



Trichloroethylene Inhalation Toxicity Values and Corresponding Risk Based Indoor Air Concentrations

US EPA REGION 8

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The purpose of this document is to provide a synopsis of trichloroethylene (TCE) inhalation toxicity values and provide the corresponding risk-based indoor air concentrations for use in vapor intrusion assessment. Table 1 summarizes the toxicity values and risk-based concentrations. Figure 1 provides a graphic comparison of the ranges of concentrations corresponding to each of the toxicity values.

The US Environmental Protection Agency (EPA) has not had definitive guidance or policy regarding trichloroethylene (TCE) toxicity for a number of years. As a result, several toxicity values that range over approximately two orders of magnitude are currently in use by various federal and state agencies. These toxicity values and their corresponding risk based concentrations are described below. The issue of TCE toxicity continues to undergo review both within EPA and by external groups. At this time, EPA does not have a schedule for completion of its review, but it is anticipated to require several years.

In 1989, EPA withdrew the TCE inhalation toxicity value in the Integrated Risk Information System (IRIS). However, in the absence of a formal inhalation toxicity value, EPA and state environmental agencies continued to use the withdrawn value: inhalation cancer slope factor $6.0E-03$ (mg/kg-d)⁻¹. This is commonly referred to as the “old withdrawn” value. The corresponding inhalation unit risk factor is $1.7E-06$ (ug/m³)⁻¹. Using the “old withdrawn” value in a residential scenario that assumes EPA’s standard residential exposure parameters (*i.e.*, a 70-kg individual occupies a residence 24 hours/day, 350 days/year, for 30 years breathing 20 m³/day of air with an averaging time for carcinogens of 24 hours/day, 365 days/year, for 70 years) (US EPA, 1991), the TCE concentrations corresponding to the 10⁻⁶ and 10⁻⁴ cancer risk levels are 1.4 and 140 ug/m³, respectively.

In August 2001, EPA’s Office of Research and Development (ORD) completed a reassessment of the existing as well as more recent scientific studies and proposed a range of toxicity values more stringent than the “old withdrawn” value. These are commonly referred to as the “new provisional” values (US EPA, 2001). ORD did not provide guidance on selecting a particular value within the proposed range of toxicity values, nor did they formally propose an inhalation cancer unit risk factor for TCE. The more conservative of the “new provisional” values (*i.e.*, the upper end of the range), cancer slope factor $4.0E-01$ (mg/kg-d)⁻¹, corresponds to an inhalation unit risk factor of $1.1E-04$ (ug/m³)⁻¹. Using EPA’s standard residential exposure assumptions (US EPA, 1991), the TCE concentrations corresponding to the 10⁻⁶ and 10⁻⁴ cancer risk levels are 0.021 and 2.1 ug/m³, respectively. The less conservative of the “new provisional” values (*i.e.*, the lower end of the range), cancer slope factor $2.0E-02$ (mg/kg-d)⁻¹, corresponds to an inhalation unit risk factor of $5.7E-06$ (ug/m³)⁻¹. The TCE concentrations corresponding to the 10⁻⁶ and 10⁻⁴ cancer risk

levels are 0.43 and 43 ug/m³, respectively. EPA's draft vapor intrusion guidance, "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," released in November 2002 uses the more conservative of the "new provisional" values. EPA acknowledges the 10⁻⁶ cancer risk levels are lower than typical background levels of TCE in indoor air.

The California Environmental Protection Agency (Cal EPA) Air Toxics Hot Spots Program in December 2002 formally adopted a cancer slope factor for TCE of 7.0E-03 (mg/kg-d)⁻¹ with a corresponding inhalation unit risk factor of 2.0E-06 (ug/m³)⁻¹ (Cal EPA, December 2002). Using EPA's standard residential exposure assumptions (US EPA, 1991), the TCE concentrations corresponding to the 10⁻⁶ and 10⁻⁴ cancer risk levels are 1.2 and 120 ug/m³, respectively.

To provide guidance in Colorado on managing the risk associated with TCE, Colorado Department of Public Health and Environment (CDPHE) has adopted an interim policy for TCE toxicity based on the more conservative of EPA's "new provisional" values. Under the terms of the policy, screening of TCE in Colorado will occur at the level of 0.016 ug/m³ (as measured in indoor air) and clean up would be required at the level of 1.6 ug/m³. CDPHE mandates that if measured indoor air TCE levels range from 0.8 to 1.6 ug/m³ (corresponding to 5 x 10⁻⁵ and 1 x 10⁻⁴ cancer risk, respectively), further study will be required to determine if remedial action is necessary. CDPHE acknowledges that the 0.016 ug/m³ screening level is lower than typical background levels of TCE in indoor air.

