

## **Industrial Waste Program**

### **Volatile organic compound screening levels**

#### **How the King County Industrial Waste Program (KCIW) determines organic compound discharge limits**

The local limit for organic compounds prohibits the discharge of any organic pollutant that results in the presence of toxic gases, vapors, or fumes within a public or private sewer or treatment works in a quantity that may cause worker health and safety problems. The local limit also provides the authority to use various methods (applied on a site-specific basis) for limiting the discharges of organic compounds. The need for restrictions must be based on a site-specific evaluation as described in the following table.

A site-specific evaluation includes these elements:

- Conditions in public or private sewers downstream of the discharge, including dilution by other wastes upstream
- Worker safety and public health standards
- Type of chemical compound
- Proximity to other discharges that may cause adverse conditions in combination with the discharge
- Technological achievability of removal
- Potential impacts to public, private, or side sewers; treatment works; sludge; or receiving waters
- Duration of the discharge

#### **Discharge screening for volatile organic compounds**

Most frequently, the highest concentrations of organic compounds are found in the discharges from groundwater remediation facilities, waste treatment facilities, and in landfill leachate.

Screening levels in the following table have been calculated for many of the volatile organic compounds that are commonly used in industries and have Washington state permissible exposure limits (PELs) per Chapter 296-62 WAC (General Occupational Health Standards). Screening levels are the concentration in the wastewater that could potentially produce sewer gas concentrations in excess of the PEL. The calculations of the screening levels are based on Henry's law equilibrium between the volatile organic compound in the wastewater and the sewer gases.

The screening also assumes that:

- There is no venting in the collection system.

- There is a continuous flow of the volatile organic compound.
- There is adequate retention time to complete the equilibrium between the sewer gases and the wastewater.

**Discharge screening levels for volatile organic compounds based on occupational standards and Henry's law constants**

<b>Compounds</b>	<b>CAS-RN</b>	<b>PEL (mg/m<sup>3</sup>)</b>	<b>Henry's law constants (A) (mg/m<sup>3</sup>)/(mg/l)</b>	<b>Discharge screening level (mg/l)</b>
Acrolein	107-02-8	0.8	4.9	<b>0.16</b>
Acrylonitrile	107-13-1	4.34	4.5	<b>0.96</b>
Benzene	71-43-2	16	228	<b>0.070</b>
Bromoform	75-25-2	5	22.8	<b>0.22</b>
Carbon disulfide	75-15-0	36	490 (B)	<b>0.073</b>
Carbon tetrachloride	56-23-5	12.6	1185	<b>0.011</b>
Chlorobenzene	108-90-7	350	151	<b>2.3</b>
Chloroethane (Ethyl chloride)	75-00-3	2600	449	<b>5.8</b>
Chloroform (Trichloromethane)	67-66-3	9.78	163.5	<b>0.060</b>
Dichloroethane, 1,1-	75-34-3	400	240.4	<b>1.7</b>
Dichloroethane, 1,2- (Ethylene dichloride)	107-06-2	8	48.1	<b>0.17</b>
Dichloroethylene, 1,1- (Vinylidene chloride)	75-35-4	4	1202.1	<b>0.003</b>
Dichloroethylene, <i>cis</i> -1,2-	156-59-2	395 (E)	389.3	<b>1.0 (E)</b>
Dichloroethylene, <i>trans</i> -1,2-	156-60-5	395 (E)	389.3	<b>1.0 (E)</b>
Dichlorodifluoromethane	75-71-8	4950	121801 (B)	<b>0.041</b>
Dichloropropane, 1,2- (Propylene dichloride)	78-87-5	350	118.5	<b>3.0</b>
Dichloropropene, 1,3-	542-75-6	5	55.3 (B)	<b>0.090</b>
Ethyl benzene	100-41-4	545	327	<b>1.7</b>
Methyl bromide (Bromomethane)	74-83-9	20	255.5	<b>0.078</b>
Methyl chloride (Chloromethane)	74-87-3	210	371.6	<b>0.57</b>
Methylene chloride	75-09-2	434	104.8	<b>4.1</b>
Methyl isobutyl ketone (4-Methyl-2-pentanone)	108-10-1	300	20 (C)	<b>15</b>
Naphthalene	91-20-3	75	19.62 (B)	<b>3.82</b>
Nitrobenzene	98-95-3	5	0.53 (B)	<b>2 (D)</b>
Styrene	100-42-5	425	107 (F)	<b>4.0</b>
Tetrachloroethane, 1,1,2,2-	79-34-5	7	18.6	<b>0.38</b>
Tetrachloroethylene (Perchloroethylene/PCE)	127-18-4	170	717.1	<b>0.24</b>
Toluene	108-88-3	375	272.5	<b>1.4</b>

Compounds	CAS-RN	PEL (mg/m <sup>3</sup> )	Henry's law constants (A) (mg/m <sup>3</sup> )/(mg/l)	Discharge screening level (mg/l)
Trichloroethane, 1,1,1- (Methyl chloroform)	71-55-6	1900	692.7	<b>2.7</b>
Trichloroethane, 1,1,2-	79-00-5	45	34.1	<b>1.3</b>
Trichloroethylene (TCE)	79-01-6	270	408.7	<b>0.5 (D)</b>
Vinyl chloride	75-01-4	12.8	1048	<b>0.012</b>
Xylenes, total	1330-20-7	655	300 (C)	<b>2.2</b>

Notes:

(A) Local Limits Development Guidance (EPA, 2004)

(B) Guidance to Protect POTW Workers From Toxic and Reactive Gases and Vapors (EPA, 1992)

(C) TOXCHEM (v. 3) Wastewater Model - Enviromega Inc.; Ontario, Canada; Phone: 905-689-4410

(D) Chapter 173-303 WAC - Dangerous Waste Regulations

(E) Based on the PEL of total 1,2-dichloroethylene divided 50 percent to the *cis*-isomer and 50 percent to the *trans*-isomer

(F) Agency for Toxic Substances and Disease Registry (ATSDR, 2010)

CAS-RN – Chemical Abstract Service - Registry Number

PEL – permissible exposure limits (TWA or STEL) per WAC 296-62-07515

STEL – short-term exposure limit

TWA – time-weighted average

Field testing performed by KCIW revealed that actual sewer-gas concentrations are less than projections using the Henry's law equilibrium method. Therefore, the screening levels are not recommended as numerical limits, but rather should be used to evaluate the need for best management practices or other controls to protect worker health and safety. The first step in determining the need to control discharges of organic compounds should be to require representative sampling and analysis, and comparison of the results to screening levels. When the screening levels have been exceeded, KCIW has historically used a range of control methods, including the following:

- Using the AKART (all known, available, and reasonable methods of prevention, control, and treatment) approach, by selecting the pretreatment method (e.g., carbon treatment or air stripping).
- Requiring air monitoring at the first potential occupational exposure point(s). Typically, KCIW has only required short-term sampling to determine if the sewer gas exceeds occupational standards.
- Requiring ongoing wastewater sampling and comparing the results with the screening levels.
- Requiring implementation of best management practices to reduce the amount of organics discharged into the sewer.