



**CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL (DTSC)  
HUMAN AND ECOLOGICAL RISK OFFICE (HERO)**

**HUMAN HEALTH RISK ASSESSMENT (HHRA) NOTE**

**HERO HHRA NOTE NUMBER: 3, DTSC-modified Screening Levels (DTSC-SLs)**

**RELEASE DATE: October 2015**

**ISSUE:** DTSC has developed modified screening levels based on the U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for use in the human health risk assessment process at hazardous waste sites and permitted facilities. HHRA Note 3 is periodically updated and users should always check the DTSC website for the most recent versions, including other HHRA Notes.<sup>a</sup>

**SUMMARY**

In 2008, the USEPA released RSLs to replace the Preliminary Remediation Goals (PRGs) formerly available from several USEPA Regional Headquarters. HERO reviewed the differences in methodology and RSL concentrations to develop a methodology to incorporate the RSLs into HERO human health risk assessment consultation and review. In addition to incorporation of more recent toxicity values than those used in the USEPA Region 9 PRGs, several differences in methodology resulted in a subset of RSLs substantially higher (less protective) than the original PRGs. HERO's review to-date had been conducted in two phases: Phase I (soil and tap water screening levels) and Phase II (ambient air screening levels). Initial versions of HHRA Note 3 (November 2009; May 2011) addressed a Phase I review only. A Phase II review was incorporated into the 21 May 2013 iteration of HHRA Note 3, and an additional update released 14 July 2014. In May 2015, a version of HHRA Note 3 was released incorporating review of the May 2014 through January 2015 releases of the RSL tables for soil, tap water, and ambient air.

The present revision of HHRA Note 3 incorporates HERO recommendations based on review of the June 2015 and June 2015 (revised) releases of the RSL tables. This HHRA Note 3 also includes updates consistent with the 6 February 2014 USEPA memorandum "*Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors*" and that memo's subsequent incorporation into the

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<sup>a</sup> <https://www.dtsc.ca.gov/assessingrisk/humanrisk2.cfm>

30 September 2014 update to HERO HHRA Note 1. Slight revisions to the February 2014 USEPA memorandum were released in June 2015, concurrent with the June 2015 RSL releases; these revisions were not incorporated into this HHRA Note 3 revision. HHRA Note 3 remains consistent with the exposure factors of the September 2014 HHRA Note 1. For the majority of the approximately 800 listed chemicals, HERO recommends the values listed in the USEPA RSL tables. However some values listed in the USEPA RSL tables differ significantly (greater than three-fold less protective) from values calculated using CalEPA toxicity criteria and risk assessment procedures.

In an effort to provide screening-level recommendations for California sites and facilities, HERO has prepared reference Tables 1, 2, and 3, respectively, for compounds with soil, tap water, or ambient-air screening levels for which the DTSC-modified screening levels (DTSC-SLs) should be used. In addition, specific recommendations and discussions are provided for several contaminants. Alternatively, in consultation with HERO, the USEPA on-line screening calculator can be used to calculate site-specific values using the more protective of CalEPA and USEPA toxicity values and applying assumptions consistent with HERO recommendations (e.g. route-to-route extrapolation between the oral and inhalation exposure pathways where no toxicity value is available for the inhalation route of exposure but an oral toxicity value is available).

HERO's development of DTSC-SLs for ambient air (Table 3) included route extrapolation for all chemicals lacking an inhalation toxicity value but which are identified as volatile by the USEPA RSL methodology,<sup>b</sup> by DTSC's vapor intrusion guidance, or by DTSC's screening models for vapor intrusion. In order to achieve agreement with DTSC's vapor intrusion guidance and to reflect the more direct exposure pathway for indoor air, a three-fold difference *is not* utilized for volatile compounds; instead, the DTSC-SLs listed in Table 3 are more stringent than the corresponding USEPA RSL by any degree. Oral toxicity values are much more abundant based on the USEPA Superfund hierarchy of sources than from California agency sources. Consequently, for compounds without an inhalation toxicity criteria, most extrapolations to derive DTSC-SLs for ambient air are based on the USEPA toxicity criteria. Toxicity values and sources are provided in Tables 1, 2, or 3 for those compounds with a recommended DTSC-SL.

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<sup>b</sup> In the June 2015 releases of the RSL tables, USEPA included a supplemental defining characteristics of volatile compounds. A long-standing criterion was a compound with a Henry's law constant greater than  $1 \times 10^{-5}$  (atmosphere-cubic meter) per mole; the supplemental criterion is a vapor pressure in excess of 1 millimeter of mercury. This criterion adds approximately 100 chemicals into the class of volatile chemicals.

## WHAT'S NEW

- As a continuation of previous iterations of HHRA Note 3, HERO has reviewed the RSL table updates through June 2015, as well as other relevant information including updated CalEPA criteria. This revised HHRA Note 3 incorporates our updated recommendations for use of screening levels, current as of August 2015.
- Changes from the May 2015 HHRA Note 3 include: removal of an oral slope factor for nickel compounds; correction of the gastrointestinal absorption factors for beryllium and beryllium sulfate, display of gastrointestinal absorption factors on dermal worksheets for soil and tap water; correction of the toxicity factors for Aroclor 1016, and re-classification as volatile for approximately 100 RSL analytes (as per the June 2015 USEPA RSL releases).
- Beginning in June 2013, USEPA now also releases a subset of the tables based on a target hazard quotient (HQ) equal to 0.1. HHRA Note 3 recommendations are based on a target HQ of 1 and, in general, HERO does not recommend use of screening levels based on a target HQ of 0.1. Instead, screening levels based on a target HQ of 1 should be used, and cumulative noncancer hazard should be summed across all site-related contaminants, media, and exposure pathways.
- Calculations for compounds identified as having a mutagenic mode of action (MMA) utilized age-dependent adjustment factors (ADAFs) in accordance with the methods employed by the USEPA in their RSL tables. Trichloroethene (TCE) was evaluated using the combined MMA and non-mutagen approaches as developed in the USEPA RSL methodology. Vinyl chloride was evaluated using the same vinyl-chloride-specific methodology used in the USEPA RSL tables, although the vinyl chloride methodology may be under review.
- As discussed previously, DTSC-SLs for soil and tap water are now calculated when they are more stringent by three fold than the corresponding USEPA RSLs. Previously they were calculated when the difference was four fold. A three-fold difference is more reflective of a logarithmic scale.
- Ambient-air screening levels for volatile compounds are listed when the DTSC-SL for ambient air is more stringent than the corresponding USEPA RSL value, by any degree.

- In previous versions of HHRA Note 3, HERO calculated screening levels for cadmium, beryllium, and beryllium sulfate in soil. For consistency with DTSC’s HHRA Note 1 and the Interim Final – Revised October 2013 Preliminary Endangerment Assessment (PEA) Guidance Manual, the DTSC-SLs have been calculated herein using DTSC’s default dermal exposure parameters and assuming a gastrointestinal absorption fraction (GIABS) of 1.<sup>c</sup> The DTSC-SLs for cadmium in soil based on noncancer endpoints are now 5.2 mg/kg and 7.3 mg/kg for residential and industrial land use scenarios, respectively. HERO’s review of relevant information for cadmium is ongoing and based on newer data and potential updates to cadmium toxicity criteria; we plan to derive updated DTSC-modified screening levels for soil in the future. Please consult with the DTSC toxicologist for sites where cadmium is a site-related contaminant in soil or water for the current status of the re-evaluation. The DTSC-SLs for noncancer endpoints for beryllium are 15 mg/kg and 220 mg/kg for residential and industrial land use scenarios, respectively. The DTSC-SLs for the cancer endpoint for beryllium sulfate are 4.4 mg/kg and 19 mg/kg for residential and industrial land use scenarios, respectively.
- USEPA incorporates a relative bioavailability factor into the RSL calculations for ingestion of soil-borne arsenic. HERO’s review of relevant bioavailability information for arsenic is ongoing. HERO currently does not include a bioavailability adjustment to the DTSC-SL for arsenic in soil but HERO does plan to derive a relative bioavailability factor based on California-specific information. If arsenic is a site-related contaminant in soil, please consult with a DTSC toxicologist for the current recommendations on arsenic bioavailability. Note that risk-based screening-level concentrations of arsenic in soil can be below naturally occurring (background) concentrations. Consequently, HERO strongly recommends consideration of site-specific background concentrations of inorganic constituents.

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<sup>c</sup> [https://www.dtsc.ca.gov/PublicationsForms/upload/PEA\\_Guidance\\_Manual.pdf](https://www.dtsc.ca.gov/PublicationsForms/upload/PEA_Guidance_Manual.pdf)

## BACKGROUND

HERO has a long history of working with the USEPA Region 9 office to integrate California-specific risk assessment concerns into the Preliminary Remediation Goal (PRG) listing and the PRG-screening risk assessment process. One example of the collaboration was the inclusion of ‘Cal-modified’ values into the USEPA Region 9 PRG list. When the USEPA Region 9 PRG was greater by a factor of 4 or more than the value which would have been obtained with the corresponding California-specific toxicity value, USEPA Region 9 added a ‘Cal-modified’ PRG to the PRG list based on California-specific cancer toxicity values. (Please note the previous bulleted item regarding the three-fold difference currently used to derive the DTSC-SLs, to better align with log-scale differences.)

In 2008, USEPA released a single set of RSL tables for national use and which replaced the USEPA Region 9 PRGs (including elimination of the Cal-modified values). Since then, new USEPA RSLs have been released on a biennial basis (Spring and Fall), and have included substantial modifications to the RSL methodology and toxicity value updates. Specific details of changes in the USEPA RSL methodology are documented in the “What’s New” webpage section of the USEPA website.<sup>d</sup>

HERO continues the ongoing process of reviewing new values and methodologies, and their application in screening risk assessment. HERO generally has incorporated the USEPA RSL methodological changes, except as noted later in this text. For example, the dermal exposure pathway has been incorporated into the tap water RSL calculation. There now are approximately 800 elements, compounds and mixtures listed in the RSL tables posted as the June 2015 versions. DTSC-SLs are derived for 150 unique elements, compounds, and mixtures in this iteration of HHRA Note 3.

## USES OF RSLs and DTSC-SLs

For reference, Section 3.0 of the RSL Users Guide<sup>e</sup> lists the following uses for the USEPA RSLs:

*“These concentrations can be used for:*

- *Prioritizing multiple sites or operable units or areas of concern within a facility or exposure units*

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<sup>d</sup> [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/whatsnew.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/whatsnew.htm)

<sup>e</sup> [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/usersguide.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm)

- *Setting risk-based detection limits for contaminants of potential concern (COPCs)*
- *Focusing future site investigation and risk assessment efforts (e.g., selecting COPCs for the baseline risk assessment)*
- *Identifying contamination which may warrant cleanup*
- *Identifying sites, or portions of sites, which warrant no further action or investigation*
- *Initial cleanup goals when site-specific data are lacking”*

RSLs are NOT to be used to perform a human health Baseline Risk Assessment (BRA), but to assist in the tasks preceding a human health BRA.

