Summary of Initial Risk Assessment Report

Trichloroethylene CAS No : 79-01-6

PRTR No of Japan: 211

This substance is assessed based on Guideline for Initial Risk Assessment Version 1.0

1. General Information

1.1 Physico-chemical properties

Appearance	Colorless liquid
Melting point	-84.8 degC
Boiling point	86.9 degC
Water solubility	1.28 g/L (25 degC)
Henry's constant	998 Pa*m^3/mol (9.85*10^{-3} atm*m^3/mol) (25degC, measured)
Octanol/water partition coefficient (log Kow)	2.42 (measured), 2.47 (estimated)
Soil adsorption coefficient	Koc = 68 (estimated)

1.2 Environmental fate

Bioaccumulation	Exhibits little to no bioaccumulation Bioconcentration factor (BCF) : 4.3-17.0 (0.070 mg/L), 4.0-16.0 (0.007 mg/L) (carp), 17 (*Lepomis macrochirus*), 39 (*Oncorhynchus mykiss*), (measured)
Biodegradation	Non-biodegradable
Stability in the environment	(In air) Reaction with OH radical: Reaction rate constant is 2.4.0*10^{-12} cm^3/molecule-sec. (25 degC, measured) The half-life is 3-7 days, given OH radical concentration of 5*10^5-1*10^6 molecule/cm^3. Reaction with ozone: Reaction rate constant is 3.0*10^{-20} cm^3/molecule-sec or smaller (25 degC, measured). The half-life is calculated to be 1 year or longer, given ozone concentration of 7*10^{11} molecule/cm^3. Reaction with nitrate radical: Reaction rate constant is 2.8*10^{-16} cm^3/molecule-sec. (25 degC, measured) The half-life is 0.4-4 months, given nitrate radical concentration of 2.4*10^8-2.4*10^9 molecule/cm^3 (10-100 ppt). (In water) Hydrolysis in the general aquatic environment is not important, since hydrolysis half-life at 25 degC is estimated to be 50 years or longer at pH 7.

Environmental fate	Trichloroethylene is expected to be non-biodegradable and is expected to be removed from water mainly by volatilization to air. When a large amount is released to the environmental water, trichloroethylene is considered to settle out to sediments without being dissolved in water, since specific gravity of trichloroethylene is larger than that of water.

2. Sources of release to the environment

2.1 Annual production, import, export and domestic supply in 2001 (ton/year)

Production	Import	Export	Domestic supply	Remarks
75,687	1,562	18,132	59,117	

2.2 Uses

Synthetic raw material for chlorofluorocarbon alternatives (52.6%), degreasing cleaners (43.2%), industrial solvents (4%), reagents (0.2%)

2.3 Release from the industries within the scope of PRTR system (in 2001)

Release sources		Air (ton)	Waters (ton)	Soil (ton)	Remarks
Listed industries	Reported release	6,317	6	0	Release to rivers: 51.7 tons
	Release outside notification	52,480	47	0	
Release outside notification from non listed industry		--	--	--	
Households		--	--	--	
Mobile sources		--	--	--	
Total		58,797	53	0	

2.4 Releases from other sources

Due to its high specific gravity (>1) and low viscosity, this substance can penetrate deeply into soil, and contaminate broad areas of land. Causes of land contamination of this substance are thought to be inappropriate handling of the substance during use and disposal processes, inappropriate landfilling of sludge that contains it, and illegal waste-dumping.

2.5 Main release route

Trichloroethylene is expected to be released to air mainly during its use as a degreasing and cleaning agent in the metal product manufacturing industries and the machinery and equipment manufacturing industries.

3. Exposure Assessment

3.1 Measured environmental concentration

Media	No. of points detected / No. of points measured	No. of samples detected / No. of samples measured	Detection range	95th percentile	Detection limit	Year of investigation, Institution
Air (microg/m^3)	--/332	--/3,985	0.022 -26[1)]	--	--	2001 Ministry of the Environment
River water (microg/L)	15/2,251	84/7,720	nd-3.0[1)]	--	0.20 - 5.0	2001 National Institute for Environmental Studies
Drinking water (microg/L)	5,648 [2)]	--	nd-12[1)]	--	--	2001 Japan Water Works Association
Food (microg/g-wet)	3/24	8/72	nd-0.0019	0.0007	0.0005	1999 Ministry of the Environment

nd: Not detected

For calculation of the 95th percentile, data less than the detection limit are replaced with a value of one half of the detection limit.

1) annual average

2) number of water purification plants

3.2 Estimated environmental concentration

Media	Estimated concentration	Description
Air (microg/m^3)	20	Calculated by mathematical model / Atmospheric Dispersion Model for Exposure and Risk Assessment ver.1.0 (AIST-ADMER)
River water (microg/L)	0.30	Calculated by mathematical model / Integrated River Model to predict the distribution of chemical concentration (IRM1)

3.3 Estimated environmental concentration in water (EEC)

EEC(microg/L)	3.0
	Measured concentration surveyed by the Environmental Information Center, National Institute for Environmental Studies in 2001 is used for risk assessment[1)].

