10	CAS No: －	Substance: Organic tin compounds (Dimethyltin compounds)

Chemical Substances Control Law Reference No.:
PRTR Law Cabinet Order No.:1-239 (Organic tin compounds)

1. General information

Dimethyltin compounds is a generic term for compounds in which two methyl groups are covalently bonded to a tin atom. They include dimethyltin dichloride (DMTC).

The vapor pressure of DMTC is 0.225 mmHg (=30.0 Pa) (25°C). DMTC decomposes rapidly in water to form dimethyltin hydroxide and this hydroxide eventually precipitates.

Organic tin compounds are classified as Class 1 Designated Chemical Substances under the PRTR Law. The main uses of DMTC are as stabilizers, intermediates for the manufacture of organic tin compounds, and glass coatings.

The production and import quantity of mono (or di) methyltin tri (or di) chloride in fiscal 2015 was not disclosed because the number of reporting businesses was less than two. The production and import category under the PRTR Law for organic tin compounds is more than 100 t. The production quantity as organic tin stabilizers in fiscal 2015 was 3,056 t.

---

2. Exposure assessment

Total release of organic tin compounds to the environment in fiscal 2015 under the PRTR Law was 5.4 t, of which approximately 5.4 t or 99% were reported. The majority of reported releases were to atmosphere. In addition, 0.019 t was transferred to sewage and 36 t was transferred to waste materials. Industry types with large reported releases were ceramics and soil and stone product manufacturing for the atmosphere, and transportation equipment manufacturing for public water bodies. The largest release among releases to the environment, including those unreported, was to the atmosphere. A prediction of distribution proportions by individual media was not carried out because the physicochemical properties required for predicting these distribution proportions were lacking.

The maximum expected concentration of exposure to humans via inhalation, based on general environmental atmospheric data, was around 0.0048 μg/m^3 (dimethyltin (DMT) equivalent). The mean annual value for the atmospheric concentration in fiscal 2015 was calculated by using a plume-puff model on the basis of releases to the atmosphere reported according to the PRTR Law; this model predicted a maximum level of 0.088 μg/m^3 (DMT equivalent) when businesses highly unlikely to be handling dimethyltin compounds are excluded.

The maximum expected oral exposure was estimated to be around 0.0030 μg/kg/day (DMT equivalent) based on calculations from data for public freshwater bodies. In contrast, when releases to public freshwater bodies in fiscal 2015 reported according to the PRTR Law 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 1.2 μg/L (DMT equivalent), assuming all reported releases were dimethyltin compounds. This estimated value is significantly higher than the 0.0075 μg/L (DMT equivalent) obtained from measurements taken downstream of applicable business sites. For this reason, the maximum expected oral exposure was calculated using the concentration of 0.0088 μg/L (DMT equivalent) obtained from downstream of the business establishment where the second highest concentration was estimated to give 0.00035 μg/kg/day (DMT equivalent).

Food data, concentration in fish species, and bioconcentration factor (BCF) are not available for these substances. For this reason, alternative data were used to calculate the exposure by intake from an environmental medium via food for reference. The concentration of dimethyltin compounds in public freshwater bodies (0.075 μg/L) and the BCF of analogue dibutyltin compounds (110) were used to calculate the concentration in fish species. The maximum concentration (fiscal 2005) in shellfish for analogue dibutyltin compounds of 0.015 μg/g was also used, together with

average daily intakes of 66.6 g/capita/day for fish species and 2.4 g/capita/day for shellfish species. This gave a value of 0.012 μg/kg/day (DMT equivalent). Combining this with the oral exposure estimated from public freshwater body data gives 0.015 μg/kg/day (DMT equivalent).

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was reported to be around 0.075 μg/L (DMT equivalent) for public freshwater bodies and around 0.0048 μg/L (DMT equivalent) for seawater. When releases to public freshwater bodies in fiscal 2015 reported according to the PRTR Law 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 1.2 μg/L (DMT equivalent), assuming all reported releases were dimethyltin compounds. This estimated value is significantly higher than the 0.0075 μg/L (DMT equivalent) obtained from measurements taken downstream of applicable businesses. For this reason, the concentration of 0.0088 μg/L (DMT equivalent) obtained from downstream of the business establishment where the second highest concentration was estimated was adopted.

