0.24	ND<0.1	ND<0.2	ND<0.1	ND<0.1	ND
HSG9-4	ND<0.05	0.23	ND<0.1	ND<0.2	ND<0.1	ND<0.1	ND
HSG10-4	ND<0.05	0.38	ND<0.1	ND<0.2	ND<0.1	ND<0.1	ND
HSG1-R-2.5	ND<0.05	ND<1	ND<0.1	ND<0.2	ND<0.1	0.15	ND
Future Residential RSL	***0.097****	***310****	***1.1***	***100***	***0.48***	***0.46****	*--*
Commercial RSL	***0.42****	***1,300****	***4.9***	***440***	***3.0***	***2.0****	*--*

*Notes: ND - Not Detected. EPA Regional Screening Levels (RSLs) are human health risk based screening levels used by EPA and DTSC to determine Health Risk in residential and commercial settings. Future Residential accounts for improved construction methods in new buildings. *-Values modified for California by DTSC HERO Note 3. Screening levels for soil gas calculated using indoor air values and attenuation factors provided by DTSC. Please refer to laboratory report for complete results.*

APPENDIX B

Cancer Risk and Health Hazard Calculation Spreadsheets

Table B-1
Health Hazards from Incidental Soil Ingestion
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Concentration (mg/kg)	Oral Reference Dose (mg/kg/day)	Residential Exposure Scenario	
			Average Daily Intake (mg/kg/day) Child	Hazard Quotient (Unitless) Child
Metals				
Cadmium	5.2	6.3E-06	6E-06	1E+00
TPH				
TPH-d	18	1.0E-02	2E-04	2E-02
Total Hazard Index				**1E+00**

Notes:
mg/kg = Milligrams per kilogram
mg/kg/day = Milligrams per kilogram per day

Equations:
Child $INTAKE_{noncancer}$ (mg/kg-day) = $((CS * IR\text{-}S_{child} * EF_{child} * ED_{child} * CF) / (BW_{child} * AT_{noncancer}))$
Noncancer Hazard = $(INTAKE_{noncancer} / RfD)$

Table B-2
Health Hazards from Dermal Contact with Soil
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Concentration (mg/kg)	Soil-to-Skin Absorption Factor (unitless)	Oral/Dermal Reference Dose (mg/kg/day)	Residential Scenario	
				Average Daily Intake (mg/kg/day) Child	Hazard Quotient (Unitless) Child
Metals					
Cadmium	5.2	0.001	6.3E-06	3E-08	4E-03
TPH					
TPH-d	18	0.1	1.0E-02	7E-05	7E-03
Total Hazard Index					**1E-02**

Notes:
mg/kg = Milligrams per kilogram
mg/kg/day = Milligrams per kilogram per day

Equations:
Child $INTAKE_{noncancer}$ (mg/kg-day) = $((CS * SA_{child} * AF_{child} * ABS * EF_{child} * ED_{child} * CF) / (BW_{child} * AT_{noncancer}))$
Noncancer Hazard = $(INTAKE_{noncancer} / RfD)$

Table B-3
Health Hazards from Inhalation of Outdoor Air
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Concentration (mg/kg)	PEF or VEF (m^3/kg)	Inhalation Reference Concentration[a] (ug/m^3)	Residential Scenario	
				Exposure Concentration (ug/m^3) Child	Hazard Quotient (Unitless) Child
Metals					
Cadmium	5.2	1.36E+09	1.0E-02	4E-06	4E-04
TPH					
TPH-d	18	1.36E+09	1.0E+02	1E-05	1E-07
Total Hazard Index					**4E-04**

Notes:
mg/kg = Milligrams per kilogram
ug/m^3 = Micrograms per cubic meter
m^3/kg = Cubic meters per kilogram

Equations:
Particulate: Child Exposure-$_{noncancer}$ (ug/m^3) = (((CS/PEF)*1000) * EF_{child} * ED_{child} * ET_{child}) / ($AT_{noncancer}$))
VOCs: Child Exposure-$_{noncancer}$ (ug/m^3) = (((CS/VEF)*1000) * Etchild * EF_{child} * ED_{child}) / ($AT_{noncancer}$))
Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD)

Table B-4
Cumulative Health Hazards from Multipathway Soil Exposure
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Conc. (mg/kg)	Noncancer Hazard			
		Child Resident			
		Ingestion of Soil	Dermal	Inhalation	Total HI
Metals					
Cadmium	5.2	1E+00	4E-03	4E-04	1E+00
TPH					
TPH-d	18	2E-02	7E-03	1E-07	3E-02
Total Hazard Index					**1E+00**

Note:
mg/kg = Milligrams per kilogram

Table B-5
Cancer Risks from Incidental Soil Ingestion
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Concentration (mg/kg)	Oral Slope Factor $(mg/kg/day)^{-1}$	Residential Scenario	
			Average Daily Intake (mg/kg/day) Adult & Child	Cancer Risk (Unitless) Adult & Child
Metals				
Cadmium	5.2	NA	7E-06	NA
TPH				
TPH-d	18	NA	3E-05	NA
Total Cancer Risk				--

Notes:
mg/kg = Milligrams per kilogram
mg/kg/day = Milligrams per kilogram per day

Equations:
Adult/Child $INTAKE_{cancer}$ (mg/kg-day) = $(CS * EF * ING_{adjusted} * CF) / (AT_{cancer})$
Where $ING_{adjusted} = [(IR\text{-}S_{child} * ED_{child} / BW_{child}) + (IR\text{-}S_{adult} * ED_{adult} / BW_{adult})]$
Cancer Risk = $(INTAKE_{cancer} * CSF)$