In the past, the USEPA Region 9 PRGs had been used by HERO primarily at open, closing, and formerly-used Department of Defense (DoD) sites. Screening risk assessments at some non-military sites have in the past used different processes. However, the DTSC-SLs included in this report are being used, and are intended for use, at any DTSC site where DTSC had previously approved the use of PRGs, Cal-modified PRGs, or RSLs.

HHRA Note Number 4<sup>f</sup> provides the most recent guidance for screening risk assessments. In general, HERO recommends compliance with the “basic” approach and principles outlined in Note 4. This includes the provision that USEPA RSLs and DTSC-SLs are used for screening sites as a whole, not for “screening out” individual chemicals. Ratios of the concentration of a particular chemical in a medium (e.g. soil, water, or air) to its risk-based concentration are calculated and the ratio is summed across all chemicals and media to estimate a total risk and hazard for the site. Prior to making risk management decisions based on the results of such an evaluation, it is critical that limitations associated with the use of USEPA RSLs and DTSC-SLs be carefully noted and understood. For example, the derivation of the USEPA RSLs and DTSC-SLs did not include an evaluation of the intrusion of vapors from the subsurface to indoor air (see below for a more detailed discussion of exposure pathways). The intrusion of volatile compounds from soil or groundwater to indoor air is a potentially major exposure pathway and is receiving considerable attention in risk assessments. It is also important to understand that ecological receptors were not considered in the calculation of the USEPA RSLs and DTSC-SLs. The USEPA RSLs and DTSC-SLs apply only to human receptor exposure scenarios and are NOT necessarily protective of ecological receptors.

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<sup>f</sup> <http://www.dtsc.ca.gov/AssessingRisk/upload/HHRA-Note-4.pdf>

## CONCEPTUAL SITE MODEL AND INCLUDED EXPOSURE PATHWAYS

Before conducting a screening level human health risk assessment, development of a site-specific conceptual site model (CSM) or site exposure model is critical to ensure all appropriate receptors and exposure pathways are addressed by the chosen screening levels.

The risk-based residential and industrial soil screening levels consider several exposure pathways (ingestion, inhalation of particles and volatile chemicals, and dermal absorption) from each of three environmental media (soil, tap water, and ambient air).

The tap water screening levels are based on assumed domestic use of water via ingestion from drinking, inhalation of volatile chemicals generated during household use (e.g. showering, dish washing), and dermal exposure.

Although the soil and tap water screening levels account for many typical exposure pathways, they do not account for the following potential exposure pathways (for example, as discussed in the RSL User's Guide<sup>9</sup>):

- The residential and industrial soil RSLs do not account for exposure to indoor air vapors due to intrusion of subsurface soil gas emissions; ingestion via uptake of plants (home-grown fruits and vegetables), meat, or dairy products; or inhalation of particles (fugitive dust) generated by activities which elevate particulate emissions such as truck traffic and use of heavy equipment.
- Pathways not considered in the calculation of the tap water RSLs include subsurface vapor intrusion to indoor air from volatile compounds present in groundwater and transfer of contaminants in the water column to aquatic organisms or terrestrial plants with subsequent ingestion by humans. The RSL on-line calculator and User's Guide do however include equations which can be used to calculate screening level fish concentrations assuming human consumption of fish. These equations do not address impacts to fish; but rather, human consumption of fish which may be contaminated. The RSL on-line calculator and User's Guide also provides equations which can be used to evaluate recreational receptor exposures to soil/sediment and surface water.

If pathways not considered in the derivation of the soil and tap water screening levels are anticipated at the site (e.g. home-grown produce consumption), an RSL- or DTSC-SL-based screening level risk evaluation may significantly underestimate risk. In addition, if there are exposure scenarios other than residential and industrial land use, a

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<sup>9</sup> [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/usersguide.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm)

screening level risk evaluation using RSLs or DTSC-SLs may not be appropriate (e.g. sites in which trench workers may be exposed to shallow groundwater). In such cases, the evaluation of risk to human receptors at the site could proceed directly to the baseline human health risk assessment process. In other instances, the screening risk assessment may overestimate risk but in these cases, a baseline human health risk assessment will likely be necessary for site-specific risk-management decisions. For reference, HERO has compiled a summary of recommended exposure factors which may be used as default values in baseline human health risk assessments for California hazardous waste sites and permitted facilities, DTSC HHRA Note 1<sup>h</sup>, which is mostly consistent with the recent changes to the USEPA RSL methodology.

#### Additional Considerations Regarding Exposure for the Industrial Scenario

The tap water RSLs and DTSC SLs are calculated using residential land use assumptions. As such, these screening levels are not reflective of industrial exposures and may overestimate exposures via the water pathways (e.g., presuming ingestion exposure).

Evaluations using the industrial soil screening levels do not account for the following pathways: all exposures to groundwater (e.g., consumption as drinking water, vapor intrusion from ground water, or dermal contact); exposure via vapor intrusion to indoor air; exposure to contaminated surface water, and inhalation of particulates generated by activities which increase particulate levels such as truck traffic and use of heavy equipment. If these exposure pathways are significant at a site, screening risk assessment using soil screening levels is generally insufficient. In some cases it may be possible, with the cooperation of the DTSC toxicologist, to incorporate the risk from the vapor intrusion pathway into the screening risk assessment by adding the risk from this pathway into the risk estimated from the use of the soil screening levels.

#### **METHODOLOGY FOR THE DTSC-SLs**

The process for derivation of DTSC-SLs is based on the identical computational algorithms used to derive USEPA's RSLs. Procedurally, a series of spreadsheet worksheets were populated with the algorithms, exposure and toxicity factors, and analyte roster used in the USEPA RSL process. DTSC-derived values were compared to the USEPA values downloaded from the USEPA website. DTSC values matched the USEPA values for soil and tap water ingestion and inhalation exposures to tap water

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<sup>h</sup> [http://dtsc.ca.gov/AssessingRisk/upload/HHRA\\_Note1.pdf](http://dtsc.ca.gov/AssessingRisk/upload/HHRA_Note1.pdf)

and ambient air (for residential and commercial/industrial receptors). DTSC values for dermal and inhalation exposures to soil and tap water differed slightly from USEPA RSL values because of full-precision calculations of component variables in the DTSC spreadsheets versus truncated values and/or factor combinations in the USEPA calculations (e.g., USEPA's "resident soil dermal contact factor- age-adjusted (mg/kg), DSFadj") which result in slight rounding differences. Nevertheless, when rounded to two significant digits, the DTSC-computed values match the USEPA RSL values.

DTSC-SLs were derived by populating copies of the aforementioned spreadsheet workbooks with California exposure and toxicity factors, and DTSC-specific methods. California exposure factors are those listed in HHRA Note 1 and the PEA Guidance Manual, and many values match those used by USEPA. California toxicity factors were obtained from the CalEPA Office of Environmental Health Hazard Assessment (OEHHA) toxicity criteria database<sup>i</sup> and the OEHHA chronic inhalation and chronic oral reference exposure levels (RELs).<sup>j</sup> In consideration of evolving methods for mutagenic carcinogens and interagency consistency, the DTSC-SLs were derived consistent with the USEPA's methods, employing the age-dependent adjustment factors for mutagenic carcinogens and the unique exposure equations for vinyl chloride. Lastly and as discussed previously, for purposes of screening volatile compounds, HERO recommends the use of route extrapolation—converting an oral reference dose or slope factor to an inhalation reference concentration or unit-risk factor—when an inhalation-specific toxicity values is not available.

DTSC-SLs were calculated for the entire roster of RSL analytes. With the exception of air values for volatile compounds (noted previously), the final roster of DTSC-SLs includes only those analytes for which the combination of California-specific exposure and toxicity factors results in a soil or tap water DTSC-SL that is at least three times more stringent than the corresponding USEPA RSL value. Previous versions of HHRA Note 3 were based on a four-fold difference. In slight contrast, ambient-air screening levels for volatile compounds are listed when the DTSC-SL is more stringent than the corresponding RSL, regardless of degree.

## **SITE SCREENING – SOIL, TAP WATER, and AIR CONTAMINANTS**

As discussed previously, HERO had reviewed the soil, tap water, and air RSLs in a phased approach. The results presented herein in this version provide

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<sup>i</sup> <http://oehha.ca.gov/tcdb/index.asp>

<sup>j</sup> <http://www.oehha.ca.gov/air/allrels.html>

recommendations on the use of screening levels for all media, soil, tap water, and ambient air, under residential and industrial/commercial land uses.

Since May 2013, USEPA has provided new tables with target hazard quotients (THQ) of 1.0 and 0.1. The RSL website states that the rationale for using a THQ of 0.1 for screening is that if 10 chemicals were at a site and all narrowly passed a screening at THQ=1.0, the resulting total HI could actually be 10. In general, HERO does not recommend use of screening levels based on a THQ of 0.1. Instead, screening levels based on a target HQ of 1 should be used, and cumulative noncancer hazard should be summed across all site-related contaminants, media, and exposure pathways. All discussion below relies on screening levels based on a THQ of 1.

### Soil and Tap Water

While it is possible to use the USEPA website's on-line RSL calculator<sup>k</sup> and employ the California-recommended toxicity values for each exposure pathway, this would be a laborious process for DTSC managers and staff, Responsible Parties, and contractors. To address this difficulty, HERO has combined the USEPA RSL methodology and values with a DTSC-specific methodology and values for all compounds in the USEPA RSL roster. HERO then identified elements, compounds and mixtures in which the soil or tap water USEPA RSLs differed significantly (i.e. greater by a factor of 3-fold or more) from the DTSC-SLs. In most cases, the differences for both media were due to toxicity value sources or the use of extrapolation from the oral to the inhalation pathway.

Screening-level users should be aware that the soil-screening values are strictly risk-based. The DTSC-SLs and the tabular versions of the USEPA RSL tables do not consider physical limitations such as soil saturation (although relevant notations are provided in the USEPA RSL tables). For example, screening levels for some chemicals can exceed liquid saturation conditions (i.e., pure analyte in the soil pore space) or can exceed reasonable physical conditions in soil such as concentrations greater than 100,000 ppm (10% by weight or more). Multiple DTSC-SLs exceeded soil-saturation concentrations or a 10% by weight threshold and these are indicated in Table 1 by bold text (26 analytes) and italicizing (3 analytes), respectively. Note that the online USEPA RSL calculator has a user-selectable site-specific option to substitute saturation or threshold concentrations when the calculated RSL exceeds those physical limitations.

