

**ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
DIVISION OF SPILL PREVENTION AND RESPONSE  
CONTAMINATED SITES PROGRAM**

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**Technical Memorandum**

**Date:** November 2017

**Additional Information about Exposure to TCE**

**PURPOSE:** To provide supplemental guidance for evaluating and responding to trichloroethylene (TCE) exposure involving sensitive subpopulations. This information is provided as a precaution and is based on updated studies and guidance provided by the U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Quality (See references at the end of this fact sheet).

**BACKGROUND:** TCE is a volatile organic compound that may exist on its own or in mixtures with other compounds. It is used primarily as an industrial solvent and degreaser, as well as in dry-cleaning, adhesives, paint removers, spot removers and other products. Once released into the environment, TCE can move through the soil, groundwater and air. It is moderately soluble in water and therefore can migrate from soil to groundwater after a large release. TCE-contaminated groundwater can move from commercial or industrial sites where releases occurred to other occupied areas such as office buildings, schools or residential housing. TCE vapors can emanate from the contaminated soil and groundwater into buildings. TCE has been shown to cause cancer and non-cancer adverse health effects on humans. People can be exposed to TCE through direct contact with contaminated soil; by drinking, showering or bathing with contaminated groundwater; and by breathing vapors both outdoors and in buildings overlying contaminated areas.

EPA's Integrated Risk Information System (IRIS) program supports the protection of human health and the environment by identifying and characterizing the health hazards associated with chemical exposure. IRIS assessments provide estimates of toxicity values for health effects resulting from chronic exposure to chemicals. Reference concentrations (RfC) are estimates of continuous human inhalation exposure that is likely to be without an appreciable risk of adverse effects during a lifetime. Reference dose (RfD) is an estimate of daily human oral exposure that is likely to be without an appreciable risk of adverse effects during a lifetime. EPA's IRIS program conducted a toxicological review of TCE (U.S. Environmental Protection Agency, 2011) for developing the RfC and RfD. The RfC and RfD were determined partly on immunotoxic and developmental effects, including fetal cardiac malformations that may occur when the mother is exposed to TCE during a 21-day early gestation window. The discussion of TCE in IRIS does not provide a specific methodology for estimating media concentrations that are protective for this period of vulnerability for sensitive subpopulations. However, there are ongoing EPA assessments at the Office of Solid Waste and Emergency Response (OSWER) and risk assessors are developing guidance on how to apply the RfC and RfD for less-than-lifetime exposures.

The default exposure duration used in a risk assessment for chronic exposure in a residential scenario is 350 days-per-year based on the assumption that residents would be absent from the site for two weeks of vacation annually. However, to be protective of possible short-term exposure to TCE during any 21-day period, the exposure frequency should be increased to 365 days per year.

**DISCUSSION:** DEC has incorporated the IRIS RfC and RfD into the DEC risk-based cleanup values for TCE with the two-week exposure frequency adjustment in order to be protective of the developing fetus. Table 1 lists the current cleanup values and target levels for media and pathways. If a cleanup or target level listed in Table 1 is exceeded as averaged over any 21-day period of time, then an immediate evaluation of acute TCE toxicity should be conducted when women of child-bearing age may be exposed. If multiple compounds and pathways are present, the cumulative risk guidance (ADEC, 2016) should be followed.

A review of available scientific information does not provide clarity on whether transient spikes in TCE exposures during a 21-day window of early gestation vulnerability may result in fetal heart malformations, when average media exposure concentrations during that window are not exceeded. If there is evidence that transient TCE concentration spikes may be occurring, they should be evaluated as a nonconservative uncertainty for risk assessment and risk management purposes.

Because the exposure duration of concern for potential fetal developmental effects is so short (21 days), Responsible Parties should notify DEC immediately after becoming aware that maximum site concentrations are known or suspected to exceed Table 1 values provided below. Depending on site-specific circumstances, the potential for adverse human health effects as described in this technical memorandum may warrant interim protective measures as required by the Department under 18 AAC 75.310-315. Appropriate interim measures may include installing indoor air treatment units or sub-slab depressurization systems, changing the building use to limit exposure to women of child-bearing age, providing an alternate drinking water source or other measures or controls to limit exposure. DEC will work with Responsible Parties to evaluate and implement mitigation or remedy efforts as soon as feasible.

This tech memo represents a precautionary approach to this issue, based on information available at this time for TCE. Due to the unique exposure concerns for TCE, DEC does not recommend utilizing common fate and transport models such as the Johnson and Ettinger Vapor Intrusion model to evaluate TCE human health risk. The default parameter inputs used in these models may not take into consideration current toxicity data for TCE or the unique 21-day period of exposure for pregnant women. As mentioned above, EPA is conducting an ongoing assessment of the toxicity information for this compound and is evaluating the best course of action going forward. Therefore, both the EPA's and states' regulatory responses to this issue are likely to evolve as more data and information become available.

**Table 1.** Updated TCE risk-based cleanup and target values for exposure pathway and media based on potential short-term exposure to women of child-bearing age.

Receptor	Pathway and Target Media	Updated DEC Cleanup/Target Level
Residential	<b>Vapor Intrusion<sup>1</sup></b>	
	Air ( $\mu\text{g}/\text{m}^3$ )	2.0
	Groundwater ( $\mu\text{g}/\text{L}$ )	5.0
	Shallow or Subslab Soil Gas <sup>3</sup> ( $\mu\text{g}/\text{m}^3$ )	20
	<b>Drinking Water</b>	
	Drinking Water ( $\mu\text{g}/\text{L}$ )	2.8
	<b>Soil<sup>†</sup></b>	
	Soil Arctic (mg/kg)	7.1
	Soil Under 40 in (mg/kg)	4.9
	Soil Over 40 in (mg/kg)	3.5
Commercial/ Industrial	<b>Vapor Intrusion<sup>1</sup></b>	
	Air ( $\mu\text{g}/\text{m}^3$ )	2.2 <sup>2</sup>
	Groundwater ( $\mu\text{g}/\text{L}$ )	21
	Shallow or Subslab Soil Gas <sup>3</sup> ( $\mu\text{g}/\text{m}^3$ )	84

<sup>1</sup>Do not rely on target levels (groundwater or soil depths) when (1) groundwater contamination is less than 5 feet from the foundation, or (2) a vapor source is less than 15 feet from the foundation, and preferential pathways, significant openings or a low air exchange rate exists in the building.

<sup>2</sup>This value is the Agency for Toxic Substance Disease Registry minimum risk level.

<sup>3</sup>Shallow soil gas includes soil gas collected from 5 feet or less below the ground surface, or 5 feet or less below a foundation. Subslab soil gas includes vapor collected from directly beneath the foundation slab.

<sup>†</sup> Migration to groundwater based is currently = 0.011 mg/kg.

## **REFERENCES:**

Alaska Department of Environmental Conservation (2016). Procedures for Calculating Cumulative Risk. [http://dec.alaska.gov/spar/csp/guidance\\_forms/csguidance.htm](http://dec.alaska.gov/spar/csp/guidance_forms/csguidance.htm).

U.S. Environmental Protection Agency Region 10 (December 2012). OEA Recommendations Regarding Trichloroethylene Toxicity in Human Health Risk Assessments.

U.S. Environmental Protection Agency (2011). IRIS Toxicity Profile for Trichloroethylene (CASRN 79-01-6). Washington D.C., U.S. EPA. <http://www.epa.gov/iris/subst/0199.htm>.

Massachusetts Department of Environmental Protection (January 2013). New EPA Toxicity Information: Implications for Chronic and Shorter-Term Exposure and Status of MassDEP Review.