Table B-6
Cancer Risks from Dermal Contact with Soil
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Concentration (mg/kg)	Soil-to-Skin Absorption Factor (unitless)	Oral/Dermal Slope Factor $(mg/kg/day)^{-1}$	Residential Scenario	
				Average Daily Intake (mg/kg/day) Adult & Child	Cancer Risk (Unitless) Adult & Child
Metals					
Cadmium	5.2	0.001	NA	2E-08	NA
TPH					
TPH-d	18	0.1	NA	8E-06	NA
Total Cancer Risk					--

Notes:
mg/kg = Milligrams per kilogram
mg/kg/day = Milligrams per kilogram per day

Equations:
Adult/Child $INTAKE_{cancer}$ (mg/kg-day) = $(CS * SAF_{adjusted} * ABS * CF) / (AT_{cancer})$
Where $SAF_{adjusted} = [(SA_{child} * AF_{child} * EF_{child} * ED_{child} / BW_{child}) + (SA_{adult} * AF_{adult} * EF_{adult} * ED_{adult} / BW_{adult})]$
Cancer Risk = $(INTAKE_{cancer} * CSF)$

Table B-7
Cancer Risks from Inhalation of Outdoor Air
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Concentration (mg/kg)	PEF or VF (m^3/kg)	Inhalation Unit Risk ($ug/m^3)^{-1}$	Residential Scenario	
				Exposure Concentration (ug/m^3) Adult & Child	Cancer Risk (Unitless) Adult & Child
Metals					
Cadmium	5.2	1.36E+09	1.8E-03	1E-06	2E-09
TPH					
TPH-d	18	1.36E+09	NA	5E-06	NA
Total Cancer Risk					**2E-09**

Notes:
mg/kg = Milligrams per kilogram
ug/m^3 = Micrograms per cubic meter
m^3/kg = Cubic meters per kilogram

Equations:
Particulate Exposure Concentartion (ug/m^3) = $((CS/PEF)*1000)*EF_{child}*ED_{child}*ET_{child})/(AT_c))+((CS/PEF)*1000)*EF_{adult}*ED_{adult}*ET_{adult})/(AT_c))$
VOC Exposure Concentartion (ug/m^3) = $((CS/VEF)*1000)*EF_{child}*ED_{child}*ET_{child})/(AT_c))+((CS/PEF)*1000)*EF_{adult}*ED_{adult}*ET_{adult})/(AT_c))$
Cancer Risk = $(INTAKE_{cancer} * CSF)$

Table B-8
Cumulative Cancer Risks from Multipathway Soil Exposure
Future Resident
2222-2224 South Escondido Boulevard
Escondido, California

COPC	Maximum Soil Conc. (mg/kg)	Cancer Risk			
		Adult & Child			
		Ingestion	Dermal	Inhalation	Total Risk
Metals					
Cadmium	5.2	NA	NA	2E-09	2E-09
TPH					
TPH-d	18	NA	NA	NA	--
Total Cancer Risk					**2E-09**

Note:
"--" not applicable or not available

APPENDIX C

Vapor Intrusion Modeling Spreadsheets

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

Land Use Exposure Scenario: **Residential** — **Using Maximum Detected Concentrations**

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	8.4E+02			Tetrachloroethylene
108883	3.8E+02			Toluene

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk (unitless)
8.4E+02	**4.6E-04**	**3.8E-01**	**8.4E-07**
3.8E+02	**6.4E-04**	**2.4E-01**	**NA**

Cumulative risk and Hazard = **8E-07**

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	152.4	24	SIC		

5

MORE ↓

Lookup Soil Parameters

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SIC	1.38	0.481	0.216	5

MORE ↓

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$	ENTER Ceiling Height CH (cm)
EW=> Residential	70	26	26	350	24	0.5	244
					(NEW)	(NEW)	(= **8.0** feet)

END

Noncancer Hazard (unitless)
9.2E-03
7.8E-04
1E-02

CHEMICAL PROPERTIES SHEET

CAS	Chemical	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
127184	Tetrachloroethylene	5.1E-02	9.5E-06	1.8E-02	25	8,288	394.40	620.20	6.1E-06	4.0E-02
108883	Toluene	7.8E-02	9.2E-06	6.6E-03	25	7,930	383.80	591.80	0.0E+00	3.0E-01

Land Use **Residential**
Exposure **Using Maximum Detected**
Scenario: **Concentrations**

CHEMICAL PROPERTIES SHEET

CAS	Chemical	Molecular weight, MW (g/mol)
127184	Tetrachloroethylene	166.00
108883	Toluene	92.10

Land Use Exposure Scenario: **Residential Using Maximum Detected Concentrations**

CHEMICAL PROPERTIES SHEET

CAS	Chemical	Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
127184	Tetrachloroethylene	137.4	0.265	0.284	1.5E-09	0.844	1.3E-09	4,000	8.4E+02	3.4E+04
108883	Toluene	137.4	0.265	0.284	1.5E-09	0.844	1.3E-09	4,000	3.8E+02	3.4E+04

Land Use **Residential**
Exposure **Using Maximum Detected**
Scenario: **Concentrations**

