4	CAS No.: 112-57-2	Substance: Tetraethylene pentamine

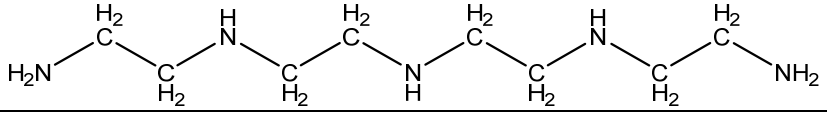
Chemical Substances Control Law Reference No.: 2-162, 7-5 (Alkyl (or alkenyl) (C1–24)) or unmodified polyalkylene polyamine)

PRTR Law Cabinet Order No.: 1-276

Molecular Formula: $C_8H_{23}N_5$

Structural Formula:

Molecular Weight: 189.30



1.General information

The aqueous solubility of this substance is 6.54×10^6 mg/L, the partition coefficient (1-octanol/water) (log K_{ow}) is -3.16 (calculated value), and the vapor pressure is 8.00×10^{-7} mmHg (=1.1×10^{-4} Pa) (25°C). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 0%. In addition, this substance does not possess any hydrolyzable groups and hydrolysis does not occur under ambient environmental conditions (pH=5–9).

This substance is classified as Class 1 Designated Chemical Substances under the PRTR Law.

The main uses of this substances are as a raw material for polyamide resin and surfactants, an epoxy curing agent, an asphalt additive, a corrosion inhibitor, and a lubricant additive. The production and import quantity in fiscal 2018 was 3,000 t.

2.Exposure assessment

Total release to the environment in fiscal 2018 under the PRTR Law was approximately 3.5 t, of which approximately 2.3 t or 66% of overall releases were reported. The majority of reported releases were to public water bodies. In addition, approximately 11 t was transferred to waste materials, and approximately 0.56 t was transferred to sewage. The shipbuilding and repair industry, ship engine manufacturing industry, ceramics and soil and stone product manufacturing industry, and chemical industry reported releases to the atmosphere. The chemical industry was the sole reporter of releases to public water bodies.

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 public water bodies in particular, the predicted proportion distributed to water bodies was 95.3%. Where the largest quantity was estimated to have been released the atmosphere, the predicted proportion distributed to soil was 93.3%.

The maximum expected concentration of exposure to humans via inhalation was not established because neither data measured for ambient atmospheric data nor indoor air could be obtained. However, the mean annual value for atmospheric concentration in fiscal 2018 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 0.082 μg/m^3.

Data for potable water, ground water, food, and soil to assess oral exposure could not be obtained. Further, no releases to public freshwater bodies were reported in fiscal 2018 under the PRTR Law but transfer to sewage was reported. Accordingly, when releases to public freshwater bodies estimated from 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 0.0020 μg/L, and the oral exposure calculated thereof is 0.000082 μg/kg/day. 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.

Data for setting the predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, could not be obtained. Further, no releases to public freshwater bodies were reported in fiscal 2018 under the PRTR Law but

transfer to sewage was reported. Accordingly, when releases to public freshwater bodies estimated from 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 0.0020 μg/L.

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3. Initial assessment of health risk

This substance is corrosive, and inhalation will cause a cough, sore throat, burning sensation, shortness of breath, and labored breathing. Ingestion will cause burns in the mouth and throat, as well as burning sensation in the throat and chest, and will cause shock or collapse. Contact to the skin will cause redness, pain, and skin burns. Contact to the eyes will cause redness, pain, and 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 NOAEL of 2,800 mg/kg/day for oral exposure (based on suppression of body weight gain, decrease in the absolute and relative weight of liver, as well as increase in the relative weight of kidneys), determined from toxicity tests in rats, was divided by a factor of 10 to account for extrapolation to chronic exposure. The calculated value of 280 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 'non-toxic level' for inhalation exposure could not be identified.

Regarding the oral exposure, due to the lack of identified exposure levels, the health risk could not be assessed. However, the MOE (Margin of Exposure) for reference would be 340,000,000, when calculated from the estimated maximum exposure level of 0.000082 μg/kg/day and the 'non-toxic level' of 280 mg/kg/day, and subsequently divided by a factor of 10 to account for extrapolation from animals to the humans. This maximum exposure level was estimated according to the concentration in effluents from the high discharging plants based on the releases to public freshwater bodies reported in FY 2018 under the PRTR Law. 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. In addition, the MOE will still be high enough, when it is calculated from the expected 'non-toxic level' derived from the new evidence, if available, on health effects of chronic exposure. The expected 'non-toxic level' will be two or three orders lower than the present value derived from the seven-days administration test. Therefore, as a comprehensive judgment, collection of further information would not be required to assess the health risk of this substance via oral exposure.

Regarding the inhalation exposure, due to the lack of identified 'non-toxic level' and exposure concentrations, the health risk could not be assessed. However, the MOE for reference would be 1,100,000, when calculated from the tentative 'non-toxic level' for inhalation exposure of 930 mg/m^3 and the concentration in ambient air of 0.082 μg/m^3, and subsequently divided by a factor of 10 to account for extrapolation from animals to the humans. This concentration in ambient air was estimated as the maximum concentration (annual mean) in ambient air, near the operators that are releasing large amount of the substance, based on the releases to air reported in FY 2018 under the PRTR Law. The tentative 'non-toxic level' for inhalation exposure was derived from the conversion of the 'non-toxic level' for oral exposure, assuming that 100% of the inhaled substance is absorbed. 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' 280 mg/kg/day	Rats	Suppression of body weight gain, decrease in the absolute and relative weight of liver etc.	Drinking water	- μg/kg/day	MOE	-	○
				Groundwater	- μg/kg/day	MOE	-	
Inhalation	'Non-toxic level' - mg/m^3	-	-	Ambient air	- $\mu g/m^3$	MOE	-	○
				Indoor air	- $\mu g/m^3$	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 121 μg/L for growth inhibition in the alga *Raphidocelis subcapitata*, a 48-h EC_{50} of 13,400 μg/L for swimming inhibition in the crustacean *Daphnia magna*, and a 96-h LC_{50} exceeding 69,600 μg/L for the fish species *Oryzias latipes* (medaka). Accordingly, based on these acute toxicity values and an assessment factor of 100, a predicted no effect concentration (PNEC) of 1.2 μg/L was obtained.

With regard to chronic toxicity, the following reliable data were obtained: a 72-h NOEC of 10 μg/L for growth inhibition in the alga *R. subcapitata*, and a 21-d NOEC of 140 μg/L for reproductive inhibition in the crustacean *D. magna.* Accordingly, based on these chronic toxicity values and an assessment factor of 100, a PNEC of 0.1 μg/L was obtained.

The value of 0.1 μg/L obtained from the chronic toxicity to the alga was used as the PNEC for this substance.

Data for setting the predicted environmental concentration (PEC) could not be obtained for this substance. Accordingly, an assessment of ecological risk could not be made.

No releases to public freshwater bodies were reported in fiscal 2018 under the PRTR Law but transfer to sewage was reported. Accordingly, when releases to public freshwater bodies estimated from 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 0.0020 μg/L. The ratio of this value with the PNEC is 0.02.

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	0.1	Freshwater	—	—	○
					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