

Tetrachloroethylene Toxicity Information & MTCA Cleanup Levels (Perc, PCE, Perchloroethylene) CAS # 127-18-4

Background Information

On February 10, 2012, the U.S. Environmental Protection Agency (EPA) provided new toxicity values for its Integrated Risk Information System (IRIS) for tetrachloroethylene (CAS # 127-18-4). The new IRIS toxicity information for tetrachloroethylene is summarized in the Table 1 below. No early-life exposure age adjustments are required for tetrachloroethylene because EPA has determined that there is insufficient or equivocal information to characterize the carcinogenic mode of action for tetrachloroethylene as mutagenic.

Table 1: New IRIS Toxicity Information for Tetrachloroethylene				
	Oral Cancer Potency Factor (CPFo) (a) (mg/kg-day)⁻¹	Inhalation Cancer Potency Factor (CPFi) (b) (mg/kg-day)⁻¹	Oral Reference Dose (RfDo) (mg/kg-day)	Inhalation Reference Dose (RfDi) (c) (mg/kg-day)
Old Tox Values	0.54	0.021	0.01	Not available
New Tox Values:	2.1E-03	9.1E-04	6.0E-03	1.14E-02
<p>(a) MTCA uses the term (oral) “Cancer Potency Factor” or CPFo; EPA uses the term (oral cancer) “Slope Factor” in the Integrated Risk Information System (IRIS). The units are the same for both terms (mg/kg-day)⁻¹.</p> <p>(b) EPA uses the term “Unit Risk Factor” (URF) in risk calculations for the air exposure pathway. The MTCA rule uses the term (inhalation) “Cancer Potency Factor” (CPFi). Until the MTCA rule is updated to incorporate this new EPA approach, the URF needs to be converted to a cancer potency factor so the current MTCA equations can be used to calculate cleanup levels.</p> <p>Inhalation URF for tetrachloroethylene = 2.6E-07 per µg/ m³ To convert this URF to an inhalation CPF use the following equation: $\text{CPFi (kg-day/mg)} = (\text{URF [m}^3/\mu\text{g]} * 70 \text{ kg}) / (20 \text{ m}^3/\text{day} * 10^{-3} \text{ mg}/\mu\text{g})$ Perc CPFi = 9.1E-04 kg-day/mg</p> <p>(c) Similarly, EPA uses the term “Reference Concentration” (RfC), while MTCA uses the term (inhalation) reference dose (RfDi).</p> <p>RfC for tetrachloroethylene = 4E-02 mg/m³ To convert a RfC to a RfDi using the following equation: $\text{RfDi} = (\text{RfC [mg/m}^3] * 70 \text{ kg}) / 20 \text{ m}^3/\text{day};$ Perc RfDi = 1.14E-02 mg/kg-day</p>				
U.S. Environmental Protection Agency, Integrated Risk Information System, link: http://www.epa.gov/iris/index.html				