CHEMICAL PROPERTIES SHEET

CAS	Chemical	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
127184	Tetrachloroethylene	1.0E+06	5.0E-03	15	9,410	1.7E-02	6.9E-01	1.8E-04	2.6E-03	137.4
108883	Toluene	1.0E+06	5.0E-03	15	9,001	6.3E-03	2.6E-01	1.8E-04	4.0E-03	137.4

Land Use **Residential**
Exposure Scenario: **Using Maximum Detected Concentrations**

CAS	Chemical	Convection path length, L_p (cm)
127184	Tetrachloroethylene	15
108883	Toluene	15

Land Use Exposure Scenario: **Residential Using Maximum Detected Concentrations**

CHEMICAL PROPERTIES SHEET

CAS	Chemical	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
127184	Tetrachloroethylene	8.4E+02	1.25	8.3E+01	2.6E-03	5.0E+03	4.1E+27	**4.6E-04**	3.8E-01	6.1E-06	4.0E-02
108883	Toluene	3.8E+02	1.25	8.3E+01	4.0E-03	5.0E+03	8.4E+17	**6.4E-04**	2.4E-01	NA	3.0E-01

Land Use Exposure Scenario: **Residential Using Maximum Detected Concentrations**

CHEMICAL PROPERTIES SHEET

CAS	Chemical	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
127184	Tetrachloroethylene	**8.4E-07**	**9.2E-03**
108883	Toluene	**NA**	**7.8E-04**

Land Use Exposure Scenario: **Residential Using Maximum Detected Concentrations**

Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	n (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	**0.40**	**0.01622**	**1.321**	**0.2430**	**0.481**	**0.111**	**0.0039**	**1.38**	**0.216**	**Silty Clay**
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

NEW => Receptor Lookup Table (added by HERO)

Receptor Type	AT_C (yrs)	AT_{NC} (yrs)	ED (yrs)	EF (days/yr)	ET (hrs/day)	ACH (1/hour)
Residential	70	26	26	350	24	0.5
Commercial	70	25	25	250	8	1
User-Defined						

Notes on Toxicity Criteria (see cell comments for individual chemical toxicity values)

1. Chemical name (blue) = Carcinogens with IUR
2. Values are from USEPA IRIS database except as indicated.
3. **Bold** = Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) toxicity value
4. IUR or RfC (red) = revised values (March 2014 update of December 2011 values)
5. X denotes route extrapolation from oral toxicity criteria.
   (Values posted by USEPA or OEHHA as inhalation criteria, including cancer slope factors, are not denoted except as in original USEPA 2002 Draft VI guidance.)

Chemical Properties Lookup Table (K_{oc}, D_a, D_w, S, H', H values updated per USEPA November 2013 RSL Table)

DTSC-Recommended Toxicity Criteria Values Used to Calculate Risk and Hazard (last updated March 2014)

