4	CAS No.: 646-06-0	Substance: 1,3-Dioxolane

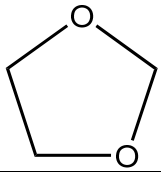
Chemical Substances Control Law Reference No.: 5-500

PRTR Law Cabinet Order No.:

Molecular Formula: $C_3H_6O_2$

Molecular weight: 74.08

Structural Formula:



1.General information

The aqueous solubility of this substance is 1×10^6 mg/L (25°C), the partition coefficient (1-octanol/water) (log K_{ow}) is −0.37 (pH unknown), and the vapor pressure is 1.46×10^4 Pa at (25°C). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 2%. In addition, the half-life for hydrolysis was more than one year (pH = 4, 7, 9; 25°C).

The main uses of this substance are as a cleaner for metal films; a polymer solvent for PVC; cellulose derivatives; a solvent for paints and adhesives; a component of photosensitive and developing solutions; an extraction solvent for oils, waxes and pharmaceuticals (vitamins, etc.); and a solvent for lithium-ion battery electrolytes. The production and import quantity in fiscal 2021 was less than 1,000 t.

2.Exposure Assessment

This substance was classified as a Class 1 Designated Chemical Substance prior to revision of substances regulated by the PRTR Law. Total release to the environment in fiscal 2021 under the PRTR Law was approximately 31 t, of which approximately 26 t or 84% were notified. All notified releases were to the atmosphere. In addition, 0.12 t was transferred to sewage and approximately 23 t was transferred to waste materials. Major sources of notified releases were the publishing, printing, and related industries; the plastic products manufacturing industry; the chemical industry; and the general machinery manufacturing industry. Including unnotified releases, the majority of releases to the environment were to the atmosphere. A multi-media model used to predict the proportions distributed to individual media in the environment indicated that in regions where the largest quantities were estimated to have been released to the environment overall or to the atmosphere and public water bodies in particular, the predicted proportion distributed to water bodies would be 97.8%.

The maximum expected concentration of exposure to humans via inhalation, based on ambient atmospheric data, was less than around 0.086 μg/m^3. Further, the mean annual value for atmospheric concentration in fiscal 2021 was calculated by use of a plume-puff model on the basis of releases to the atmosphere reported under the PRTR Law: this model predicts a maximum level of 1.9 μg/m^3.

Data for potable water, groundwater, public freshwater bodies, food, and soil to assess oral exposure could not be obtained. Thereupon, assuming ingestion solely from public freshwater bodies, an average daily exposure and maximum predicted daily exposure of less than around 0.096 μg/kg/day was obtained. Further, while no emissions to public freshwater bodies were notified in fiscal 2021 under the PRTR Law, transfer to sewage was reported. Accordingly, when releases to public freshwater bodies estimated from the reported transfer to sewage were divided by the ordinary water discharge of the national river channel structure database, estimating the concentration in rivers by taking into consideration only dilution gave a maximum value of 0.026 μg/L, and a calculated average daily exposure of 0.0010 μg/kg/day. Exposure to this substance by intake from an environmental medium via food is considered slight, given the low bioaccumulation of the substance expected on the basis of its physicochemical properties.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was less than around 2.4 μg/L for both public freshwater bodies and seawater. Further, while no emissions to public freshwater bodies were notified in fiscal 2021 under the PRTR Law, transfer to sewage was reported. Accordingly, when releases to public freshwater bodies estimated from the reported transfer to sewage were divided by the ordinary water discharge of the national river channel

structure database, estimating the concentration in rivers by taking into consideration only dilution gave a maximum value of 0.026 μg/L.

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3. Initial assessment of health risk

No information was available on acute symptoms in humans caused by this substance. Ataxia and respiratory depression were observed in the acute oral toxicity test in rats which reported the LD_{50} of 5,200 mg/kg.

Since not enough information was available on the carcinogenicity of the substance, the initial assessment was conducted based on information on its non-carcinogenic effects.

The NOAEL of 62 mg/kg/day for oral exposure (no observed effect dose), determined from toxicity tests in rats, was deemed the lowest reliable dose and was identified as the 'non-toxic level' of the substance for oral exposure. The NOAEL of 298 ppm for inhalation exposure (based on the increased red blood cell counts, the increased relative weight of the liver, and the decreased relative weight of the spleen), determined from toxicity tests in rats, was adjusted according to exposure conditions to obtain 53 ppm and subsequently divided by a factor of 10 to account for extrapolation to chronic exposure. The calculated value of 5.3 ppm (16 mg/m^3) was deemed the lowest reliable concentration and was identified as the 'non-toxic level' of the substance for inhalation exposure.