No other state in Region 8 has developed a formal policy regarding TCE toxicity.

REFERENCES

California Environmental Protection Agency (Cal EPA). Air Toxics Hot Spot Program Risk Assessment Guidelines. Part II. Technical Support for Describing Available Cancer Potency Factors. December 2002.

Colorado Department of Public Health and Environment (CDPHE). News: State health director establishes TCE policy for Colorado. August, 2004;
<http://www.cdphe.state.co.us/release/2004/082004.html>

US EPA. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors, OSWER Directive 9285.6-03. March 1991.

US EPA. Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft). U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC, EPA/600/P-01/002A, 2001.

Table 1. Trichloroethylene Toxicity Factors and Indoor Air Risk Based Concentrations

Toxicity Value Source	Cancer Slope Factor (mg/kg-d)⁻¹	Inhalation Unit Risk Factor (1)⁽¹⁾ (ug/m³)⁻¹	10⁻⁶ Indoor Air RBC (ug/m³)	10⁻⁴ Indoor Air RBC (ug/m³)
EPA: "Old Withdrawn" Value (US EPA, IRIS, 1989)	6.0 E-03	1.7 E-06	1.4 ⁽²⁾	140 ⁽²⁾
EPA: Less Conservative "New Provisional" Value (US EPA 2001)	2.0 E-02	5.7 E-06	0.43 ⁽²⁾	43 ⁽²⁾
EPA: More Conservative "New Provisional" Value (US EPA 2001)	4.0 E-01	1.1 E-04	0.021 ⁽²⁾	2.1 ⁽²⁾
Cal EPA: Air Toxics Hot Spots Program (CalEPA 2002)	7.0 E-03	2.0 E-06	1.2 ⁽²⁾	120 ⁽²⁾
CDPHE: Interim Value (CDPHE 2004)	4.0 E-01		0.016 ⁽³⁾	1.6 ⁽³⁾

Notes:

- (1) Inhalation Unit Risk Factors (URF) were calculated from the cancer slope factors (CSF) provided in the cited documents as follows: $URF = CSF \times 20 \text{ (m}^3/\text{d)} \times 10^{-3} \text{ (mg/ug)} / 70 \text{ kg}$
- (2) Calculated using EPA's standard residential exposure parameters (US EPA, 1991).
- (3) Calculated according to the methodology described in CDPHE 2004. CDPHE uses childhood-weighted inhalation rates and body weights in calculating the risk based concentrations and thus derives slightly lower levels than those calculated using EPA's standard residential exposure parameters (US EPA, 1991).

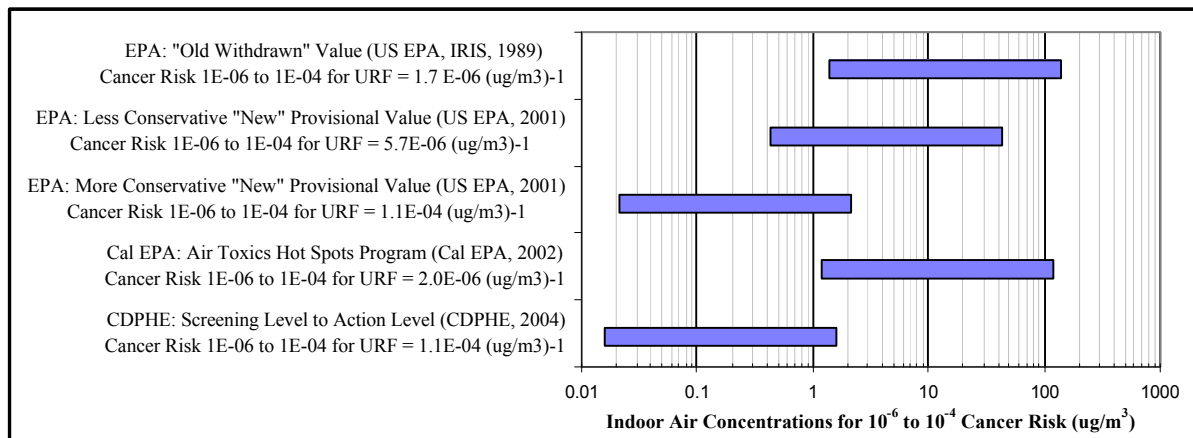


Figure 1. Ranges of TCE indoor air concentrations corresponding to the 10⁻⁶ to 10⁻⁴ cancer risk levels for various TCE toxicity factors.