NEW => 11 Additional Chemicals (CAS No. in red)		Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Enthalpy of vaporization at the normal boiling point, $DH_{v,b}$ (cal/mol)	Inhalation Unit Risk IUR ($\mu g/m^3)^{-1}$ (0.0E+00 = no value available)	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)	Extrapolated from oral toxicity value: IUR (X)	Extrapolated from oral toxicity value: RfC (X)	Comment Flag (y)
56235	Carbon tetrachloride	4.39E+01	5.71E-02	9.79E-06	7.93E+02	1.13E+00	2.76E-02	25	349.9	556.6	7,127	**4.2E-05**	**1.0E-01**	1.54E+02			
57749	Chlordane	3.38E+04	3.44E-02	4.02E-06	5.60E-02	1.99E-03	4.85E-05	25	624.2	885.7	14,000	**3.4E-04**	7.0E-04	4.10E+02			
58899	gamma-HCH (Lindane)	2.81E+03	4.33E-02	5.06E-06	7.30E+00	2.10E-04	5.14E-06	25	596.6	839.4	15,000	**3.1E-04**	1.1E-03	2.91E+02		X	
60297	Ethyl ether	9.70E+00	8.52E-02	9.36E-06	6.04E+04	5.03E-02	1.23E-03	25	307.5	466.7	6,338	0.0E+00	7.0E-01	7.41E+01		X	
60571	Dieldrin	2.01E+04	2.33E-02	6.01E-06	1.95E-01	4.09E-04	1.00E-05	25	613.3	842.3	17,000	**4.6E-03**	1.8E-04	3.81E+02		X	
67641	Acetone	2.36E+00	1.06E-01	1.15E-05	1.00E+06	1.43E-03	3.50E-05	25	329.2	508.1	6,955	0.0E+00	3.1E+01	5.81E+01			
67663	Chloroform	3.18E+01	7.69E-02	1.09E-05	7.95E+03	1.50E-01	3.67E-03	25	334.3	536.4	6,988	2.3E-05	9.8E-02	1.19E+02			
67721	Hexachloroethane	1.97E+02	3.21E-02	8.89E-06	5.00E+01	1.59E-01	3.89E-03	25	458.0	695.0	9,510	**1.1E-05**	3.0E-02	2.37E+02			
71432	Benzene	1.46E+02	8.95E-02	1.03E-05	1.79E+03	2.27E-01	5.55E-03	25	353.2	562.2	7,342	**2.9E-05**	**3.0E-03**	7.81E+01			y
71556	1,1,1-Trichloroethane	4.39E+01	6.48E-02	9.60E-06	1.29E+03	7.03E-01	1.72E-02	25	347.2	545.0	7,136	0.0E+00	**1.0E+00**	1.33E+02			
72435	Methoxychlor	2.69E+04	2.21E-02	5.59E-06	1.00E-01	8.30E-06	2.03E-07	25	651.0	848.5	16,000	0.0E+00	1.8E-02	3.46E+02		X	
72559	DDE	1.18E+05	4.08E-02	4.76E-06	4.00E-02	1.70E-03	4.16E-05	25	636.4	860.4	15,000	**9.7E-05**	0.0E+00	3.18E+02	X		
74839	Methyl bromide (bromomethane)	1.32E+01	1.00E-01	1.35E-05	1.52E+04	3.00E-01	7.34E-03	25	276.7	467.0	5,714	0.0E+00	**5.0E-03**	9.49E+01			
74873	Methyl chloride (chloromethane)	1.32E+01	1.24E-01	1.36E-05	5.32E+03	3.61E-01	8.82E-03	25	249.0	416.3	5,115	0.0E+00	9.0E-02	5.05E+01			y
74908	Hydrogen cyanide	3.80E+00	1.68E-01	1.68E-05	1.00E+06	5.44E-03	1.33E-04	25	299.0	456.7	6,676	0.0E+00	8.0E-04	2.70E+01			
74953	Methylene bromide (dibromomethane)	2.17E+01	5.51E-02	1.19E-05	1.19E+04	3.36E-02	8.22E-04	25	370.0	583.0	7,868	0.0E+00	4.0E-03	1.74E+02			
75003	Chloroethane (ethyl chloride)	2.17E+01	1.04E-01	1.16E-05	6.71E+03	4.54E-01	1.11E-02	25	285.3	460.4	5,879	1.3E-06	1.0E+01	6.45E+01	X		y
75014	Vinyl chloride (chloroethene)	2.17E+01	1.07E-01	1.20E-05	8.80E+03	1.14E+00	2.78E-02	25	259.3	432.0	5,250	**7.8E-05**	1.0E-01	6.25E+01			
75058	Acetonitrile	4.67E+00	1.34E-01	1.41E-05	1.00E+06	1.41E-03	3.45E-05	25	354.6	545.5	7,110	0.0E+00	6.0E-02	4.11E+01			
75070	Acetaldehyde	1.00E+00	1.28E-01	1.35E-05	1.00E+06	2.73E-03	6.67E-05	25	293.1	466.0	6,157	**2.7E-06**	9.0E-03	4.41E+01			
75092	Methylene chloride (dichloromethane)	2.17E+01	9.99E-02	1.25E-05	1.30E+04	1.33E-01	3.25E-03	25	313.0	510.0	6,706	**1.0E-06**	**4.0E-01**	8.49E+01			
75150	Carbon disulfide	2.17E+01	1.06E-01	1.30E-05	2.16E+03	5.89E-01	1.44E-02	25	319.0	552.0	6,391	0.0E+00	7.0E-01	7.61E+01			
75218	Ethylene oxide	3.24E+00	1.34E-01	1.45E-05	1.00E+06	6.05E-03	1.48E-04	25	283.6	469.0	6,104	**8.8E-05**	**3.0E-02**	4.41E+01			
75252	Bromoform	3.18E+01	3.57E-02	1.04E-05	3.10E+03	2.19E-02	5.35E-04	25	422.4	696.0	9,479	1.1E-06	7.0E-02	2.53E+02		X	