Regarding oral exposure, assuming that the substance is absorbed via public freshwater bodies, both the average exposure level and the predicted maximum exposure level were approximately less than 0.096 μg/kg/day. The MOE (Margin of Exposure) would exceed 65,000 which is calculated from the predicted maximum exposure level and the 'non-toxic level' of 62 mg/kg/day and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. This would lead to the health risk judgment that no further work would be required at present. The maximum exposure level was estimated to be 0.0010 μg/kg/day according to the concentration in effluents based on the transfers to the sewage system reported in FY 2021 under the PRTR Law. The MOE for reference would exceed 6,200,000 which is calculated from the estimated maximum exposure level and the 'non-toxic level' of 62 mg/kg/day and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. Since exposure to the substance in environmental media via food is presumed to be limited, despite the lack of exposure level via food, including it in the calculation would not change the MOE significantly. Therefore, as a comprehensive judgment, no further work would be required at present.

Regarding inhalation exposure, both the average exposure concentration and the predicted maximum exposure concentration in ambient air were approximately less than 0.086 μg/m^3. The MOE would exceed 19,000 which is calculated from the predicted maximum exposure concentration and the 'non-toxic level' of 16 mg/m^3 and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. This would lead to the health risk judgment that no further work would be required at present. The maximum concentration (annual mean) in ambient air near the operators that are releasing a large amount of the substance was estimated to be 1.9 μg/m^3, based on the releases to air reported in FY 2021 under the PRTR Law. The MOE for reference would be 840 which is calculated from the estimated maximum concentration (annual mean) in ambient air and the 'non-toxic level' of 16 mg/m^3 and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. Therefore, as a comprehensive judgment, no further work would be required at present.

Toxicity					Exposure assessment		Result of risk assessment		Comprehensive judgment
Exposure Path	Criteria for risk assessment		Animal	Criteria for diagnoses （endpoint）	Exposure medium	Predicted maximum exposure dose and concentration			
Oral	'Non-toxic level*'	62 mg/kg/day	Rats	No observed effect dose	Drinking water	- μg/kg/day	MOE	-	○
					Freshwater	＜0.096 μg/kg/day	MOE	>65,000	
Inhalation	'Non-toxic level*'	16 mg/m^3	Rats	The increased red blood cell counts, the increased relative weight of the liver, and the decreased relative weight of the spleen	Ambient air	<0.086 μg/m^3	MOE	>19,000	○
					Indoor air	- μg/m^3	MOE	-	×

Non-toxic level *

・When a LOAEL is available, it is divided by 10 to obtain a NOAEL-equivalent level.

・When an adverse effect level for the short-term exposure is available, it is divided by 10 to obtain a level equivalent to an adverse effect level for the long-term exposure.

4.Initial assessment of ecological risk

With regard to acute toxicity, the following reliable data were obtained: a 72-h EC_{50} exceeding 877,000 μg/L for growth inhibition in the green alga *Raphidocelis subcapitata*, a 48-h EC_{50} exceeding 772,000 μg/L for swimming inhibition in the crustacean *Daphnia magna*, and a 96-h LC_{50} exceeding 95,400 μg/L for the fish *Lepomis macrochirus* (bluegill). Accordingly, based on this acute toxicity value and an assessment factor of 100, a predicted no effect concentration (PNEC) exceeding 950 μg/L was obtained.

With regard to chronic toxicity, the following reliable datum was obtained: a 72-h NOEC of 877,000 μg/L for growth inhibition in the green alga *R. subcapitata*. Accordingly, based on this chronic toxicity values and an assessment factor of 100, a PNEC of 8,700 μg/L was obtained.

The value of 950 μg/L obtained from the acute toxicity to the fish was used as the PNEC for this substance.

The PEC/PNEC ratio is less than 0.003 for both freshwater bodies and seawater. According, further work to evaluate ecological risk is considered unnecessary at this time.

While no emissions to public freshwater bodies were notified in fiscal 2021 under the PRTR Law, transfer to sewage was reported. Accordingly, when releases to public freshwater bodies estimated from the reported transfer to sewage were divided by the ordinary water discharge of the national river channel structure database, estimating the concentration in rivers by taking into consideration only dilution gave a maximum value of 0.026 μg/L. The ratio of this value and PNEC was less than 0.00003. Accordingly, based on a comprehensive review of the above findings, further work is considered unnecessary at this time.

Hazard assessment (basis for PNEC)			Assessment coefficient	Predicted no effect concentration PNEC (μg/L)	Exposure assessment		PEC/ PNEC ratio	Comprehensive judgment
Species	Acute/ chronic	Endpoint			Water body	Predicted environmental concentration PEC (μg/L)		
Fish *Lepomis macrochirus*	Acute	LC_{50} Mortality	100	>950	Freshwater	<2.4	<0.003	○
					Seawater	<2.4	<0.003	

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	No need for further work.	○
	Inhalation exposure	No need for further work.	○
Ecological risk	No need for further work.		○

［Risk judgments］○: No need for further work ▲: Requiring information collection

■: Candidates for further work ×: Impossibility of risk characterization