3.4 Estimated human intake

Intake route		Concentration used for estimation of intake	Estimated intake (microg/ person/ day)	Estimated intake (microg/ kg-Bodyweight (BW)/ day)
Inhalation	Air	26 (microg/m^3)	520	10
		The maximum of annual average concentrations (26 microg/m^3) measured by Ministry of the Environment was used for the risk assessment.		
Oral	Drinking water	12 (microg/L)	24	0.48
		The maximum of annual average concentrations measured by the Japan Water Works Association (12 microg/L) was used for the risk assessment.		
	Food	0.0007 (microg/g)	1.4	0.028
		A duplicate diet study was performed by the Ministry of the Environment in 1999. The ninety-fifth percentile (0.0007 microg/g-wet) was used for the risk assessment.		
	Subtotal	--	25	0.51
Total route		--	550	11

1) This substance is assessed based on the Guideline for Initial Risk Assessment Version1.0. If adequate measured concentrations are available, they are given priority and used as values for risk assessment. If they are not available, an estimated value calculated using a mathematical model is used.

4. Hazard assessment

4.1 Effects on organisms in the environment

	Acute or Chronic	Species	Endpoint	Concentration
Algae	Chronic	*Selenastrum capricornutum*	96 hours NOEC Growth inhibition (biomass)	11.0 (mg/L)
Crustacea	Chronic	*Daphnia magna*	21 days NOEC Reproduction	2.0 (mg/L)
Fish	Chronic	*Jordanella floridae*	10 days NOEC Mortality	5.76 (mg/L)
Key study		Data of crustacea (*daphnia magna*) is chosen for the key study because effects were observed at the lowest concentration in the hazard assessment.		

4.2 Human health toxicity

Toxicity	Exposure route	Species	Duration / Dose method	Toxic effects	NOAEL or LOAEL
Repeated dose toxicity	Inhalation	Rat	104 weeks	Cytomegaly of renal tubular epithelium cells, renal tubular meganucleocytosis	NOAEL: 100 ppm (equivalent to 85 mg/kg/day)
	Oral	Rat	52 weeks (5 days/week) Gavage administration	Cytomegaly of renal tubular epithelium cells, renal tubular meganucleocytosis	NOAEL: 50 mg/kg/day (equivalent to 36 mg/kg/day)
	Dermal	--	--	--	--
Reproductive and developmental toxicity	Oral	Mouse	From 1 week before mating up to 17th week of mating/ cohabitation period Oral administration (in feed)	Parental animals: decreased sperm motility ratio, centrilobular hepatocyte hypertrophy, degeneration of renal tubular epithelium, and increased relative weight of liver Offspring: increased neonatal mortality during lactation, decreased sperm motility, increased relative weight of liver, hepatocellular hypertrophy, and degeneration of renal tubular epithelium	NOAEL: 350 mg/kg/day
	Oral	Rat	From 1 week before mating up to 17th week of mating/ cohabitation period Oral administration (in feed)	Parents: decreased bodyweight gain, increased relative liver weight Offspring: decreased bodyweight gain, increased relative liver weight, reduced litter size	NOAEL: 75 mg/kg/day
Carcinogenicity	Evaluation by IARC : Group 2A (Probably carcinogenic to humans)				
Genotoxicity	Unable to determine genotoxicity				

5. Risk Assessment

5.1 Environmental organisms

Risk characterization	EEC (microg/L)	NOEC * (mg/L)	MOE (NOEC * /EEC)	Product of uncertainty factors	Conclusion
	3.0	NOEC: 2.0	670	10	No immediate concern
	Product of uncertainty factors (UFs): Extrapolation from laboratory test (10) = 10				
Recommendation : The substance is considered to be of no immediate concern for the moment, and a low priority for further work.					

NOEC* means NOEC, LOEC, EC_{50}, etc.

5.2 Human health

5.2.1 Repeated dose toxicity

Exposure route	Intake (microg/kgBW/day)	NOAEL (mg/kgBW/day)	Risk characterization		
			MOE	Product of uncertainty factors	Conclusion
Inhalation	10	NOAEL: 85	8,500	100	No immediate concern
Oral	0.51	NOAEL: 36	71,000	100	No immediate concern
Total	11	36 (oral)	3,300	100	No immediate concern
Product of uncertainty factors (UFs): Inhalation/Oral/Toal: Interspecies (10) * Intraspecies (10) = 100					

5.2.2 Reproductive and developmental toxicity

Since NOAEL of reproductive toxicity is larger than NOAEL of repeated oral toxicity, risk characterization was not carried out.

5.2.3 Carcinogenicity

Risk characterization of carcinogenicity of the substance was not carried out in this assessment.

5.2.4. Recommendation for Human Health

Though the substance is considered to be of no immediate concern for the moment and a low priority for further work, it should be noted that a carcinogenic risk characterization was not conducted. The possibility remains that this substance may be carcinogenic to humans.

6. Supplement

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