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<sup>k</sup> [http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)

The HERO recommendations outlined here (with the exception of the elements discussed in the following section) reflect that for the greater number of compounds listed in the USEPA RSL tables, the USEPA soil and tap water RSLs may be used for screening-level evaluation of California sites. It is also important to note that many of the compounds are volatile. If volatile compounds are present at a site, soil gas data are required to evaluate the vapor intrusion to indoor air pathway. This allows a more comprehensive evaluation because the soil and tap water screening levels do not consider the vapor intrusion pathway, which is often the risk driver.

### Air

Subsurface vapor intrusion to indoor air from volatile compounds in soil or groundwater is a potentially major exposure pathway. The air screening levels address residential and industrial ambient air exposure scenarios, and may be used for screening concentrations of volatile compounds in indoor air. The air screening levels for volatile compounds also have potential applications for screening soil gas data when used in concert with an appropriate attenuation factor as described in DTSC's 2011 *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (2011 VIG).<sup>1</sup> DTSC-recommended default attenuation factors for preliminary screening evaluations can be found in Table 2 of DTSC's 2011 VIG. For detailed recommendations on the vapor intrusion to indoor air pathway and evaluation of soil gas and indoor air data, please consult DTSC's 2011 VIG, or contact the DTSC site toxicologist to ensure appropriate use of air screening levels on a site-specific basis.

- To facilitate site screening, HERO herein provides recommendations on use of air screening levels for all compounds identified as volatile in the USEPA RSL tables, DTSC's VIG, or DTSC's screening models for vapor intrusion. HERO's derivation is based on a comparison of the inhalation toxicity criteria used to derive the USEPA's air RSLs relative to California toxicity criteria and HERO recommendations (e.g. route-to-route extrapolation). As noted previously, screening levels for volatile compounds in air are the more stringent of USEPA or DTSC screening values.
- One-hundred ten volatile compounds lacked inhalation toxicity criteria and HERO performed a route to route extrapolation based on oral-exposure toxicity values.

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<sup>1</sup> [http://www.dtsc.ca.gov/AssessingRisk/upload/Final\\_VIG\\_Oct\\_2011.pdf](http://www.dtsc.ca.gov/AssessingRisk/upload/Final_VIG_Oct_2011.pdf)

- For any constituent not identified by USEPA or DTSC as volatile, the DTSC site toxicologist should be consulted prior to using any air-based screening concentration.

## DISCUSSION AND RECOMMENDATIONS FOR SPECIFIC CONTAMINANTS

1. **Lead (Soil).** In 2007, CalEPA OEHHA developed a new toxicity evaluation of lead, replacing the 10 microgram per deciliter ( $\mu\text{g}/\text{dL}$ ) threshold blood lead concentration with a source-specific “benchmark change” of 1  $\mu\text{g}/\text{dL}$ .<sup>m</sup> One  $\mu\text{g}/\text{dL}$  is the estimated incremental increase in children’s blood lead that would reduce Intelligence Quotient (IQ) by up to 1 point. In light of the updated CalEPA lead toxicity criterion, as well as the need for revision to ensure that the model is adequately protective of women of child-bearing age, a new version of the DTSC LEAD RISK ASSESSMENT SPREADSHEET (LeadSpread 8; 2011) has been developed.<sup>n</sup>

Worksheets 1 and 2 of the LeadSpread 8 file include PRG90 calculations for residential and industrial land use scenarios, respectively. The PRG90s represent concentrations in soil that will result in a 90<sup>th</sup> percentile estimate of a 1 $\mu\text{g}/\text{dl}$  increase in blood lead in a child or the fetus of a pregnant adult worker. While DTSC has historically used the 99<sup>th</sup> percentile estimate of blood lead, HERO considers the 90<sup>th</sup> percentile of the distribution appropriate for use in evaluating lead exposures given that the target blood lead (PbB) level of concern was updated to the more recent health-protective criterion of 1  $\mu\text{g}/\text{dL}$ .

HERO implements the risk-based soil concentrations in a residential use (i.e., unrestricted use) scenario as an Exposure Point Concentration (EPC). A 95-percent upper confidence limit on the arithmetic mean (95% UCL) calculated to be 80 mg/kg or less for residential soil lead, or a 95% UCL of 320 mg/kg or less for industrial soil lead, would be protective of children and women of child-bearing ages, respectively. With regard to assessment of lead risk and evaluating cleanup options, if sufficient data are available, HERO recommends calculating the 95% UCL lead concentration for each exposure area. If individual samples exceed the PRG90, it would not mean that the exposure area itself is in exceedance of the PRG90 as long as the 95% UCL itself is below ~80 mg/kg for residential and ~320 mg/kg for industrial/commercial, assuming hot spots are not present. If “hot spots” (i.e., geographically collocated

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<sup>m</sup> [http://oehha.ca.gov/public\\_info/public/kids/pdf/PbHGV041307.pdf](http://oehha.ca.gov/public_info/public/kids/pdf/PbHGV041307.pdf)

<sup>n</sup> <http://www.dtsc.ca.gov/AssessingRisk/LeadSpread8.cfm>

areas of elevated concentration), or “outliers” (i.e., individual samples with elevated concentrations) are present, they must be addressed separately.

For initial site screening where data are insufficient to calculate a 95% UCL, comparison of the maximum detected concentration to the PRG90s would be appropriate. If individual sample results exceed the PRG90s, depending on site-specific conditions and sampling results, additional investigation, evaluation, and potentially remediation may be warranted to address concerns about lead exposure.

It is important to note that background exposures to lead, and media other than soil which may be impacted by lead are not considered in LeadSpread8. If lead is present at levels above background in media other than soil (e.g. water, air), or if the home grown produce pathway is anticipated at the site, please contact the HERO toxicologist. DTSC’s LeadSpread model has been recently revised and is also periodically updated; users should check the DTSC website for the latest version.<sup>9</sup>

2. **Cadmium (Soil)**. The cadmium soil and tap water RSLs based on noncancer effects were calculated using the USEPA Integrated Risk Information System (IRIS) oral reference dose (RfDo) for food (1 µg/kg-day) and water (0.5 µg/kg-day), respectively. However, the 2006 CalEPA OEHHA public health goal (PHG) for cadmium is based on a more health protective oral acceptable daily intake level than the current USEPA RfDo. Specifically, the acceptable daily dose (ADD) used by OEHHA to derive their PHG was 0.0063 µg/kg-day.

For residential scenarios, risk-based soil concentrations based on noncancer effects are generally calculated for the first six years of childhood based on an assumption that children have higher estimated exposure rates than adults because of factors such as a lower body weight and higher soil ingestion rate. For cadmium, HERO has reviewed the CalEPA OEHHA PHG document and, at this time, we consider a 26-year adult residential scenario appropriate for calculating a risk-based soil concentration to address noncancer effects. As discussed in the PHG document, cadmium accumulates rapidly in the kidney during the first decades of life and then approaches a plateau around age 40 to 50. The PHG is derived from a daily cadmium intake based on toxicokinetic studies in adults and assumes accumulation of cadmium over approximately 50 years. The no observed adverse effect level (NOAEL) identified by OEHHA is also based on a very sensitive indicator of renal toxicity, and the ADD incorporates an overall uncertainty factor of 50. First, an

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<sup>9</sup> <http://www.dtsc.ca.gov/assessingrisk/humanrisk2.cfm>

uncertainty factor of 5 was used to address sensitive individuals (principally uncertainties due to limited information on the toxicokinetics of cadmium, particularly in women). An additional uncertainty factor of 10 was used to address potential cancer risk due to oral exposure to cadmium since no oral studies were considered suitable for estimating the oral cancer potency for cadmium.

Applying the CalEPA ADD ( $6.3E-6$  mg/kg-day) and January 2015 RSL table inhalation RfC ( $1E-2$   $\mu\text{g}/\text{m}^3$ ; Source ATSDR) with a 26-year adult residential exposure scenario and DTSC default dermal exposure parameters (including GIABS=1), the DTSC-modified screening level for residential soil based on noncancer effects was calculated to be 6.8 mg/kg. The DTSC-modified screening level for industrial soil based on noncancer effects was calculated to be 7.3 mg/kg. Applying the CalEPA inhalation unit risk factor of  $4.2E-3$  per  $\mu\text{g}/\text{m}^3$ , the DTSC-modified screening levels for residential and industrial soil based on cancer are 910 mg/kg and 4000 mg/kg, respectively. Therefore, the noncancer-based values of 5.2 mg/kg and 7.3 mg/kg were selected as screening levels for residential and industrial soil, respectively.

Please note that the DTSC-modified soil screening levels presented herein are undergoing re-evaluation. Based on newer data and potential updates to cadmium toxicity criteria, HERO's review of relevant information for this contaminant is ongoing and we plan to derive updated DTSC-modified screening levels for soil in the future. At this time we have not derived tap water screening levels for cadmium, however, we may do so as part of a future revision. Please consult with the DTSC toxicologist for sites where cadmium is a site-related contaminant in soil or water to ensure an up-to-date analysis for site conditions.

- Beryllium and Beryllium Compounds (Soil)**. CalEPA toxicity criteria for beryllium differ from current USEPA values in some regards. For cancer, the USEPA and CalEPA's inhalation unit risk for beryllium and beryllium oxide are the same. However, CalEPA also has a separate inhalation unit risk specifically for beryllium sulfate ( $8.6E-1$  per  $\mu\text{g}/\text{m}^3$ ). For noncancer, the USEPA RfDo ( $2E-3$  mg/kg-day) is 10-fold higher than the noncancer toxicity criterion used by CalEPA OEHHA to derive the PHG for beryllium and beryllium compounds ( $2E-4$  mg/kg-day). The difference is based on agency differences in dose metrics and uncertainty adjustments applied to the same underlying primary research. In addition, the USEPA inhalation reference concentration (RfC) for beryllium and compounds ( $2E-2$   $\mu\text{g}/\text{m}^3$ ) is higher than the OEHHA chronic inhalation reference level (REL) for beryllium and compounds ( $7E-3$   $\mu\text{g}/\text{m}^3$ ) because OEHHA weighted the key study's critical effect as more severe than USEPA did for the same study.