75274	Bromodichloromethane	3.18E+01	5.63E-02	1.07E-05	3.03E+03	8.67E-02	2.12E-03	25	363.2	585.9	7,800	**3.7E-05**	7.0E-02	1.64E+02	X	X	
75296	2-Chloropropane	9.14E+00	8.88E-02	1.01E-05	3.73E+03	5.93E-01	1.45E-02	25	308.7	485.0	6,286	0.0E+00	1.0E-01	7.85E+01			y
75343	1,1-Dichloroethane	3.18E+01	8.36E-02	1.06E-05	5.04E+03	2.30E-01	5.62E-03	25	330.6	523.0	6,895	**1.6E-06**	8.0E-01	9.90E+01	X	X	
75354	1,1-Dichloroethylene	3.18E+01	8.63E-02	1.10E-05	2.42E+03	1.07E+00	2.61E-02	25	304.8	576.1	6,247	0.0E+00	**7.0E-02**	9.69E+01			
75456	Chlorodifluoromethane	3.18E+01	1.03E-01	1.33E-05	2.77E+03	1.66E+00	4.06E-02	25	232.4	369.3	4,836	0.0E+00	5.0E+01	8.65E+01			
75694	Trichlorofluoromethane	4.39E+01	6.54E-02	1.00E-05	1.10E+03	3.97E+00	9.70E-02	25	296.7	471.0	5,999	0.0E+00	1.2E+00	1.37E+02			
75718	Dichlorodifluoromethane	4.39E+01	7.60E-02	1.08E-05	2.80E+02	1.40E+01	3.43E-01	25	243.2	385.0	9,421	0.0E+00	1.0E-01	1.21E+02			
76131	1,1,2-Trichloro-1,2,2-trifluoroethane	1.97E+02	3.76E-02	8.59E-06	1.70E+02	2.15E+01	5.26E-01	25	320.7	487.3	6,463	0.0E+00	5.0E+00	1.87E+02			
76448	Heptachlor	4.13E+04	2.23E-02	5.70E-06	1.80E-01	1.20E-02	2.94E-04	25	603.7	846.3	13,000	**1.2E-03**	1.8E-03	3.73E+02		X	
77474	Hexachlorocyclopentadiene	1.40E+03	2.72E-02	7.22E-06	1.80E+00	1.10E+00	2.70E-02	25	512.2	746.0	10,931	0.0E+00	2.0E-04	2.73E+02			
78831	Isobutanol	2.92E+00	8.97E-02	1.00E-05	8.50E+04	4.00E-04	9.78E-06	25	381.0	547.8	10,936	0.0E+00	1.1E+00	7.41E+01		X	
78875	1,2-Dichloropropane	6.07E+01	7.33E-02	9.73E-06	2.80E+03	1.15E-01	2.82E-03	25	369.5	572.0	7,590	**1.0E-05**	4.0E-03	1.13E+02	X		
78933	Methylethylketone (2-butanone)	4.51E+00	9.14E-02	1.02E-05	2.23E+05	2.33E-03	5.69E-05	25	352.5	536.8	7,481	0.0E+00	5.0E+00	7.21E+01			
79005	1,1,2-Trichloroethane	6.07E+01	6.69E-02	1.00E-05	4.59E+03	3.37E-02	8.24E-04	25	386.2	602.0	8,322	1.6E-05	2.0E-04	1.33E+02			
79016	Trichloroethylene	6.07E+01	6.87E-02	1.02E-05	1.28E+03	4.03E-01	9.85E-03	25	360.4	544.2	7,505	4.1E-06	2.0E-03	1.31E+02			y
79209	Methyl acetate	3.06E+00	9.58E-02	1.10E-05	2.43E+05	4.70E-03	1.15E-04	25	329.8	506.7	7,260	0.0E+00	3.5E+00	7.41E+01		X	
79345	1,1,2,2-Tetrachloroethane	9.49E+01	4.89E-02	9.29E-06	2.83E+03	1.50E-02	3.67E-04	25	419.6	661.2	8,996	**5.8E-05**	7.0E-02	1.68E+02		X	
79469	2-Nitropropane	3.08E+01	8.47E-02	1.02E-05	1.70E+04	4.87E-03	1.19E-04	25	393.2	594.0	8,383	2.7E-03	2.0E-02	8.91E+01			
80626	Methylmethacrylate	9.14E+00	7.50E-02	9.21E-06	1.50E+04	1.30E-02	3.19E-04	25	373.5	567.0	8,975	0.0E+00	7.0E-01	1.00E+02			
83329	Acenaphthene	5.03E+03	5.06E-02	8.33E-06	3.90E+00	7.52E-03	1.84E-04	25	550.5	803.2	12,155	0.0E+00	2.1E-01	1.54E+02		X	
86737	Fluorene	9.16E+03	4.40E-02	7.89E-06	1.69E+00	3.93E-03	9.62E-05	25	570.4	870.0	12,666	0.0E+00	1.4E-01	1.66E+02		X	
87683	Hexachloro-1,3-butadiene	8.45E+02	2.67E-02	7.03E-06	3.20E+00	4.21E-01	1.03E-02	25	486.2	738.0	10,206	2.2E-05	3.5E-03	2.61E+02		X	
88722	o-Nitrotoluene	3.71E+02	5.88E-02	8.67E-06	6.50E+02	5.11E-04	1.25E-05	25	495.0	720.0	12,239	6.3E-05	3.2E-03	1.37E+02	X	X	y
91203	Naphthalene	1.54E+03	6.05E-02	8.38E-06	3.10E+01	1.80E-02	4.40E-04	25	491.1	748.4	10,373	**3.4E-05**	3.0E-03	1.28E+02			
91576	2-Methylnaphthalene	2.48E+03	5.24E-02	7.78E-06	2.46E+01	2.11E-02	5.18E-04	25	514.3	761.0	12,600	0.0E+00	1.4E-02	1.42E+02		X	
92524	Biphenyl	5.13E+03	4.71E-02	7.56E-06	6.94E+00	1.26E-02	3.08E-04	25	529.1	789.0	10,890	0.0E+00	4.0E-04	1.54E+02			y
95476	o-Xylene	3.83E+02	6.89E-02	8.53E-06	1.78E+02	2.12E-01	5.18E-03	25	417.6	630.3	8,661	0.0E+00	1.0E-01	1.06E+02			
95501	1,2-Dichlorobenzene	3.83E+02	5.62E-02	8.92E-06	1.56E+02	7.85E-02	1.92E-03	25	453.6	705.0	9,700	0.0E+00	2.0E-01	1.47E+02			

