3	CAS No.: 111-42-2	Substance: Diethanolamine

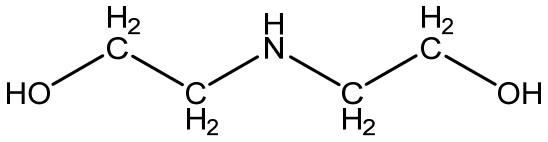
Chemical Substances Control Law Reference No.: 2-302

PRTR Law Cabinet Order No.:

Molecular Formula: $C_4H_{11}NO_2$

Molecular Weight: 105.14

Structural Formula:



1.General information

The aqueous solubility of this substance is 2.07×10^7 mg/1,000 g (20°C), the partition coefficient (1-octanol/water) (log K_{ow}) is –1.43, and the vapor pressure is 2.8×10^{-4} mmHg (=0.037 Pa) (25°C). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 51.4% and biodegradability is judged to be good. In addition, this substance does not possess any hydrolyzable groups and hydrolysis does not occur under ambient environmental conditions.

This substance is classified as a priority assessment chemical substance under the Act on the Evaluation of Chemical Substances and Regulation of their Manufacture etc. from the perspectives of its effects on human health and ecology.

The main uses of this substance are as an additive for synthetic detergents (as a raw material for neutralizers and foam stabilizers), emulsifiers, cosmetics (creams), shoe polish, polishes, and waxes; organic synthesis of agricultural chemicals, etc. (pharmaceuticals, agricultural chemicals, rubber additives, surfactants, etc.); an additive for metal working fluids and lubricants; an additive for pesticides; a raw material for fiber softeners; gas refining (removal of carbon dioxide gas and hydrogen sulfide from syngases used for ammonia and methanol synthesis); an organic solvent; a pH regulator; and a neutralizer. It is also used as a buffer for pharmaceuticals, a stabilizer, and a solubilizer. The production and import quantity in fiscal 2018 was 14,385 t.

2.Exposure assessment

Because this substance is not classified as a Class 1 Designated Chemical Substance under the PRTR Law, release and transfer quantities could not be obtained. Predictions of proportions distributed to individual media by use of a Mackay-type level III fugacity model indicate that if equal quantities were released to the atmosphere, water bodies, and soil, the proportion distributed to soil would be largest.

The maximum expected concentration of exposure to humans via inhalation was not established because neither data measured for the ambient atmosphere nor indoor air could be obtained.

Data for potable water, ground water, food, and soil to assess oral exposure could not be obtained. Thus, assuming intake solely from public freshwater bodies, a maximum expected concentration of exposure of around 0.029 μg/kg/day was obtained. The risk of 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 reported to be around 0.72 μg/L for public freshwater bodies and around 1.1 μg/L for seawater.

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3. Initial assessment of health risk

This substance is corrosive to the eyes, and ingestion will cause abdominal pain and burning sensation. Contact to the eyes will cause redness, pain, and severe deep burns.

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

The LOAEL of 14 mg/kg/day for oral exposure (based on anemia, nephropathy and tubular mineralization), determined from toxicity tests in rats, was divided by a factor of 10 to account for uncertainty in using a LOAEL, and by another factor of 10 to account for extrapolation to chronic exposure. The calculated value of 0.14 mg/kg/day was deemed to be the lowest reliable dose and was identified as the 'non-toxic level' of the substance for oral exposure. The NOAEL of 3.3 mg/m^3 for inhalation exposure (based on increase in the relative weight of liver and squamous metaplasia of the larynx), determined from toxicity tests in rats, was adjusted according to exposure conditions to obtain 0.59 mg/m^3 and subsequently divided by a factor of 10 to account for extrapolation to chronic exposure. The calculated value of 0.059 mg/m^3 was deemed to be the lowest reliable concentration and was identified as the 'non-toxic level' of the substance for inhalation exposure.

Regarding the oral exposure, assuming that the substance is absorbed via public freshwater bodies, the predicted maximum exposure level would be 0.029 µg/kg/day, approximately. The MOE (Margin of Exposure) would be 97, when calculated from the predicted maximum exposure level and the 'non-toxic level' of 0.14 mg/kg/day, and subsequently divided by a factor of 10 to account for extrapolation from animals to the humans, and by another factor of 5 to take into consideration the carcinogenicity in animals. This would lead to the health risk judgment that collection of information would be required. 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, collection of information would be required to assess the health risk of this substance via oral exposure, starting from data on exposure based on current releases.

Regarding the inhalation exposure, due to the lack of identified exposure concentrations, the health risk could not be assessed. The vapor pressure of the substance is relatively low, and predictions of the multimedia fugacity model indicated that the proportion distributed to air was little. Therefore, as a comprehensive judgment, collection of further information would not be required to assess the health risk of this substance via inhalation in ambient air.

Toxicity				Exposure assessment		MOE		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' 0.14 mg/kg/day	Rats	Anemia, nephropathy and tubular mineralization etc.	Drinking water	- µg/kg/day	MOE	-	▲
				Public Freshwater bodies	0.029 µg/kg/day	MOE	97	
Inhalation	'Non-toxic level' 0.059 mg/m^3	Rats	Increase in the relative weight of liver and squamous metaplasia of the larynx	Ambient air	- µg/m^3	MOE	-	○
				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} of 7,800 µg/L for growth inhibition in the alga *Desmodesmus subspicatus*, a 48-h LC_{50} of 30,100 µg/L for the crustacean *Ceriodaphnia dubia/affinis*, a 96-h LC_{50} of 460,000 µg/L for the fish species *Oncorhynchus mykiss* (rainbow trout), and a 48-h LC_{50} of 1,174,000 µg/L for African clawed frog (3–4-week-old tadpoles) *Xenopus laevis*. Accordingly, based on these acute toxicity values and an assessment factor of 100, a PNEC of 78 µg/L was obtained.

With regard to chronic toxicity, the following reliable data were obtained: a 72-h NOEC of 600 µg/L for growth inhibition in the alga *Raphidocelis subcapitata* and a 21-d NOEC of 780 µg/L for reproductive inhibition in the crustacean *Daphnia*

magna. Accordingly, based on these chronic toxicity values and an assessment factor of 100, a PNEC of 6 μg/L was obtained

The value of 6 μg/L obtained from the chronic toxicity to the alga was used as the PNEC for this substance.

The PEC/PNEC ratio was 0.12 for freshwater bodies and 0.18 for seawater; accordingly, efforts to collect data are considered necessary for determining ecological risk. A comprehensive review of the above findings draws the same conclusion.

Efforts to elucidate trends in production and import quantities of this substance, and quantities used in different applications are considered necessary, and environmental concentration data needs to be augmented. Further, efforts to collect data regarding chronic toxicity levels for fish species are considered necessary.

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)		
Green algae	Chronic	NOEC Growth inhibition	100	6	Freshwater	0.72	0.12	▲
					Seawater	1.1	0.18	

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	Requiring information collection.	▲
	Inhalation exposure	No need for further work.	○
Ecological risk	Requiring information collection.		▲

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

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