For beryllium and compounds, applying the CalEPA OEHHA inhalation unit risk ( $2.4E-3$  per  $\mu\text{g}/\text{m}^3$ ), the RfDo-equivalent from the PHG document ( $2E-4$  mg/kg-day), the chronic REL ( $7E-3$   $\mu\text{g}/\text{m}^3$ ), and DTSC default dermal exposure parameters (including GIABS=1) the DTSC-modified screening levels for soil based on noncancer effects were calculated to be 15 mg/kg and 220 mg/kg for residential and industrial land use, respectively. For cancer, the DTSC-modified screening levels for beryllium and compounds in soil were calculated to be 1600 mg/kg and 6900 mg/kg under the residential and industrial land use scenarios, respectively.

For beryllium sulfate, applying the CalEPA inhalation unit risk ( $8.6E-1$  per  $\mu\text{g}/\text{m}^3$ ) results in DTSC-modified screening levels for soil based on cancer of 4.4 mg/kg and 19 mg/kg (residential and industrial land uses, respectively). For noncancer endpoints, the DTSC-modified screening levels for beryllium sulfate and beryllium and compounds in soil are identical since the only CalEPA criterion specific for beryllium sulfate is the inhalation unit risk. Similar to cadmium above, at this time we have not derived tap water screening levels for beryllium sulfate. Please consult with the DTSC toxicologist for sites where beryllium is a site-related contaminant in water.

4. **Arsenic (Soil)**. USEPA incorporates a relative bioavailability factor into the RSL calculations for screening level concentrations for ingestion of soil-borne arsenic (a dimensionless value of 0.6, in contrast to a default value of 1.0 for all other compounds). HERO's review of relevant bioavailability information for arsenic is ongoing. Based on this review, HERO plans to derive updated DTSC-modified screening levels for soil-borne arsenic based on California-specific bioavailability information. Please consult with the DTSC toxicologist for sites where soil-borne arsenic is a site-related contaminant for the current recommendations for arsenic bioavailability. Note that risk-based screening-level concentrations of arsenic in soil are often below naturally occurring (background) concentrations. Consequently, HERO strongly recommends consideration of site-specific background concentrations of inorganic constituents.

## TABULAR RESULTS

HERO has calculated DTSC-SLs for all compounds on the USEPA RSL roster and several additional analytes. However, not all DTSC-modified values for soil or tap water differ significantly from the USEPA-derived version (e.g., when identical or similar toxicity factors or exposure factors are used). Screening concentrations for air were derived for all volatile compounds, and a DTSC-SL is listed when the value is more stringent, by any degree, than the corresponding USEPA RSL value.

Supporting documentation presenting the computations for all screening-level analytes, using both the USEPA and DTSC-modified approaches, are provided in separate media-specific Appendices A through C (soil, tap water, and air, respectively). These are available for download from the DTSC website. These documentation files provide the exposure factors, exposure algorithms, toxicity values, and computed screening-level concentrations for soil, tap water, and ambient air, for exposures via ingestion, dermal contact, and inhalation.

Alternatively, the on-line screening calculator can be used to calculate site-specific values using the more protective of CalEPA or USEPA toxicity values, applying assumptions consistent with HERO recommendations (e.g. route-to-route extrapolation between the oral and inhalation exposure pathways where no toxicity value is available for the inhalation route of exposure but an oral toxicity value is available), and site-specific values agreed in consultation with HERO.

#### Table 1, Screening Levels for Soil

Table 1 presents DTSC-modified screening values for soil that are at least three-times more stringent than the corresponding USEPA value, and includes the corresponding toxicity factors. A Microsoft Excel® version of Table 1 is available for download from the DTSC website.

#### Table 2, Screening Levels for Tap Water

Table 2 presents DTSC-modified screening values for tap water that are at least three-times more stringent than the corresponding USEPA value, and includes the corresponding toxicity factors. A Microsoft Excel® version of Table 2 is available for download from the DTSC website.

#### Table 3, Screening Levels for Air

Table 3 presents DTSC-modified screening values for volatile analytes in ambient air that are more stringent than the corresponding USEPA RSL value, and includes the corresponding toxicity factors. A Microsoft Excel® version of Table 3 is available for download from the DTSC website.

#### Appendices A through C

Computational details for the derivation of screening levels are provided in Appendix A (soil), Appendix B (tap water), and Appendix C (ambient air). The appendices are provided as a separate file, available for download from the DTSC website.

Table 1. DTSC-Recommended Screening Levels for Soil<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value								Screening Levels for Residential Soil (mg/kg)		Screening Levels for Commercial/Industrial Soil (mg/kg)	
		Oral Slope Factor		Inhalation Unit Risk		Reference Dose - Oral		Reference Concentration		Cancer Endpoint	Noncancer Endpoint	Cancer Endpoint	Noncancer Endpoint
		SFo (mg/kg-d) <sup>-1</sup>	Source	IUR (µg/m <sup>3</sup> ) <sup>-1</sup>	Source	RfDo (mg/kg-d)	Source	RfC or REL (µg/m <sup>3</sup> )	Source	DTSC-SL	DTSC-SL	DTSC-SL	DTSC-SL
<b>USEPA RSL Analytes</b>													
Acrylamide	79-06-1	4.5E+00	OEHHA	1.3E-03	OEHHA	--	--	--	--	2.6E-02	--	4.2E-01	--
Acrylonitrile	107-13-1	1.0E+00	OEHHA	2.9E-04	OEHHA	--	--	--	--	6.8E-02	--	3.0E-01	--
Arsenic, Inorganic	7440-38-2	9.5E+00	OEHHA PHG	3.3E-03	OEHHA	3.5E-06	OEHHA	1.5E-02	OEHHA	6.7E-02	2.5E-01	2.8E-01	3.4E+00
Benzaldehyde	100-52-7	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	--	--	<b>3.0E+04</b>
Benzene	71-43-2	1.0E-01	OEHHA	2.9E-05	OEHHA	4.0E-03	IRIS	3.0E+00	OEHHA	3.3E-01	1.1E+01	1.4E+00	4.7E+01
Benzenethiol	108-98-5	--	--	--	--	1.0E-03	PPRTV	4.0E+00	Route	--	--	--	2.7E+02
Beryllium and compounds	7440-41-7	--	--	--	--	2.0E-04	OEHHA PHG	7.0E-03	OEHHA	--	1.5E+01	--	2.2E+02
Bromodichloromethane	75-27-4	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	2.8E+02	--	<b>1.3E+03</b>
Bromoform	75-25-2	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	--	--	<b>3.0E+03</b>
Butadiene, 1,3-	106-99-0	6.0E-01	OEHHA	1.7E-04	OEHHA	--	--	--	--	1.4E-02	--	6.2E-02	--
Butanol, N-	71-36-3	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	--	--	<b>3.7E+04</b>
Butylbenzene, n-	104-51-8	--	--	--	--	5.0E-02	PPRTV	2.0E+02	Route	--	<b>1.2E+03</b>	--	<b>6.4E+03</b>
Butylbenzene, sec-	135-98-8	--	--	--	--	1.0E-01	sPPRTV	4.0E+02	Route	--	<b>2.2E+03</b>	--	<b>1.2E+04</b>
Butylbenzene, tert-	98-06-6	--	--	--	--	1.0E-01	sPPRTV	4.0E+02	Route	--	<b>2.2E+03</b>	--	<b>1.2E+04</b>
Cadmium (Diet)	7440-43-9 (diet)	--	--	--	--	6.3E-06	OEHHA PHG	1.0E-02	ATSDR	--	5.2E+00	--	7.3E+00
Carbon Tetrachloride	56-23-5	1.5E-01	OEHHA	4.2E-05	OEHHA	--	--	--	--	9.9E-02	--	4.3E-01	--
Chlordane	12789-03-6	1.3E+00	OEHHA	3.4E-04	OEHHA	--	--	--	--	4.3E-01	--	1.7E+00	--
Chloro-2-methylaniline, 4-	95-69-2	2.7E-01	OEHHA	7.7E-05	OEHHA	--	--	--	--	--	--	7.0E+00	--
Chloroacetaldehyde, 2-	107-20-0	2.7E-01	sPPRTV	6.8E-05	Route	--	--	--	--	6.0E-01	--	2.7E+00	--
Chlorobutane, 1-	109-69-3	--	--	--	--	4.0E-02	PPRTV	1.6E+02	Route	--	2.7E+02	--	<b>1.2E+03</b>
Chlorotoluene, o-	95-49-8	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	4.8E+02	--	<b>2.6E+03</b>
Chlorotoluene, p-	106-43-4	--	--	--	--	2.0E-02	sPPRTV	8.0E+01	Route	--	<b>4.4E+02</b>	--	<b>2.3E+03</b>
Chromium(III), Insoluble Salts	16065-83-1	--	--	--	--	1.5E+00	IRIS	--	--	--	3.6E+04	--	2.7E+05
Crotonaldehyde, trans-	123-73-9	1.9E+00	HEAST	4.8E-04	Route	1.0E-03	PPRTV	4.0E+00	Route	8.7E-02	--	3.8E-01	2.6E+02
<b>Cyanides</b>													
~Cyanogen	460-19-5	--	--	--	--	1.0E-03	IRIS	4.0E+00	Route	--	--	--	1.5E+02
~Cyanogen Bromide	506-68-3	--	--	--	--	9.0E-02	IRIS	3.6E+02	Route	--	1.5E+03	--	7.5E+03
~Cyanogen Chloride	506-77-4	--	--	--	--	5.0E-02	IRIS	2.0E+02	Route	--	--	--	1.2E+04
Dibromobenzene, 1,3-	108-36-1	--	--	--	--	4.0E-04	sPPRTV	1.6E+00	Route	--	--	--	9.1E+01
Dibromobenzene, 1,4-	106-37-6	--	--	--	--	1.0E-02	IRIS	4.0E+01	Route	--	--	--	2.9E+03
Dibromochloromethane	124-48-1	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	4.7E+02	--	<b>2.5E+03</b>
Dibromoethane, 1,2-	106-93-4	--	--	--	--	9.0E-03	IRIS	8.0E-01	OEHHA	--	7.2E+00	--	3.1E+01
Dichlorobenzidine, 3,3'-	91-94-1	1.2E+00	OEHHA	3.4E-04	OEHHA	--	--	--	--	--	--	1.6E+00	--
Dichloroethane, 1,1-	75-34-3	--	--	--	--	2.0E-01	PPRTV	8.0E+02	Route	--	1.6E+03	--	<b>7.2E+03</b>
Dichloroethylene, 1,2-cis-	156-59-2	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	1.9E+01	--	8.6E+01
Dichloroethylene, 1,2-trans-	156-60-5	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	1.3E+02	--	6.0E+02
Dichloropropane, 1,3-	142-28-9	--	--	--	--	2.0E-02	PPRTV	8.0E+01	Route	--	4.2E+02	--	<b>2.2E+03</b>
Dichloropropene, 1,3-	542-75-6	9.1E-02	OEHHA	1.6E-05	OEHHA	--	--	--	--	5.8E-01	--	2.6E+00	--
Dimethylaniline, N,N-	121-69-7	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	--	--	7.5E+02
Epichlorohydrin	106-89-8	8.0E-02	OEHHA	2.3E-05	OEHHA	--	--	--	--	1.8E+00	--	8.2E+00	--
Ethyl Acrylate	140-88-5	4.8E-02	HEAST	1.2E-05	Route	--	--	--	--	1.4E+00	--	6.0E+00	--
Ethyl Chloride (Chloroethane)	75-00-3	4.7E-03	OEHHA NSRL	1.2E-06	Route	--	--	--	--	3.1E+00	--	1.3E+01	--
Ethyl Ether	60-29-7	--	--	--	--	2.0E-01	IRIS	8.0E+02	Route	--	2.3E+03	--	<b>1.1E+04</b>
<b>Furans</b>													
~Furan	110-00-9	--	--	--	--	1.0E-03	IRIS	4.0E+00	Route	--	9.6E+00	--	4.4E+01
Hexachlorobutadiene	87-68-3	--	--	--	--	1.0E-03	PPRTV	4.0E+00	Route	--	--	--	<b>1.6E+02</b>
Isobutyl Alcohol	78-83-1	--	--	--	--	3.0E-01	IRIS	1.2E+03	Route	--	--	--	<b>1.1E+05</b>
<b>Lead Compounds</b>													
~Lead subacetate	1335-32-6	3.8E-02	OEHHA	1.1E-05	OEHHA	--	--	--	--	1.4E+01	--	5.0E+01	--
~Tetraethyl Lead	78-00-2	--	--	--	--	1.0E-07	IRIS	4.0E-04	Route	--	7.3E-04	--	3.3E-03