Table 2: MTCA Standard Method B and C Groundwater Cleanup Levels for Tetrachloroethylene (Perc) [WAC 173-340-720(4) & (5)] (a)				
Toxicity Values From Table 1	MTCA Method B (µg/L)		MTCA Method C (µg/L)	
	Eqn 720-1 Non-Cancer (@ HQ = 1)	Eqn 720-2 Cancer (@ Risk = 10 ⁻⁶)	Eqn 720-1 (mod) Non-Cancer (@ HQ = 1) (b)	Eqn 720-2 Cancer (@ Risk = 10 ⁻⁵)
Using new CPFO of 2E-03 (mg/kg-day) ⁻¹	-----	2.1E+01	-----	2.1E+02
Using new RfDo of 6E-03 mg/kg-day	4.8E+01	-----	1.1E+02	-----
Applicable State and Federal Law: State & Federal MCL = 5.0 µg/L; Federal drinking water standards located at: http://water.epa.gov/action/advisories/drinking/drinking_index.cfm				
New Perc Groundwater Cleanup Levels (c)				
	MTCA Method B		MTCA Method C	
	5 µg/L		5 µg/L	
(a) All cleanup levels calculated using an inhalation correction factor (INH) = 2.				
(b) Method C (non-cancer) groundwater CUL calculated using equation 720-1 modified for an adult exposure scenario by changing the body weight to 70 kg and the drinking water intake rate to 2 liters/day per WAC 173-340-720(5).				
(c) Because the MCL does not exceed a hazard quotient of 1 or a cancer risk of 1 x 10 ⁻⁵ , the MCL can be used as the Method B and Method C ground water cleanup level [WAC 173-340-720 (7) (b)]. Thus, the MTCA groundwater cleanup levels are based on the drinking water standard (MCL) for Perc of 5 µg/L.				
NOTE: These are not necessarily final cleanup levels. These values may need to be adjusted for additive risk, PQLs and natural background per WAC 173-340-720(7). (They are already adjusted for ARARs.)				
Also, if contaminants in the groundwater are likely to discharge to a surface water, surface water CULs may need to be considered when determining a final CUL (see Table 3).				

Table 3: MTCA Standard Method B and C Surface Water Cleanup Levels for Tetrachloroethylene (Perc) [WAC 173-340-730(3) and (4)] (a)				
Toxicity Values from Table 1	MTCA Method B (µg /L)		MTCA Method C (µg /L) (b)	
	Eqn 730-1 Non-Cancer (@ HQ=1)	Eqn 730-2 Cancer (@ Risk = 10 ⁻⁶)	Eqn 730-1 (mod) Non-Cancer (@ HQ=1)	Eqn 730-2 (mod) Cancer (@ Risk = 10 ⁻⁵)
Using new CPFo of 2E-03 (mg/kg-day) ⁻¹	-----	1.0E+02	-----	2.5E+03
Using new RfDo of 6E-03 mg/kg-day	5.0E+02	-----	1.3E+03	-----
Applicable State & Federal Law: Ambient water quality criteria (AWQC)				
U.S. EPA's AWQC	Drinking Water + organism consumption = 0.69 µg/L			
	Consumption of organism only = 3.3 µg/L			
U.S. EPA's AWQC web location: http://water.epa.gov/scitech/swguidance/standards/current/index.cfm				
New MTCA Surface Water Cleanup levels (c)				
	MTCA Method B		MTCA Method C	
	0.69 µg/L or 3.3 µg/L		0.69 µg/L or 3.3 µg/L	
<p>(a) All cleanup levels calculated using a BCF = 31 liters/kg.</p> <p>(b) Method C cleanup levels calculated using equations 730-1 and 730-2 modified with a FDF = 0.2 and a cancer risk of 1x 10⁻⁵ per WAC 173-340-730(4).</p> <p>(c) MTCA requires CULs to comply with ARARs, which in this case are the federal and state water quality criteria. This includes consideration of both the survivability of the organisms and risk to humans eating fish and shellfish. It also includes consideration of whether or not the surface water has drinking water as a designated beneficial use under state law.</p> <p>The most stringent ARARs for Perc are the Federal Ambient Water Quality Criteria (AWQC), and thus these criteria govern the cleanup levels in this case. If drinking the surface water is identified as a beneficial use under WAC 173-340-201A, then use 0.69 ug/L as the cleanup level. Otherwise, use 3.3 ug/L.</p> <p>NOTE: These are not necessarily final cleanup levels. These values may need to be adjusted for additive risk, PQLs and natural background per WAC 173-340-730(5). (They are already adjusted for ARARs.)</p>				

