Summary of Initial Risk Assessment Report

1,4-Dioxane CAS No : 123-91-1

PRTR No of Japan:113

This substance is assessed based on Guideline for Initial Risk Assessment; Version1.0

1. General Information

1.1 Physico-chemical properties

Appearance	Colorless liquid
Melting point	11.80 degC
Boiling point	101.1 degC
Water solubility	Miscible
Henry's constant	0.486 Pa*m^3/mol (4.80 * 10^{-6} atm*m^3/mol) (25degC measured)
Octanol/water partition coefficient (log Kow)	-0.27 (measured) , -0.32 (estimated)
Soil adsorption coefficient	Koc = 1.23 (estimated)

1.2 Environmental fate

Bioaccumulation	Low accumulative Bioconcentration factor (BCF) : 0.2-0.6 (10mg/L),0.3-0.7 (1 mg/L) (carp)(measured)
Biodegradation	Non- biodegradable
Stability in the environment	(In air) Reaction with OH radical : Reaction rate constant is 1.09 * $10^{-11}$$cm^3$/molecule-sec. (25degC, measured) The half-life is 1-2 days, given OH radical concentration is 5 * 10^5-1 * 10^6 molecule/cm^3 , Reaction with ozone: No data Reaction with nitrate radical: No data (In water) 1,4-dioxiane is photooxidized by OH radical in water, the half-life is 336 days at pH7. Not expected to be hydrolyzed in the general environmental water.
Environmental fate	When released into water, 1,4-dioxane is expected to be removed slowly by volatilization.

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
4,833		783	4,050	

2.2 Uses

Solvent for extraction and reaction, stabilizer for chlorine solvents, solvent for cleaning

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	160	23	0	Release to rivers: 14.2 tons
	Release outside notification	64	9	0	
Release outside notification from non listed industry		--	--	--	
Households		--	--	--	
Mobile sources		--	--	--	
Total		224	32	0	

2.4 Releases from other sources

1,4-dioxane may be by-produced during productions of polyoxyethylenic nonionic detergents and its sulfic ester.

2.5 Main release route

1,4-dioxane is released mainly during use of 1,4-dioxane or chemicals including 1,4-dioxane.

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)	9/12	22/34	nd-1.2	0.14	0.0068	2001 Ministry of Environment
River water (microg/L)	--	26/35	nd-20	2.9	0.08	2001 Chemical Evaluation and Research Institute, Japan
Seawater (microg/L)	17/26	47/78	nd-160	4.3	0.08	2000 Ministry of Environment
Drinking water (microg/L)	-/16	- /97	nd-9.1	--	Not available	2000 Health, Labor and Welfare Ministry

Food (microg/g)	--	0/45	nd	--	0.01	1997 Japan Food Research Laboratories

nd: not detected

For calculation of the 95th percentile, data less than the detection limit are replaced with a value equal to 1/2 of the detection limit.

3.2 Estimated environmental concentration

Media	Estimated concentration	Description
Air (microg/m^3)	1.8	Calculated by mathematical model / Atmospheric Dispersion Model for Exposure and Risk Assessment (AIST-ADMER)
River water (microg/L)	10	Calculated by the mathematical model/ Initial Assessment System for the PRTR chemicals (IAS).

3.3 Estimated environmental concentration in water (EEC) for risk assessment

EEC(microg/L)	2.9
	The 95th percentile of measured concentration in river was used[1)]

3.4 Estimated human intake

Intake route		Concentrations used for estimation of intake	Estimated intake (microg/ person/ day)	Estimated intake (microg/ kg-Bodyweight (BW)/ day)
Inhalation	Air	0.14 (microg/m^3)	2.8	0.056
		The 95th percentile of measured concentration in air was used for the risk assessment.		
Oral	Drinking water	1.8 (microg/L)	3.6	0.072
		Maximum of measured concentration in tap water was used for the risk assessment.		
	Foods	0.0030 (microg/g)	0.36	0.0072
		-Japan Food Research Laboratories surveyed the concentration of 1,4-dioxane in food in 1997. In the survey, 1,4-dioxan was not detected in any samples. -Therefore the concentration in fish was estimated as a product of the concentration in seawater and a BCF. 4.3 (microg/L) * 0.7 (L/kg) = 3.0 (microg/kg)		
	Subtotal	--	4.0	0.080
Total route		--	6.8	0.14

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*	72 hours growth inhibition (biomass)	580 (mg/L)
Crustacea	Chronic	*Ceriodaphnia dubia*	7 days NOEC Reproduction	625 (mg/L)
Fish	Chronic	*Oryzias latipes*	21 days NOEC Growth	100 or higher (mg/L)
Key study		Data of algae was chosen for the key study because effects were observed at the lowest concentration in the hazard assessment.		

4.2 Human health toxicity

	Exposure route	Species	Dose term/ dose method	Toxic effects	NOAEL or LOAEL
Repeated dose toxicity	Inhalation	--	--	--	--
	Oral	Rat	2 years Drinking water	Degeneration and necrosis of hepatocytes, hyperplasia of hepatocytes, degeneration and regeneration of renal tubular epithelium	NOAEL 0.01% (9.6 mg/kgBW/day)
	Dermal	--	--	--	--
Reproductive and developmental toxicity	Oral	Rat	10 days	Suppression of body weight gain in dam, decreased body weight in fetus, decreased ossification ratio of breast bone	NOAEL 516 mg/kgBW/day
Carcinogenicity	Oral	Rat	104 weeks Drinking water	Increased incidence of hepatocellular adenoma (male)	NOAEL 200 ppm (26mg/kgBW/ day)
	Evaluation by IARC : Group 2B (possibly carcinogenic to humans)				
Genotoxicity	Not considered to be genotoxic.				

5. Risk Assessment

5.1 Environmental organisms

Risk characterization	EEC (microg/L)	NOEC* (mg/L)	MOE (NOEC* /EEC)	Product of uncertainty factors	Conclusion
	2.9	NOEC : 580	200,000	10	No immediate concern
	Product of uncertainty factors (UF):Extrapolation from laboratory test (10)				

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	0.056	No data	Not calculated	--	--
Oral	0.080	9.6	120,000	100	No immediate concern
Total	0.14	9.6 (oral)	69,000	100	No immediate concern
Product of uncertainty factors (UF) (oral and total): Interspecies (10) * Intraspecies (10) = 100					

5.2.2 Reproductive and developmental toxicity

Since NOAEL of reproductive and developmental toxicity is larger than NOAEL of repeated-dose toxicity, risk characterization of reproductive and developmental toxicity was not carried out.

5.2.3 Carcinogenicity

Exposure route	Intake (microg/kgBW/day)	NOAEL (mg/kgBW/day)	Risk characterization		
			MOE	Product of uncertainty factors	Conclusion
Total routes	0.14	26	190,000	1,000	No immediate concern
Product of uncertainty factors (UF): Interspecies (10) * Intraspecies (10) * carcinogenicity (10) = 1,000					

5.2.4 Recommendation for human health

Although there was no adequate toxicity data available to evaluate exposure via the inhalation route, the MOE calculated using total intake from both routes (inhalation and oral) is larger than the product of uncertainty factors. Thus, 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 in this assesment. The possibility remains that this substance may be carcinogenic to humans.

6. Supplement

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