Table 1. DTSC-Recommended Screening Levels for Soil<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value								Screening Levels for Residential Soil (mg/kg)		Screening Levels for Commercial/Industrial Soil (mg/kg)	
		Oral Slope Factor		Inhalation Unit Risk		Reference Dose - Oral		Reference Concentration		Cancer Endpoint	Noncancer Endpoint	Cancer Endpoint	Noncancer Endpoint
		SFo (mg/kg-d) <sup>-1</sup>	Source	IUR (µg/m <sup>3</sup> ) <sup>-1</sup>	Source	RfDo (mg/kg-d)	Source	RfC or REL (µg/m <sup>3</sup> )	Source	DTSC-SL	DTSC-SL	DTSC-SL	DTSC-SL
Mercury Compounds													
~Mercuric Chloride (and other Mercury salts)	7487-94-7	--	--	--	--	1.6E-04	OEHHA	3.0E-02	OEHHA	--	--	--	9.2E+01
~Mercury (elemental)	7439-97-6	--	--	--	--	1.6E-04	OEHHA	3.0E-02	OEHHA	--	8.9E-01	--	<b>3.9E+00</b>
Methyl Acetate	79-20-9	--	--	--	--	1.0E+00	sPPRTV	4.0E+03	Route	--	2.4E+04	--	<b>1.3E+05</b>
Methylene Chloride	75-09-2	1.4E-02	OEHHA	1.0E-06	OEHHA	--	--	--	--	1.9E+00	--	2.4E+01	--
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.5E+00	OEHHA	4.3E-04	OEHHA	--	--	--	--	7.8E-02	--	1.3E+00	--
Methylstyrene, Alpha-	98-83-9	--	--	--	--	7.0E-02	HEAST	2.8E+02	Route	--	--	--	<b>1.3E+04</b>
Mineral oils	8012-95-1	--	--	--	--	3.0E+00	PPRTV	1.2E+04	Route	--	<b>1.6E+04</b>	--	<b>7.2E+04</b>
Nickel Soluble Salts	7440-02-0	--	--	--	--	1.1E-02	OEHHA	1.4E-02	OEHHA	--	4.9E+02	--	4.3E+03
Pentachloroethane	76-01-7	9.0E-02	PPRTV	2.3E-05	Route	--	--	--	--	1.1E+00	--	4.6E+00	--
Phosphorus, White	7723-14-0	--	--	--	--	2.0E-05	IRIS	8.0E-02	Route	--	4.3E-01	--	2.2E+00
Phthalates													
~Dimethylterephthalate	120-61-6	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	--	--	2.9E+04
Tetrachloroethane, 1,1,1,2-	630-20-6	--	--	--	--	3.0E-02	IRIS	1.2E+02	Route	--	5.5E+02	--	<b>2.8E+03</b>
Tetrachloroethane, 1,1,2,2-	79-34-5	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	--	--	<b>4.4E+03</b>
Tetrachloroethylene	127-18-4	5.4E-01	OEHHA PHG	5.9E-06	OEHHA	--	--	--	--	6.0E-01	--	2.7E+00	--
Toluene	108-88-3	--	--	--	--	8.0E-02	IRIS	3.0E+02	OEHHA	--	<b>1.1E+03</b>	--	<b>5.4E+03</b>
Tri-n-butyltin	688-73-3	--	--	--	--	3.0E-04	PPRTV	1.2E+00	Route	--	3.6E+00	--	1.7E+01
Trichlorobenzene, 1,2,3-	87-61-6	--	--	--	--	8.0E-04	sPPRTV	3.2E+00	Route	--	--	--	3.1E+02
Trichloroethane, 1,1,1-	71-55-6	--	--	--	--	2.0E+00	IRIS	1.0E+03	OEHHA	--	<b>1.7E+03</b>	--	<b>7.3E+03</b>
Trichlorophenol, 2,4,6-	88-06-2	7.0E-02	OEHHA	2.0E-05	OEHHA	--	--	--	--	7.5E+00	--	2.7E+01	--
Trichloropropane, 1,1,2-	598-77-6	--	--	--	--	5.0E-03	IRIS	2.0E+01	Route	--	--	--	1.1E+03
Trichloropropane, 1,2,3-	96-18-4	3.0E+01	IRIS	7.5E-03	Route	--	--	--	--	1.5E-03	--	2.1E-02	--
Trimethylbenzene, 1,3,5-	108-67-8	--	--	--	--	1.0E-02	sPPRTV	4.0E+01	Route	--	<b>2.1E+02</b>	--	<b>1.1E+03</b>
Vanadium and Compounds	7440-62-2	--	--	--	--	5.0E-03	RSL	1.0E-01	ATSDR	--	--	--	1.6E+03
Vinyl Chloride	75-01-4	2.7E-01	OEHHA	7.8E-05	OEHHA	--	--	--	--	8.8E-03	--	1.5E-01	--
<b>Additional Analytes</b>													
Beryllium Sulfate	13510-49-1	--	--	8.6E-01	OEHHA	2.0E-04	OEHHA PHG	7.0E-03	OEHHA	4.4E+00	1.5E+01	1.9E+01	2.2E+02
Chloropropane, 2-	75-29-6	--	--	--	--	--	--	1.0E+02	DTSC J&E	--	1.3E+02	--	5.3E+02
Dichlorobenzene, 1,3-	541-73-1	--	--	--	--	3.0E-02	DTSC J&E	1.2E+02	Route	--	2.4E+02	--	1.1E+03
Methylcyclohexane	108-87-2	--	--	--	--	--	--	6.0E+03	Cyclohexane	--	5.5E+03	--	2.3E+04

<sup>a</sup> Summarized from Appendix A, Table A-1. Screening levels in the table are based on DTSC-modified factors and are at least three-times more stringent than the corresponding derived USEPA value based on USEPA factors; "--" = indicates that, if calculated, the DTSC-modified approach was not at least three-times more stringent than the USEPA Superfund approach OR that no value could be calculated.

**Bold values** indicate a concentration in excess of the soil saturation concentration  
*Italicized values* indicate a concentration in excess of 10% by weight (100,000 mg/kg)

(mg/kg-d)<sup>-1</sup> = per (milligram per kilogram--day)  
 (µg/m<sup>3</sup>)<sup>-1</sup> = per (microgram per cubic meter)  
 µg/m<sup>3</sup> = micrograms per cubic meter  
 ATSDR = Agency for Toxic Substances and Disease Registry  
 CAS# = Chemical Abstracts Service Registry Number  
 DTSC = California Department of Toxic Substances Control  
 HEAST = Health Effects Assessment Summary Tables  
 IRIS = USEPA's *Integrated Risk Information System*

IUR = inhalation unit-risk factor  
 J&E = Johnson and Etinger model for vapor intrusion  
 mg/kg = milligrams per kilogram  
 mg/kg-d = milligrams per kilogram--day  
 NSRL = no significant risk level  
 OEHHA = California Office of Environmental Health Hazard Assessment  
 PHG = Public Health Goal toxicity factor  
 PPRTV = provisional peer-reviewed toxicity value

RfC = reference concentration  
 REL = reference exposure level  
 RfDo = oral reference dose  
 Route = route extrapolation from an oral toxicity value to an inhalation toxicity value:  
 $IUR (\mu\text{g}/\text{m}^3)^{-1} = SFo (\text{mg}/\text{kg}\text{-day})^{-1} \times (1/80 \text{ kg}) \times 20 \text{ m}^3/\text{day} \times 0.001 \text{ mg}/\mu\text{g}$   
 $RfC (\mu\text{g}/\text{m}^3) = RfDo (\text{mg}/\text{kg}\text{-day}) \times 80 \text{ kg} \times (1 \text{ day}/20 \text{ m}^3) \times 1000 \mu\text{g}/\text{mg}$   
 RSL = USEPA Regional Screening Level  
 SFo = oral slope factor  
 SL = screening level  
 sPPRTV = screening-level PPRTV  
 USEPA = U.S. Environmental Protection Agency