Chemical Properties Lookup Table (K_{oc}, D_a, D_w, S, H', H values updated per USEPA November 2013 RSL Table)

DTSC-Recommended Toxicity Criteria Values Used to Calculate Risk and Hazard (last updated March 2014) (0.0E+00 = no value available)

NEW => 11 Additional Chemicals
(CAS No. in red)

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Enthalpy of vaporization at the normal boiling point, $DH_{v,b}$ (cal/mol)	Inhalation Unit Risk IUR ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)	Extrapolated from oral toxicity value: IUR (X)	Extrapolated from oral toxicity value: RfC (X)	Comment Flag (y)
95578	2-Chlorophenol	3.07E+02	6.61E-02	9.48E-06	1.13E+04	4.58E-04	1.12E-05	25	447.5	675.0	9,572	0.0E+00	1.8E-02	1.29E+02		X	
95636	1,2,4-Trimethylbenzene	6.14E+02	6.07E-02	7.92E-06	5.70E+01	2.52E-01	6.16E-03	25	442.3	649.2	9,369	0.0E+00	6.0E-02	1.20E+02			
96128	1,2-Dibromo-3-chloropropane	1.16E+02	3.21E-02	8.90E-06	1.23E+03	6.01E-03	1.47E-04	25	469.0	703.5	9,960	6.0E-03	2.0E-04	2.36E+02			
96184	1,2,3-Trichloropropane	1.16E+02	5.75E-02	9.24E-06	1.75E+03	1.40E-02	3.43E-04	25	430.0	652.0	9,171	8.6E-03	3.0E-04	1.47E+02	X		y
96333	Methyl acrylate	5.84E+00	8.60E-02	1.02E-05	4.94E+04	8.14E-03	1.99E-04	25	353.7	536.0	7,749	0.0E+00	2.0E-02	8.61E+01			
97632	Ethylmethacrylate	1.67E+01	6.53E-02	8.38E-06	5.40E+03	2.34E-02	5.73E-04	25	390.0	571.0	10,957	0.0E+00	3.0E-01	1.14E+02			
98066	tert-Butylbenzene	1.00E+03	5.30E-02	7.37E-06	2.95E+01	5.40E-01	1.32E-02	25	442.1	1220.0	8,980	0.0E+00	4.0E-01	1.34E+02			
98828	Cumene	6.98E+02	6.03E-02	7.86E-06	6.13E+01	4.70E-01	1.15E-02	25	425.6	631.1	10,335	0.0E+00	4.0E-01	1.20E+02			y
98862	Acetophenone	5.19E+01	6.52E-02	8.72E-06	6.13E+03	4.25E-04	1.04E-05	25	475.0	709.5	11,732	0.0E+00	3.5E-01	1.20E+02		X	
98953	Nitrobenzene	2.26E+02	6.81E-02	9.45E-06	2.09E+03	9.81E-04	2.40E-05	25	484.0	719.0	10,566	4.0E-05	9.0E-03	1.23E+02			
100414	Ethylbenzene	4.46E+02	6.85E-02	8.46E-06	1.69E+02	3.22E-01	7.88E-03	25	409.3	617.2	8,501	**2.5E-06**	1.0E+00	1.06E+02			
100425	Styrene	4.46E+02	7.11E-02	8.78E-06	3.10E+02	1.12E-01	2.75E-03	25	418.3	636.0	8,737	0.0E+00	**9.0E-01**	1.04E+02			
100447	Benzylchloride	4.46E+02	6.34E-02	8.81E-06	5.25E+02	1.68E-02	4.12E-04	25	452.0	685.0	8,773	**4.9E-05**	1.0E-03	1.27E+02	X		
100527	Benzaldehyde	1.11E+01	7.44E-02	9.46E-06	6.95E+03	1.09E-03	2.67E-05	25	452.0	695.0	11,658	0.0E+00	3.5E-01	1.06E+02		X	
103651	n-Propylbenzene	8.13E+02	6.02E-02	7.83E-06	5.22E+01	4.29E-01	1.05E-02	25	432.2	630.0	9,123	0.0E+00	1.0E+00	1.20E+02			
104518	n-Butylbenzene	1.48E+03	5.28E-02	7.33E-06	1.18E+01	6.50E-01	1.59E-02	25	456.5	660.5	9,290	0.0E+00	1.8E-01	1.34E+02		X	
106423	p-Xylene	3.75E+02	6.82E-02	8.42E-06	1.62E+02	2.82E-01	6.90E-03	25	411.5	616.2	8,525	0.0E+00	1.0E-01	1.06E+02			
106467	1,4-Dichlorobenzene	3.75E+02	5.50E-02	8.68E-06	8.13E+01	9.85E-02	2.41E-03	25	447.2	684.8	9,271	**1.1E-05**	**8.0E-01**	1.47E+02			
106898	Epichlorohydrin	9.91E+00	8.89E-02	1.11E-05	6.59E+04	1.24E-03	3.04E-05	25	390.0	600.0	10	**2.3E-05**	1.0E-03	9.25E+01			
106934	1,2-Dibromoethane (ethylene dibromide)	3.96E+01	4.30E-02	1.04E-05	3.91E+03	2.66E-02	6.50E-04	25	404.6	583.0	8,310	6.0E-04	**8.0E-04**	1.88E+02			