Table 4: MTCA Standard Method B and C Soil Cleanup Levels for Tetrachloroethylene (Perc) Protective of the Soil Ingestion Pathway [see WAC 173-340-740 (3)(b)(iii)(B) & 173-340-745(5)(b)(iii)(B)]				
Toxicity Values from Table 2	MTCA Method B (mg/kg)		MTCA Method C (mg/kg)	
	Eqn 740-1 Non-Cancer (@ HQ=1)	Eqn 740-2 Cancer (@ Risk = 10 ⁻⁶)	Eqn 745-1 Non-Cancer (@ HQ=1)	Eqn 745-2 Cancer (@ Risk = 10 ⁻⁵)
Using new CPFo of 2E-03 (mg/kg-day) ⁻¹	-----	4.8E+02	-----	6.3E+04
Using new RfDo of 6E-03 mg/kg-day	4.8E+02	-----	2.1E+04	-----
New Perc Soil Cleanup Levels for the Soil Ingestion Pathway (a)				
	MTCA Method B		MTCA Method C	
	480 mg/kg		21,000 mg/kg	
<p>(a) NOTE: These are not necessarily final cleanup levels. These values may need to be adjusted for additive risk PQLs and natural background per WAC 173-340-740(5) and 745(6). (There are no known ARARs, so there is no adjustment for ARARs.)</p> <p>Also, this is just the soil ingestion exposure pathway. Other pathways such as leaching (see Table 5) and vapors may need to be considered when determining a final cleanup level.</p>				

Table 5: MTCA Soil Cleanup Levels for Tetrachloroethylene (Perc) Protective of Potable Groundwater through the Soil Leaching Pathway (see WAC 173-340-747(4))				
Target Groundwater Cleanup Level	Based on Protection of Potable Groundwater		Based on Protection of Surface Water	
	Method B Drinking H2O (see Table 2)	Method C Drinking H2O (See Table 2)	Drinking H2O and Fish Consumption (see Table 3)	Fish Consumption Only (see Table 3)
		5.0 µg/L	5.0 µg/L	0.69 µg/L
New Perc Soil Cleanup Level for Leaching Pathway (a)	0.05 mg/kg	0.05 mg/kg	0.007 mg/kg	0.04 mg/kg
<p>(a) Calculated using Equation 747-1 (3-phase model), default assumptions and the following Perc specific properties: Koc = 265 L/kg; Henry's Law Constant (Hcc) = 0.754 (unitless)</p> <p>These values are the same for unrestricted and industrial uses as the surface land use (zoning) does not affect the leachability of a chemical.</p> <p>NOTE: These are not necessarily final cleanup levels. These values may need to be adjusted for additive risk, PQLs and natural background per WAC 173-340-740(5) and 745(6). (There are no known ARARs, so there is no adjustment needed for ARARs.)</p>				

Table 6: MTCA Standard Method B and C Air Cleanup Levels for Tetrachloroethylene (Perc) [WAC 173-340-750(3)and (4)]				
Toxicity Values from Table 1	MTCA Method B ($\mu\text{g}/\text{m}^3$)		MTCA Method C ($\mu\text{g}/\text{m}^3$)	
	Eqn 750-1 Non-Cancer (@ HQ = 1)	Eqn 750-2 Cancer (@ Risk = 10^{-6})	Eqn 750-1 (mod) Non-Cancer (a) (@ HQ = 1)	Eqn 750-2 Cancer (@ Risk = 10^{-5})
Using new CPF _i of $9.10\text{E}-04$ (mg/kg-day) ⁻¹	-----	9.6E+00	-----	9.6E+01
Using new RfD _i of $1.14\text{E}-02$ mg/kg-day	1.8E+01	-----	4.0E+01	-----
New Perc Air Cleanup Levels (b)				
	MTCA Method B		MTCA Method C	
	9.6 $\mu\text{g}/\text{m}^3$		40 $\mu\text{g}/\text{m}^3$	
(a) Method C (non-cancer) air CUL calculated using equation 750-1 modified for an adult exposure scenario by changing the body weight to 70 kg and the breathing rate to 20 m ³ /day per WAC 173-340-750(4).				
(b) These are not necessarily final cleanup levels. These values may need to be adjusted for ARARs, additive risk, PQLs and natural background per WAC 173-340-750(5).				