Table 2. DTSC-Recommended Screening Levels for Tap Water<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value								Screening Levels for Tap Water (µg/L)	
		Oral Slope Factor		Inhalation Unit Risk		Reference Dose - Oral		Reference Concentration		Cancer Endpoint	Noncancer Endpoint
		SFO (mg/kg-d) <sup>-1</sup>	Source	IUR (µg/m <sup>3</sup> ) <sup>-1</sup>	Source	RfDo (mg/kg-d)	Source	RfC or REL (µg/m <sup>3</sup> )	Source	DTSC-SL	DTSC-SL
<b>USEPA RSL Analytes</b>											
Acetophenone	98-86-2	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	5.8E+02
Acrylamide	79-06-1	4.5E+00	OEHHA	1.3E-03	OEHHA	--	--	--	--	5.6E-03	--
Acrylonitrile	107-13-1	1.0E+00	OEHHA	2.9E-04	OEHHA	--	--	--	--	1.5E-02	--
Aldrin	309-00-2	--	--	--	--	3.0E-05	IRIS	1.2E-01	Route	--	1.8E-01
Arsenic, Inorganic	7440-38-2	9.5E+00	OEHHA PHG	3.3E-03	OEHHA	3.5E-06	OEHHA	1.5E-02	OEHHA	8.2E-03	7.0E-02
Benzaldehyde	100-52-7	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	5.8E+02
Benzene	71-43-2	1.0E-01	OEHHA	2.9E-05	OEHHA	4.0E-03	IRIS	3.0E+00	OEHHA	1.5E-01	5.7E+00
Benzenethiol	108-98-5	--	--	--	--	1.0E-03	PPRTV	4.0E+00	Route	--	5.6E+00
Beryllium and compounds	7440-41-7	--	--	--	--	2.0E-04	OEHHA PHG	7.0E-03	OEHHA	--	4.0E+00
Bis(2-chloro-1-methylethyl) ether	108-60-1	--	--	--	--	4.0E-02	IRIS	1.6E+02	Route	--	2.3E+02
Bromodichloromethane	75-27-4	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	1.2E+02
Bromoform	75-25-2	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	1.2E+02
Butanol, N-	71-36-3	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	5.9E+02
Butylbenzene, n-	104-51-8	--	--	--	--	5.0E-02	PPRTV	2.0E+02	Route	--	2.9E+02
Butylbenzene, sec-	135-98-8	--	--	--	--	1.0E-01	sPPRTV	4.0E+02	Route	--	5.9E+02
Carbon Tetrachloride	56-23-5	1.5E-01	OEHHA	4.2E-05	OEHHA	--	--	--	--	1.0E-01	--
Chloral Hydrate	302-17-0	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	5.9E+02
Chlordane	12789-03-6	1.3E+00	OEHHA	3.4E-04	OEHHA	--	--	--	--	1.3E-02	--
Chloroacetaldehyde, 2-	107-20-0	2.7E-01	sPPRTV	6.8E-05	Route	--	--	--	--	6.4E-02	--
Chloroethanol, 2-	107-07-3	--	--	--	--	2.0E-02	PPRTV	8.0E+01	Route	--	1.2E+02
Chlorophenol, 2-	95-57-8	--	--	--	--	5.0E-03	IRIS	2.0E+01	Route	--	2.9E+01
Crotonaldehyde, trans-	123-73-9	1.9E+00	HEAST	4.8E-04	Route	1.0E-03	PPRTV	4.0E+00	Route	9.1E-03	5.9E+00
<b>Cyanides</b>											
~Cyanogen	460-19-5	--	--	--	--	1.0E-03	IRIS	4.0E+00	Route	--	5.9E+00
~Cyanogen Bromide	506-68-3	--	--	--	--	9.0E-02	IRIS	3.6E+02	Route	--	5.3E+02
~Cyanogen Chloride	506-77-4	--	--	--	--	5.0E-02	IRIS	2.0E+02	Route	--	2.9E+02
~Thiocyanic Acid	463-56-9	--	--	--	--	2.0E-04	PPRTV	8.0E-01	Route	--	1.2E+00
Cyclohexylamine	108-91-8	--	--	--	--	2.0E-01	IRIS	8.0E+02	Route	--	1.2E+03
Dibromochloromethane	124-48-1	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	1.2E+02
Dibromoethane, 1,2-	106-93-4	--	--	--	--	9.0E-03	IRIS	8.0E-01	OEHHA	--	1.7E+00
Dichloroethane, 1,1-	75-34-3	--	--	--	--	2.0E-01	PPRTV	8.0E+02	Route	--	1.2E+03
Dichloroethylene, 1,2-cis-	156-59-2	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	1.2E+01
Dichloroethylene, 1,2-trans-	156-60-5	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	1.1E+02
Dichloropropane, 1,3-	142-28-9	--	--	--	--	2.0E-02	PPRTV	8.0E+01	Route	--	1.1E+02
Diethylformamide	617-84-5	--	--	--	--	1.0E-03	PPRTV	4.0E+00	Route	--	5.9E+00
Diisopropyl Methylphosphonate	1445-75-6	--	--	--	--	8.0E-02	IRIS	3.2E+02	Route	--	4.7E+02
Dimethylaniline, N,N-	121-69-7	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	1.1E+01
Dithiane, 1,4-	505-29-3	--	--	--	--	1.0E-02	IRIS	4.0E+01	Route	--	5.9E+01
Endosulfan	115-29-7	--	--	--	--	6.0E-03	IRIS	2.4E+01	Route	--	3.3E+01
Epichlorohydrin	106-89-8	8.0E-02	OEHHA	2.3E-05	OEHHA	--	--	--	--	1.9E-01	--
Ethyl Acrylate	140-88-5	4.8E-02	HEAST	1.2E-05	Route	--	--	--	--	3.6E-01	--
Ethyl Chloride (Chloroethane)	75-00-3	4.7E-03	OEHHA NSRL	1.2E-06	Route	--	--	--	--	3.7E+00	--
Ethyl Ether	60-29-7	--	--	--	--	2.0E-01	IRIS	8.0E+02	Route	--	1.2E+03
Ethylene Diamine	107-15-3	--	--	--	--	9.0E-02	PPRTV	3.6E+02	Route	--	5.3E+02
<b>Furans</b>											
~Furan	110-00-9	--	--	--	--	1.0E-03	IRIS	4.0E+00	Route	--	5.8E+00
Guanidine	113-00-8	--	--	--	--	1.0E-02	sPPRTV	4.0E+01	Route	--	5.9E+01
Hexabromobenzene	87-82-1	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	1.2E+01
Hexachlorobenzene	118-74-1	--	--	--	--	8.0E-04	IRIS	3.2E+00	Route	--	4.7E+00
Isobutyl Alcohol	78-83-1	--	--	--	--	3.0E-01	IRIS	1.2E+03	Route	--	1.8E+03
<b>Lead Compounds</b>											
~Lead subacetate	1335-32-6	3.8E-02	OEHHA	1.1E-05	OEHHA	--	--	--	--	2.1E+00	--
Merphos	150-50-5	--	--	--	--	3.0E-05	IRIS	1.2E-01	Route	--	1.8E-01
Methyl Acetate	79-20-9	--	--	--	--	1.0E+00	sPPRTV	4.0E+03	Route	--	5.9E+03
Methylene Chloride	75-09-2	1.4E-02	OEHHA	1.0E-06	OEHHA	--	--	--	--	9.3E-01	--
Methylene-bis(2-chloroaniline), 4,4'	101-14-4	1.5E+00	OEHHA	4.3E-04	OEHHA	--	--	--	--	1.0E-02	--

Table 2. DTSC-Recommended Screening Levels for Tap Water<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value								Screening Levels for Tap Water (µg/L)	
		Oral Slope Factor		Inhalation Unit Risk		Reference Dose - Oral		Reference Concentration		Cancer Endpoint	Noncancer Endpoint
		SFo (mg/kg-d) <sup>-1</sup>	Source	IUR (µg/m <sup>3</sup> ) <sup>-1</sup>	Source	RfDo (mg/kg-d)	Source	RfC or REL (µg/m <sup>3</sup> )	Source	DTSC-SL	DTSC-SL
Mineral oils	8012-95-1	--	--	--	--	3.0E+00	PPRTV	1.2E+04	Route	--	1.8E+04
Mirex	2385-85-5	--	--	--	--	2.0E-04	IRIS	8.0E-01	Route	--	1.2E+00
Naled	300-76-5	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	1.2E+01
Nitrotoluene, o-	88-72-2	2.2E-01	PPRTV	5.5E-05	Route	9.0E-04	PPRTV	3.6E+00	Route	7.7E-02	5.1E+00
Pentachloroethane	76-01-7	9.0E-02	PPRTV	2.3E-05	Route	--	--	--	--	1.8E-01	--
Perfluorobutane Sulfonate	375-73-5	--	--	--	--	2.0E-02	PPRTV	8.0E+01	Route	--	1.2E+02
Phosphorus, White	7723-14-0	--	--	--	--	2.0E-05	IRIS	8.0E-02	Route	--	1.2E-01
Phthalates											
~Dimethylterephthalate	120-61-6	--	--	--	--	1.0E-01	IRIS	4.0E+02	Route	--	5.8E+02
Polychlorinated Biphenyls (PCBs)											
~Aroclor 1016	12674-11-2	--	--	--	--	7.0E-05	IRIS	2.8E-01	Route	--	4.1E-01
~Aroclor 1254	11097-69-1	--	--	--	--	2.0E-05	IRIS	8.0E-02	Route	--	1.2E-01
~Aroclor 5460	11126-42-4	--	--	--	--	6.0E-04	sPPRTV	2.4E+00	Route	--	3.5E+00
Propargyl Alcohol	107-19-7	--	--	--	--	2.0E-03	IRIS	8.0E+00	Route	--	1.2E+01
Propylene Glycol Monoethyl Ether	1569-02-4	--	--	--	--	7.0E-01	HEAST	2.8E+03	Route	--	4.1E+03
Pyridine	110-86-1	--	--	--	--	1.0E-03	IRIS	4.0E+00	Route	--	5.9E+00
Tetrachloroethane, 1,1,2,2-	79-34-5	--	--	--	--	2.0E-02	IRIS	8.0E+01	Route	--	1.1E+02
Tetrachloroethylene	127-18-4	5.4E-01	OEHHA PHG	5.9E-06	OEHHA	--	--	--	--	8.3E-02	--
Thallium Acetate	563-68-8	--	--	--	--	6.0E-06	sPPRTV	2.4E-02	Route	--	3.5E-02
Trichloroethane, 1,1,1-	71-55-6	--	--	--	--	2.0E+00	IRIS	1.0E+03	OEHHA	--	2.0E+03
Trichlorophenol, 2,4,6-	88-06-2	7.0E-02	OEHHA	2.0E-05	OEHHA	--	--	--	--	6.3E-01	--
Trichloropropane, 1,1,2-	598-77-6	--	--	--	--	5.0E-03	IRIS	2.0E+01	Route	--	2.8E+01
Trichloropropane, 1,2,3-	96-18-4	3.0E+01	IRIS	7.5E-03	Route	--	--	--	--	2.0E-04	--
<b>Additional Analytes</b>											
Chloropropane, 2-	75-29-6	--	--	--	--	--	--	1.0E+02	DTSC J&E	--	2.1E+02
Dichlorobenzene, 1,3-	541-73-1	--	--	--	--	3.0E-02	DTSC J&E	1.2E+02	Route	--	1.8E+02
Methylcyclohexane	108-87-2	--	--	--	--	--	--	6.0E+03	Cyclohexane	--	1.3E+04

<sup>a</sup> Summarized from Appendix B, Table B-1. Screening levels in the table are based on DTSC-modified factors and are at least three-times more stringent than the corresponding derived USEPA value based on USEPA factors; "--" indicates that, if calculated, the DTSC-modified approach was not at least three-times more stringent than the USEPA Superfund approach OR that no value could be calculated.