106990	1,3-Butadiene	3.96E+01	1.00E-01	1.03E-05	7.35E+02	3.01E+00	7.36E-02	25	268.6	425.0	5,370	**1.7E-04**	**2.0E-03**	5.41E+01			
107028	Acrolein	1.00E+00	1.12E-01	1.22E-05	2.12E+05	4.99E-03	1.22E-04	25	325.6	506.0	6,731	0.0E+00	2.0E-05	5.61E+01			
107062	1,2-Dichloroethane	3.96E+01	8.57E-02	1.10E-05	8.60E+03	4.82E-02	1.18E-03	25	356.7	561.0	7,643	2.6E-05	7.0E-03	9.90E+01			
107131	Acrylonitrile	8.51E+00	1.14E-01	1.23E-05	7.45E+04	5.64E-03	1.38E-04	25	350.3	519.0	7,786	**2.9E-04**	2.0E-03	5.31E+01			
108054	Vinyl acetate	5.58E+00	8.49E-02	1.00E-05	2.00E+04	2.09E-02	5.11E-04	25	345.7	519.1	7,800	0.0E+00	**2.0E-01**	8.61E+01			
108101	Methylisobutylketone (4-methyl-2-pentar	1.26E+01	6.98E-02	8.35E-06	1.90E+04	5.64E-03	1.38E-04	25	389.5	571.0	8,243	0.0E+00	3.0E+00	1.00E+02			y
108203	Diisopropyl ether (DIPE)	2.28E+01	6.54E-02	7.76E-06	8.80E+03	7.76E-06	2.56E-03	25	341.5	499.9	6,950	0.0E+00	7.0E-01	1.02E+02			
108383	m-Xylene	3.75E+02	6.84E-02	8.44E-06	1.61E+02	2.94E-01	7.18E-03	25	412.3	617.1	8,523	0.0E+00	1.0E-01	1.06E+02			
108601	bis(2-Chloroisopropyl)ether	8.29E+01	3.99E-02	7.36E-06	1.70E+03	3.03E-03	7.42E-05	25	460.0	690.0	9,695	1.0E-05	1.4E-01	1.71E+02		X	
108678	1,3,5-Trimethylbenzene	6.02E+02	6.02E-02	7.84E-06	4.82E+01	3.59E-01	8.77E-03	25	437.9	637.3	9,321	0.0E+00	6.0E-02	1.20E+02		X	
108872	Methylcyclohexane	7.85E+01	7.35E-02	8.52E-06	1.40E+01	4.22E+00	1.03E-01	25	373.9	572.2	7,474	0.0E+00	7.0E-01	9.82E+01			y
108883	Toluene	2.34E+02	7.78E-02	9.20E-06	5.26E+02	2.71E-01	6.64E-03	25	383.8	591.8	7,930	0.0E+00	**3.0E-01**	9.21E+01			
108907	Chlorobenzene	2.34E+02	7.21E-02	9.48E-06	4.98E+02	1.27E-01	3.11E-03	25	404.9	632.4	8,410	0.0E+00	5.0E-02	1.13E+02			
109660	Pentane, n-	7.22E+01	8.21E-02	8.80E-06	3.80E+01	5.11E+01	1.25E+00	25	309.0	469.7	6,155	0.0E+00	1.0E+00	7.22E+01			
109693	1-Chlorobutane	7.22E+01	7.84E-02	9.33E-06	1.10E+03	6.83E-01	1.67E-02	25	351.6	542.0	7,263	0.0E+00	1.4E-01	9.26E+01		X	
109999	Tetrahydrofuran	1.08E+01	9.54E-02	1.08E-05	1.00E+06	2.88E-03	7.05E-05	25	339.0	541.0	7,074	0.0E+00	2.0E+00	7.21E+01			y
110009	Furan	8.00E+01	1.03E-01	1.17E-05	1.00E+04	2.21E-01	5.40E-03	25	304.6	490.2	6,477	0.0E+00	3.5E-03	6.81E+01		X	y
110543	Hexane	1.32E+02	7.31E-02	8.17E-06	9.50E+00	7.36E+01	1.80E+00	25	341.7	508.0	6,895	0.0E+00	7.0E-01	8.62E+01			
110827	Cyclohexane	1.46E+02	8.00E-02	9.11E-06	5.50E+01	6.13E+00	1.50E-01	25	353.7	553.4	7,154	0.0E+00	6.0E+00	8.42E+01			
111444	Bis(2-chloroethyl)ether	3.22E+01	5.67E-02	8.71E-06	1.72E+04	6.95E-04	1.70E-05	25	451.2	659.8	10,803	**7.1E-04**	0.0E+00	1.43E+02			
115297	Endosulfan	6.76E+03	2.25E-02	5.76E-06	3.25E-01	2.66E-03	6.50E-05	25	674.4	942.9	14,000	0.0E+00	2.1E-02	4.07E+02		X	
118741	Hexachlorobenzene	6.20E+03	2.90E-02	7.85E-06	6.20E-03	6.95E-02	1.70E-03	25	582.6	825.0	14,447	**5.1E-04**	2.8E-03	2.85E+02		X	
120821	1,2,4-Trichlorobenzene	1.36E+03	3.96E-02	8.40E-06	4.90E+01	5.81E-02	1.42E-03	25	486.2	725.0	10,471	0.0E+00	2.0E-03	1.81E+02			
123739	Crotonaldehyde (2-butenal)	1.79E+00	9.56E-02	1.08E-05	1.50E+05	7.93E-04	1.94E-05	25	375.2	568.0	9	5.4E-04	0.0E+00	7.01E+01	X		
123911	1,4-Dioxane	2.63E+00	8.74E-02	1.05E-05	1.00E+06	1.96E-04	4.80E-06	25	374.3	587.2	8,164	**7.7E-06**	3.0E-02	8.81E+01			
124481	Dibromochloromethane	3.18E+01	3.66E-02	1.06E-05	2.70E+03	3.20E-02	7.83E-04	25	416.1	678.2	5,900	**2.7E-05**	7.0E-02	2.08E+02		X	
