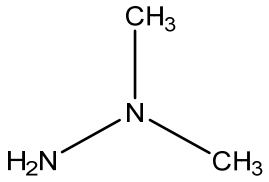
5	CAS No.: 57-14-7	Substance: 1,1-Dimethylhydrazine

Chemical Substances Control Law Reference No.: 2-200 (Unsymmetrical dimethylhydrazine)

PRTR Law Cabinet Order No.: 1-226

Molecular Formula: $C_2H_8N_2$ Structural Formula:

Molecular Weight: 60.10



1. General information

This substance is freely miscible in water (exothermic), the partition coefficient (1-octanol/water) (log K_{ow}) is −0.40 (pH = 10.0), and the vapor pressure is 157 mmHg (= 2.09×10^4 Pa) (25°C). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 0% and bioaccumulation is thought to be nonexistent or low. In addition, this substance does not possess any hydrolyzable groups.

This substance is classified as a Class 1 Designated Chemical Substance under the PRTR Law. The main uses of this substance are as a raw material for synthetic resin and fiber stabilizers, pharmaceuticals, agricultural chemicals, and surfactants; it is also used as a rocket propellant. The production and import quantity in fiscal 2017 was not disclosed because the number of reporting businesses was not more than two. The production and import quantity under the PRTR Law was more than 100 t.

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2. Exposure assessment

Total release to the environment in fiscal 2017 under the PRTR Law was 0.005 t, and all releases were reported. All reported releases were to the atmosphere, and 0.0003 t was transferred to waste materials. The chemical industry was the sole reporter of releases. A multimedia model used to predict the proportions distributed to individual media in the environment indicates that in regions where the largest quantities were estimated to have been released to the environment overall or the atmosphere in particular, the predicted proportion distributed to the atmosphere was 51.7%, and that to water bodies was 36.4%.

The maximum expected concentration of exposure to humans via inhalation could not be determined because ambient atmospheric and indoor air quality data could not be obtained. The mean annual value for the atmospheric concentration in fiscal 2017 was calculated by use of a plume-puff model on the basis of releases to the atmosphere reported according to the PRTR Law; this model predicts a maximum level of 0.0013 μg/m^3 .

Data for potable water, ground water, public freshwater bodies, food, and soil to assess oral exposure could not be obtained. In lieu of such data, the maximum expected exposure was calculated to be around less than 0.0022 μg/kg/day assuming intake solely from public freshwater bodies. Further, in a study covering a limited area for a water treatment plant, concentrations were below the detection limit (less than 10 μg/L) in both the raw water and the purified water. The likelihood of the environmental concentration of this substance exceeding the concentration in purified water is considered low because the likelihood of this substance forming during the water purification process is also considered low. Further, there were no releases to public water bodies reported in fiscal 2017 under the PRTR Law. On this account, public water body concentrations are thought to be low. Given the low bioaccumulation of the substance, the risk of exposure to this substance by intake from an environmental medium via food is considered slight.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was reported to be around less than 0.055 μg/L for public freshwater bodies, whereas data for setting the PEC for seawater could not be obtained. There were no releases to public water bodies reported in fiscal 2017 according to the PRTR Law. On this account, public water body concentrations are thought to be low.

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3. Initial assessment of health risk

This substance is irritating to the eyes, skin and respiratory tract. Both inhalation and ingestion cause cough, sore throat,

burning sensation, nausea, headache, vomiting, labored breathing and convulsions. Inhalation of the vapor may cause lung edema. Contact with the eyes or skin causes redness and pain.

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

The NOAEL of 0.1 mg/kg/day for oral exposure (based on corneal calcification), determined from toxicity tests in rats, was deemed to be the lowest reliable dose and was identified as the 'non-toxic level' of the substance for oral exposure. The LOAEL of 0.89 ppm for inhalation exposure (based on suppression of body weight gain, effects on nasal mucosa and angiectasis in the liver, etc.), determined from toxicity tests in mice, was divided by a factor of 10 to account for uncertainty in using a LOAEL. The calculated value of 0.089 ppm (0.22 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.

With regard to oral exposure, assuming the substance is absorbed via public freshwater bodies, the predicted maximum exposure level would be less than 0.0022 μg/kg/day, approximately. The MOE (Margin of Exposure) would exceed 910, when calculated from the predicted maximum exposure level and the 'non-toxic level' of 0.1 mg/kg/day, and subsequently divided by a factor of 10 to account for extrapolation from animals to humans and by another factor of 5 to take into consideration the carcinogenicity in animals. This would lead to the health risk judgment that no further work would be required at present. Since exposure to the substance in environmental media via food is presumed to be limited in spite of data unavailability, including it in the calculation would not change the MOE significantly. Therefore, as a comprehensive judgment, no further work would be required at present to assess the health risk of this substance via oral exposure.

With regard to inhalation exposure, owing to the lack of identified 'non-toxic level', the health risk could not be assessed. However, the MOE for reference would be 3,400, when calculated from the concentration in ambient air of 0.0013 μg/m^3 and the 'non-toxic level' for inhalation exposure of 0.22 mg/m^3, and subsequently divided by a factor of 10 to account for extrapolation from animals to humans and by another factor of 5 to take into consideration the carcinogenicity in animals. This concentration was estimated as the maximum concentration (annual mean) in ambient air near the operators releasing large amount of this substance based on the releases to air reported in FY 2017 under the PRTR Law. 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' 0.1 mg/kg/day	Rats	Corneal calcification	Drinking water	- μg/kg/day	MOE	-	○
				Public Freshwater bodies	<0.0022 μg/kg/day	MOE	>910	
Inhalation	'Non-toxic level' 0.22 mg/m^3	Mice	Suppression of body weight gain, effects on nasal mucosa and angiectasis in the liver etc.	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.

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4. Initial assessment of ecological risk

With regard to acute toxicity, the following reliable data were obtained: a 72-h EC_{50} of 2090 μg/L for growth inhibition in the alga *Raphidocelis subcapitata*, a 48-h EC_{50} of 1280 μg/L for swimming inhibition in the crustacean *Daphnia magna*, a 96-h LC_{50} of 6600 μg/L for the American catfish *Ictalurus punctatus*, and a 96-h LC_{50} of 28,900 μg/L for the mole salamander *Ambystoma* spp. Accordingly, based on these acute toxicity values and an assessment factor of 100, a predicted

no effect concentration (PNEC) of 12 μg/L was obtained.

With regard to chronic toxicity, the following reliable data was obtained: a 72-d NOEC of 129 μg/L for growth inhibition in the green alga *R. subcapitata.* Accordingly, based on this chronic toxicity value and an assessment factor of 100, a PNEC of 1.2 μg/L was obtained.

The value of 1.2 μg/L obtained from the chronic toxicity to the green alga was used as the PNEC for this substance.

The PEC/PNEC ratio is less than 0.05 for freshwater bodies; accordingly, further work to evaluate the ecological risk in freshwater bodies is considered unnecessary at this time. The risk for seawater could not be evaluated.

However, no releases to public freshwater bodies were reported in in fiscal 2017 under the PRTR Law; accordingly, this substance's concentration in public water bodies is thought to be low. Accordingly, based on a comprehensive review of the above findings, there is little need to collect new data regarding this substance.

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	1.2	Freshwater	<0.055	<0.05	○
					Seawater	—	—	

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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