(mg/kg-d)<sup>-1</sup> = per (milligram per kilogram--day)  
 (µg/m<sup>3</sup>)<sup>-1</sup> = per (microgram per cubic meter)  
 µg/L = micrograms per liter  
 µg/m<sup>3</sup> = micrograms per cubic meter  
 CAS# = Chemical Abstracts Service Registry Number  
 DTSC = California Department of Toxic Substances Control  
 HEAST = Health Effects Assessment Summary Tables  
 IRIS = USEPA's *Integrated Risk Information System*  
 IUR = inhalation unit-risk factor  
 J&E = Johnson and Etinger model for vapor intrusion  
 mg/kg-d = milligrams per kilogram--day  
 NSRL = no significant risk level  
 OEHHA = California Office of Environmental Health Hazard Assessment  
 PHG = Public Health Goal toxicity factor  
 PPRTV = provisional peer-reviewed toxicity value  
 RfC = reference concentration  
 REL = reference exposure level  
 RfDo = oral reference dose  
 Route = route extrapolation from an oral toxicity value to an inhalation toxicity value  
 $IUR (\mu\text{g}/\text{m}^3)^{-1} = SFo (\text{mg}/\text{kg}\text{-day})^{-1} \times (1/80 \text{ kg}) \times 20 \text{ m}^3/\text{day} \times 0.001 \text{ mg}/\mu\text{g}$   
 $RfC (\mu\text{g}/\text{m}^3) = RfDo (\text{mg}/\text{kg}\text{-day}) \times 80 \text{ kg} \times (1 \text{ day}/20 \text{ m}^3) \times 1000 \mu\text{g}/\text{mg}$   
 SFo = oral slope factor  
 SL = screening level  
 sPPRTV = screening-level PPRTV  
 USEPA = U.S. Environmental Protection Agency

Table 3. Screening Levels for Volatile Compounds in Ambient Air<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value				Screening Levels for Residential Air ( $\mu\text{g}/\text{m}^3$ )		Screening Levels for Commercial/Industrial Air ( $\mu\text{g}/\text{m}^3$ )	
		Inhalation Unit Risk, IUR ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Source	Reference Concentration, RFC or REL ( $\mu\text{g}/\text{m}^3$ )	Source	Cancer Endpoint	Noncancer Endpoint	Cancer Endpoint	Noncancer Endpoint
						DTSC-SL	DTSC-SL	DTSC-SL	DTSC-SL
<b>USEPA RSL Analytes</b>									
Acetaldehyde	75-07-0	2.7E-06	OEHHA	--	--	1.0E+00	--	4.5E+00	--
Acetophenone	98-86-2	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03
Acrylonitrile	107-13-1	2.9E-04	OEHHA	--	--	9.7E-03	--	4.2E-02	--
Aldrin	309-00-2	--	--	1.2E-01	Route	--	1.3E-01	--	5.3E-01
Benefin	1861-40-1	--	--	1.2E+03	Route	--	1.3E+03	--	5.3E+03
Benzaldehyde	100-52-7	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03
Benzene	71-43-2	2.9E-05	OEHHA	3.0E+00	OEHHA	9.7E-02	3.1E+00	4.2E-01	1.3E+01
Benzenethiol	108-98-5	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
Benzotrichloride	98-07-7	3.3E-03	Route	--	--	8.6E-04	--	3.8E-03	--
Biphenyl, 1,1'	92-52-4	2.0E-06	Route	--	--	1.4E+00	--	6.1E+00	--
Bis(2-chloro-1-methylethyl) ether	108-60-1	--	--	1.6E+02	Route	--	1.7E+02	--	7.0E+02
Bis(2-chloroethyl)ether	111-44-4	7.1E-04	OEHHA	--	--	4.0E-03	--	1.7E-02	--
Boron Trifluoride	7637-07-2	--	--	7.0E-01	HEAST	--	7.3E-01	--	3.1E+00
Bromodichloromethane	75-27-4	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Bromoform	75-25-2	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Bromophos	2104-96-3	--	--	2.0E+01	Route	--	2.1E+01	--	8.8E+01
Bromoxynil Octanoate	1689-99-2	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Butadiene, 1,3-	106-99-0	1.7E-04	OEHHA	--	--	1.7E-02	--	7.2E-02	--
Butanol, n-	71-36-3	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03
Butylate	2008-41-5	--	--	2.0E+02	Route	--	2.1E+02	--	8.8E+02
Butylbenzene, n-	104-51-8	--	--	2.0E+02	Route	--	2.1E+02	--	8.8E+02
Butylbenzene, sec-	135-98-8	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03
Butylbenzene, tert-	98-06-6	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03
Carbon Tetrachloride	56-23-5	4.2E-05	OEHHA	4.0E+01	OEHHA	6.7E-02	4.2E+01	2.9E-01	1.8E+02
Chloral Hydrate	302-17-0	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03
Chlordane	12789-03-6	3.4E-04	OEHHA	--	--	8.3E-03	--	3.6E-02	--
Chloroacetaldehyde, 2-	107-20-0	6.8E-05	Route	--	--	4.2E-02	--	1.8E-01	--
Chlorobutane, 1-	109-69-3	--	--	1.6E+02	Route	--	1.7E+02	--	7.0E+02
Chloroethanol, 2-	107-07-3	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Chlorophenol, 2-	95-57-8	--	--	2.0E+01	Route	--	2.1E+01	--	8.8E+01
Chlorotoluene, o-	95-49-8	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Chlorotoluene, p-	106-43-4	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Crotonaldehyde, trans-	123-73-9	4.8E-04	Route	4.0E+00	Route	5.9E-03	4.2E+00	2.6E-02	1.8E+01
<b>Cyanides</b>									
~Cyanogen	460-19-5	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
~Cyanogen Bromide	506-68-3	--	--	3.6E+02	Route	--	3.8E+02	--	1.6E+03
~Cyanogen Chloride	506-77-4	--	--	2.0E+02	Route	--	2.1E+02	--	8.8E+02
~Thiocyanic Acid	463-56-9	--	--	8.0E-01	Route	--	8.3E-01	--	3.5E+00
Cyclohexylamine	108-91-8	--	--	8.0E+02	Route	--	8.3E+02	--	3.5E+03
Dibenzothiophene	132-65-0	--	--	4.0E+01	Route	--	4.2E+01	--	1.8E+02
Dibromobenzene, 1,3-	108-36-1	--	--	1.6E+00	Route	--	1.7E+00	--	7.0E+00
Dibromobenzene, 1,4-	106-37-6	--	--	4.0E+01	Route	--	4.2E+01	--	1.8E+02
Dibromochloromethane	124-48-1	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Dibromoethane, 1,2-	106-93-4	--	--	8.0E-01	OEHHA	--	8.3E-01	--	3.5E+00
Dichloroethane, 1,1-	75-34-3	--	--	8.0E+02	Route	--	8.3E+02	--	3.5E+03
Dichloroethylene, 1,1-	75-35-4	--	--	7.0E+01	OEHHA	--	7.3E+01	--	3.1E+02
Dichloroethylene, 1,2-cis-	156-59-2	--	--	8.0E+00	Route	--	8.3E+00	--	3.5E+01
Dichloroethylene, 1,2-trans-	156-60-5	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Dichloropropane, 1,3-	142-28-9	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Dichloropropene, 1,3-	542-75-6	1.6E-05	OEHHA	--	--	1.8E-01	--	7.7E-01	--
Dieldrin	60-57-1	--	--	2.0E-01	Route	--	2.1E-01	--	8.8E-01
Diethylformamide	617-84-5	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01