126987	Methacrylonitrile	1.31E+01	9.64E-02	1.06E-05	2.54E+04	1.01E-02	2.47E-04	25	363.3	554.0	7,600	0.0E+00	3.0E-02	6.71E+01			
126998	2-Chloro-1,3-butadiene (chloroprene)	6.07E+01	8.42E-02	1.00E-05	8.37E+02	2.29E+00	5.61E-02	25	332.4	525.0	8,075	3.0E-04	2.0E-02	8.85E+01			
127184	Tetrachloroethylene	9.49E+01	5.05E-02	9.46E-06	2.06E+02	7.24E-01	1.77E-02	25	394.4	620.2	8,288	**6.1E-06**	**4.0E-02**	1.66E+02			
129000	Pyrene	5.43E+04	2.78E-02	7.25E-06	1.35E-01	4.87E-04	1.19E-05	25	668.0	936.0	14,370	0.0E+00	1.1E-01	2.02E+02		X	
132649	Dibenzofuran	9.16E+03	4.11E-02	7.38E-06	3.10E+00	8.71E-03	2.13E-04	25	560.0	824.0	66,400	0.0E+00	3.5E-03	1.68E+02		X	
135988	sec-Butylbenzene	1.33E+03	5.28E-02	7.34E-06	1.76E+01	7.20E-01	1.76E-02	25	446.5	679.0	88,730	0.0E+00	4.0E-01	1.34E+02			
141786	Ethylacetate	5.58E+00	8.23E-02	9.70E-06	8.00E+04	5.48E-03	1.34E-04	25	350.3	523.3	7,634	0.0E+00	7.0E-02	8.81E+01			
142289	1,3-Dichloropropane	7.22E+01	7.39E-02	9.82E-06	2.75E+03	3.99E-02	9.76E-04	25	393.9	590.9	8,103	0.0E+00	7.0E-02	1.13E+02		X	
142825	Heptane	**2.40E+02**	**6.49E-02**	**7.59E-06**	**3.40E+00**	**8.18E+01**	**2.00E+00**	25	341.7	508.0	6,895	0.0E+00	4.0E-01	8.62E+01			
156592	cis-1,2-Dichloroethylene	3.96E+01	8.84E-02	1.13E-05	6.41E+03	1.67E-01	4.08E-03	25	333.7	544.0	7,192	0.0E+00	8.0E-03	9.69E+01		X	
156605	trans-1,2-Dichloroethylene	3.96E+01	8.76E-02	1.12E-05	4.52E+03	1.67E-01	4.08E-03	25	320.9	516.5	6,717	0.0E+00	8.0E-02	9.69E+01			
205992	Benzo(b)fluoranthene	5.99E+05	4.76E-02	5.56E-06	1.50E-03	2.69E-05	6.57E-07	25	715.9	969.3	17,000	**1.1E-04**	0.0E+00	2.52E+02			
218019	Chrysene	1.81E+05	2.61E-02	6.75E-06	2.00E-03	2.14E-04	5.23E-06	25	714.2	979.0	16,455	**1.1E-05**	0.0E+00	2.28E+02			
309002	Aldrin	8.20E+04	3.72E-02	4.35E-06	1.70E-02	1.80E-03	4.40E-05	25	603.0	839.4	15,000	**4.9E-03**	1.1E-04	3.65E+02		X	
319846	alpha-HCH (alpha-BHC)	2.81E+03	4.33E-02	5.06E-06	2.00E+00	2.10E-04	5.14E-06	25	596.6	839.4	15,000	1.8E-03	0.0E+00	2.91E+02			
541731	1,3-Dichlorobenzene	3.79E+02	5.56E-02	8.80E-06	1.19E+02	8.85E-02	2.17E-03	25	446.0	684.0	9,230	0.0E+00	1.1E-01	1.47E+02		X	y
542756	1,3-Dichloropropene	7.22E+01	7.63E-02	1.01E-05	2.80E+03	1.45E-01	3.55E-03	25	381.2	587.4	7,900	**1.6E-05**	2.0E-02	1.11E+02			
542881	bis(Chloromethyl)ether	9.70E+00	7.63E-02	1.04E-05	2.20E+04	1.78E-01	4.36E-03	25	379.0	568.5	7,910	6.2E-02	0.0E+00	1.15E+02			y
622968	4-Ethyltoluene	3.83E+02	6.89E-02	8.53E-06	1.78E+02	2.12E-01	5.18E-03	25	417.6	630.3	8,661	0.0E+00	1.0E-01	1.06E+02			
630206	1,1,1,2-Tetrachloroethane	8.60E+01	4.82E-02	9.10E-06	1.07E+03	1.02E-01	2.50E-03	25	403.5	624.0	9,768	7.4E-06	1.1E-01	1.68E+02		X	
924163	N-Nitroso-di-n-butylamine	9.15E+02	6.49E-02	7.59E-06	1.27E+03	5.40E-04	1.32E-05	25	389.0	583.5	11,200	**3.1E-03**	0.0E+00	1.58E+02			
1634044	MTBE (methyl-*tert*-butyl ether)	1.16E+01	7.53E-02	8.59E-06	5.10E+04	2.40E-02	5.87E-04	25	328.3	497.1	6,678	**2.6E-07**	3.0E+00	8.82E+01			
7439976	Mercury (elemental)	5.20E+01	3.07E-02	6.30E-06	6.00E-02	4.67E-01	1.14E-02	25	629.9	1750.0	14,127	0.0E+00	**3.0E-05**	2.01E+02			
123456789	TBD	5.20E+01	3.07E-02	6.30E-06	6.00E-02	4.67E-01	1.14E-02	25	629.9	1,750.0	14,127	0.0E+00	**1.0E+02**	2.01E+02			