Table 3. Screening Levels for Volatile Compounds in Ambient Air<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value				Screening Levels for Residential Air ( $\mu\text{g}/\text{m}^3$ )		Screening Levels for Commercial/Industrial Air ( $\mu\text{g}/\text{m}^3$ )	
		Inhalation Unit Risk, IUR ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Source	Reference Concentration, RFC or REL ( $\mu\text{g}/\text{m}^3$ )	Source	Cancer Endpoint	Noncancer Endpoint	Cancer Endpoint	Noncancer Endpoint
						DTSC-SL	DTSC-SL	DTSC-SL	DTSC-SL
Diisopropyl Methylphosphonate	1445-75-6	--	--	3.2E+02	Route	--	3.3E+02	--	1.4E+03
Dimethylaniline, N,N-	121-69-7	--	--	8.0E+00	Route	--	8.3E+00	--	3.5E+01
Dioxane, 1,4-	123-91-1	7.7E-06	OEHHA	--	--	3.6E-01	--	1.6E+00	--
Dithiane, 1,4-	505-29-3	--	--	4.0E+01	Route	--	4.2E+01	--	1.8E+02
EPTC	759-94-4	--	--	1.0E+02	Route	--	1.0E+02	--	4.4E+02
Endosulfan	115-29-7	--	--	2.4E+01	Route	--	2.5E+01	--	1.1E+02
Epichlorohydrin	106-89-8	2.3E-05	OEHHA	--	--	1.2E-01	--	5.3E-01	--
Ethoxyethanol, 2-	110-80-5	--	--	7.0E+01	OEHHA	--	7.3E+01	--	3.1E+02
Ethyl Acrylate	140-88-5	1.2E-05	Route	--	--	2.3E-01	--	1.0E+00	--
Ethyl Chloride (Chloroethane)	75-00-3	1.2E-06	Route	--	--	2.4E+00	--	1.0E+01	--
Ethyl Ether	60-29-7	--	--	8.0E+02	Route	--	8.3E+02	--	3.5E+03
Ethylene Diamine	107-15-3	--	--	3.6E+02	Route	--	3.8E+02	--	1.6E+03
Formaldehyde	50-00-0	--	--	9.0E+00	OEHHA	--	9.4E+00	--	3.9E+01
Furans									
~Dibenzofuran	132-64-9	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
~Furan	110-00-9	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
Guanidine	113-00-8	--	--	4.0E+01	Route	--	4.2E+01	--	1.8E+02
Heptachlor	76-44-8	--	--	2.0E+00	Route	--	2.1E+00	--	8.8E+00
Heptachlor Epoxide	1024-57-3	--	--	5.2E-02	Route	--	5.4E-02	--	2.3E-01
Hexabromobenzene	87-82-1	--	--	8.0E+00	Route	--	8.3E+00	--	3.5E+01
Hexachlorobenzene	118-74-1	5.1E-04	OEHHA	3.2E+00	Route	5.5E-03	3.3E+00	2.4E-02	1.4E+01
Hexachlorobutadiene	87-68-3	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
Hexachlorocyclohexane, Alpha-	319-84-6	--	--	3.2E+01	Route	--	3.3E+01	--	1.4E+02
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	--	--	1.2E+00	Route	--	1.3E+00	--	5.3E+00
Hydrogen Chloride	7647-01-0	--	--	9.0E+00	OEHHA	--	9.4E+00	--	3.9E+01
Isobutyl Alcohol	78-83-1	--	--	1.2E+03	Route	--	1.3E+03	--	5.3E+03
Isopropalin	33820-53-0	--	--	6.0E+01	Route	--	6.3E+01	--	2.6E+02
Lead Compounds									
~Tetraethyl Lead	78-00-2	--	--	4.0E-04	Route	--	4.2E-04	--	1.8E-03
Mercury Compounds									
~Mercury (elemental)	7439-97-6	--	--	3.0E-02	OEHHA	--	3.1E-02	--	1.3E-01
Merphos	150-50-5	--	--	1.2E-01	Route	--	1.3E-01	--	5.3E-01
Methanol	67-56-1	--	--	4.0E+03	OEHHA	--	4.2E+03	--	1.8E+04
Methoxychlor	72-43-5	--	--	2.0E+01	Route	--	2.1E+01	--	8.8E+01
Methyl Acetate	79-20-9	--	--	4.0E+03	Route	--	4.2E+03	--	1.8E+04
Methylene Chloride	75-09-2	1.0E-06	OEHHA	4.0E+02	OEHHA	1.0E+00	4.2E+02	1.2E+01	1.8E+03
Methylstyrene, Alpha-	98-83-9	--	--	2.8E+02	Route	--	2.9E+02	--	1.2E+03
Mineral oils	8012-95-1	--	--	1.2E+04	Route	--	1.3E+04	--	5.3E+04
Mirex	2385-85-5	--	--	8.0E-01	Route	--	8.3E-01	--	3.5E+00
Naled	300-76-5	--	--	8.0E+00	Route	--	8.3E+00	--	3.5E+01
Nitroso-di-N-butylamine, N-	924-16-3	3.1E-03	OEHHA	--	--	9.1E-04	--	4.0E-03	--
Nitrotoluene, o-	88-72-2	5.5E-05	Route	3.6E+00	Route	5.1E-02	3.8E+00	2.2E-01	1.6E+01
Pebulate	1114-71-2	--	--	2.0E+02	Route	--	2.1E+02	--	8.8E+02
Pentachlorobenzene	608-93-5	--	--	3.2E+00	Route	--	3.3E+00	--	1.4E+01
Pentachloroethane	76-01-7	2.3E-05	Route	--	--	1.2E-01	--	5.5E-01	--
Pentachloronitrobenzene	82-68-8	6.5E-05	Route	1.2E+01	Route	4.3E-02	1.3E+01	1.9E-01	5.3E+01
Perfluorobutane Sulfonate	375-73-5	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Phosphorus, White	7723-14-0	--	--	8.0E-02	Route	--	8.3E-02	--	3.5E-01
Phthalates									
~Dimethylterephthalate	120-61-6	--	--	4.0E+02	Route	--	4.2E+02	--	1.8E+03

Table 3. Screening Levels for Volatile Compounds in Ambient Air<sup>a</sup>

Analyte	CAS #	Toxicity Factor for Final Screening Value				Screening Levels for Residential Air (µg/m <sup>3</sup> )		Screening Levels for Commercial/Industrial Air (µg/m <sup>3</sup> )	
		Inhalation Unit Risk, IUR (µg/m <sup>3</sup> ) <sup>-1</sup>	Source	Reference Concentration, RfC or REL (µg/m <sup>3</sup> )	Source	Cancer Endpoint	Noncancer Endpoint	Cancer Endpoint	Noncancer Endpoint
						DTSC-SL	DTSC-SL	DTSC-SL	DTSC-SL
<b>Polychlorinated Biphenyls (PCBs)</b>									
~Aroclor 1016	12674-11-2	--	--	2.8E-01	Route	--	2.9E-01	--	1.2E+00
~Aroclor 1254	11097-69-1	--	--	8.0E-02	Route	--	8.3E-02	--	3.5E-01
~Aroclor 5460	11126-42-4	--	--	2.4E+00	Route	--	2.5E+00	--	1.1E+01
<b>Polynuclear Aromatic Hydrocarbons (PAHs)</b>									
~Acenaphthene	83-32-9	--	--	2.4E+02	Route	--	2.5E+02	--	1.1E+03
~Anthracene	120-12-7	--	--	1.2E+03	Route	--	1.3E+03	--	5.3E+03
~Chloronaphthalene, Beta-	91-58-7	--	--	3.2E+02	Route	--	3.3E+02	--	1.4E+03
~Fluorene	86-73-7	--	--	1.6E+02	Route	--	1.7E+02	--	7.0E+02
~Methylnaphthalene, 1-	90-12-0	7.3E-06	Route	2.8E+02	Route	3.9E-01	2.9E+02	1.7E+00	1.2E+03
~Methylnaphthalene, 2-	91-57-6	--	--	1.6E+01	Route	--	1.7E+01	--	7.0E+01
~Pyrene	129-00-0	--	--	1.2E+02	Route	--	1.3E+02	--	5.3E+02
Profluralin	26399-36-0	--	--	2.4E+01	Route	--	2.5E+01	--	1.1E+02
Propargyl Alcohol	107-19-7	--	--	8.0E+00	Route	--	8.3E+00	--	3.5E+01
Propylene Glycol Monoethyl Ether	1569-02-4	--	--	2.8E+03	Route	--	2.9E+03	--	1.2E+04
Pyridine	110-86-1	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
Ronnel	299-84-3	--	--	2.0E+02	Route	--	2.1E+02	--	8.8E+02
Styrene	100-42-5	--	--	9.0E+02	OEHHA	--	9.4E+02	--	3.9E+03
Terbufos	13071-79-9	--	--	1.0E-01	Route	--	1.0E-01	--	4.4E-01
Tetrachlorobenzene, 1,2,4,5-	95-94-3	--	--	1.2E+00	Route	--	1.3E+00	--	5.3E+00
Tetrachloroethane, 1,1,1,2-	630-20-6	--	--	1.2E+02	Route	--	1.3E+02	--	5.3E+02
Tetrachloroethane, 1,1,2,2-	79-34-5	--	--	8.0E+01	Route	--	8.3E+01	--	3.5E+02
Tetrachloroethylene	127-18-4	5.9E-06	OEHHA	3.5E+01	OEHHA	4.8E-01	3.7E+01	2.1E+00	1.5E+02
Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	5.0E-03	Route	--	--	5.6E-04	--	2.5E-03	--
Thallium Acetate	563-68-8	--	--	2.4E-02	Route	--	2.5E-02	--	1.1E-01
Toluene	108-88-3	--	--	3.0E+02	OEHHA	--	3.1E+02	--	1.3E+03
Tri-n-butyltin	688-73-3	--	--	1.2E+00	Route	--	1.3E+00	--	5.3E+00
Triallate	2303-17-5	--	--	5.2E+01	Route	--	5.4E+01	--	2.3E+02
Tribromobenzene, 1,2,4-	615-54-3	--	--	2.0E+01	Route	--	2.1E+01	--	8.8E+01
Trichlorobenzene, 1,2,3-	87-61-6	--	--	3.2E+00	Route	--	3.3E+00	--	1.4E+01
Trichlorobenzene, 1,2,4-	120-82-1	7.3E-06	Route	--	--	3.9E-01	--	1.7E+00	--
Trichloroethane, 1,1,1-	71-55-6	--	--	1.0E+03	OEHHA	--	1.0E+03	--	4.4E+03
Trichloropropane, 1,1,2-	598-77-6	--	--	2.0E+01	Route	--	2.1E+01	--	8.8E+01
Trichloropropane, 1,2,3-	96-18-4	7.5E-03	Route	--	--	1.4E-04	--	1.6E-03	--
Trifluralin	1582-09-8	1.9E-06	Route	3.0E+01	Route	1.5E+00	3.1E+01	6.4E+00	1.3E+02
Trimethylbenzene, 1,3,5-	108-67-8	--	--	4.0E+01	Route	--	4.2E+01	--	1.8E+02
Vernolate	1929-77-7	--	--	4.0E+00	Route	--	4.2E+00	--	1.8E+01
Vinyl Chloride	75-01-4	7.8E-05	OEHHA	--	--	9.5E-03	--	1.6E-01	--
<b>Additional Analytes</b>									
Dichlorobenzene, 1,3-	541-73-1	--	--	1.2E+02	Route	--	1.3E+02	--	5.3E+02
Methylcyclohexane	108-87-2	--	--	6.0E+03	Cyclohexane	--	6.3E+03	--	2.6E+04

<sup>a</sup> Summarized from Appendix C, Table C-1. Screening levels in the table are based on the more-stringent values between DTSC-modified values and corresponding derived USEPA values based on USEPA factors; "--" = indicates that no value could be calculated.

(µg/m<sup>3</sup>)<sup>-1</sup> = per (microgram per cubic meter)

µg/m<sup>3</sup> = micrograms per cubic meter

ATSDR = Agency for Toxic Substances and Disease Registry

CAS# = Chemical Abstracts Service Registry Number

DTSC = California Department of Toxic Substances Control

HEAST = Health Effects Assessment Summary Tables

IRIS = USEPA's *Integrated Risk Information System*

IUR = inhalation unit-risk factor

J&E = Johnson and Etinger model for vapor intrusion

PPRTV = provisional peer-reviewed toxicity value

RfC = reference concentration

REL = reference exposure level

Route = route extrapolation from an oral toxicity value to an inhalation toxicity value

IUR (µg/m<sup>3</sup>)<sup>-1</sup> = Sfo (mg/kg-day)<sup>-1</sup> × (1/80 kg) × 20 m<sup>3</sup>/day × 0.001 mg/µg

RfC (µg/m<sup>3</sup>) = RfDo (mg/kg-day) × 80 kg × (1 day/20 m<sup>3</sup>) × 1000 µg/mg

RSL = USEPA Regional Screening Level

SL = screening level

sPPRTV = screening-level PPRTV

USEPA = U.S. Environmental Protection Agency