---

3. Initial assessment of health risk

No information was available on acute symptoms in humans. Anorexia, decrease in body weight, clonic convulsions, tremors, irritability and conjunctival hyperemia were observed in rabbits exposed to dimethyltin dichloride by ingestion. Hematologically, marked decrease in the concentration of hemoglobin and the number of red blood cells and reticulocytosis were observed. Hypoactivity, ataxia, labored respiration, soft feces, rough fur and soiled fur around genital area were observed in rats exposed to dimethyltin bis(isooctyl thioglycolate) (DMT(IOTG)) by ingestion.

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

The NOAEL for oral exposure of 0.62 mg/kg/day (based on neurological symptoms, inhibition of body weight gain and effects on tissues from brain, kidneys and thymus), determined from toxicity tests in rats exposed to the mixture of DMTC and monomethyltin trichloride (MMTC), was divided by a factor of 10 to account for extrapolation to chronic exposure. The calculated value of 0.062 mg/kg/day was deemed to be the lowest reliable dose and the value of 0.042 mg/kg/day, obtained by conversion to dimethyltin (DMT) for compatibility with the estimate of the exposure level, was identified as the ‘non-toxic level*’ of the compounds for oral exposure. The ‘non-toxic level*’ for inhalation exposure could not be identified.

With regard to oral exposure, assuming the compounds are absorbed via public freshwater bodies, the predicted maximum exposure level would be 0.0030 μg/kg/day, approximately. The MOE (Margin of Exposure) would be 1,400, when calculated from the predicted maximum exposure level and the ‘non-toxic level*’of 0.042 mg/kg/day, and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. In addition, the maximum exposure level was calculated to be 0.00035 μg/kg/day. This value derives from the estimated concentration in the effluents from the high discharging plants, according to the releases of the organic tin compounds reported in FY 2015 under the PRTR Law. The MOE would be 12,000, when calculated from this level. Assuming the compounds are absorbed via public freshwater bodies and seafood in the context of unidentified exposure level via food, the maximum exposure level would be 0.015 μg/kg/day, and the MOE calculated from this level would be 280. Therefore, no further work would be required at present to assess the health risk of dimethyltin compounds via oral exposure.

With regard to inhalation exposure, owing to the lack of identified ‘non-toxic level*’, the health risk could not be assessed. Assuming that 100% of the ingested compounds is absorbed, the ‘non-toxic level*’ for inhalation exposure, derived from the conversion of the ‘non-toxic level*’ for oral exposure, would be 0.14 mg/m^3. The predicted maximum exposure concentration in ambient air was 0.0048 μg/m^3, approximately. The MOE would be 2,900, when calculated from the predicted maximum exposure concentration and the converted ‘non-toxic level*’ for inhalation exposure, and

subsequently divided by a factor of 10 to account for extrapolation from animals to humans. The maximum concentration (annual mean) in ambient air near the operators releasing large amount of organic tin compounds was estimated to be 0.088 μg/m^3 based on the releases reported in FY 2015 under the PRTR Law. The MOE would be 160, when calculated from this concentration. Therefore, collection of further information would not be required to assess the health risk of dimethyltin compounds via inhalation in ambient air.

Toxicity				Exposure assessment		Result of risk assessment			Judgment
Exposure Path	Criteria for risk assessment	Animal	Criteria for diagnoses (endpoint)	Exposure medium	Predicted maximum exposure dose and concentration				
Oral	'Non-toxic level*' 0.042 mg/kg/day	Rats	Neurological symptoms, inhibition of body weight gain and effects on tissues from brain, kidneys and thymus	Drinking water	— μg/kg/day	MOE	—	×	○
				Public Freshwater bodies	0.0030 μg/kg/day	MOE	1,400	○	
Inhalation	'Non-toxic level*' — mg/m^3	—	—	Ambient air	0.0048 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 25,100 μg/L for growth inhibition in the green alga *Desmodesmus subspicatus*, a 48-h EC_{50} of 11,500 μg/L for immobilization in the crustacean *Daphnia magna*, and a 48-h LC_{50} of 4,060 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 41 μg/L was obtained.

With regard to chronic toxicity, the following reliable data were obtained: a 72-h NOEC of 745 μg/L for growth inhibition in the green alga *D. subspicatus*. Accordingly, based on this chronic toxicity value and an assessment factor of 100, a predicted no effect concentration (PNEC) 7.5 μg/L was obtained.

The value of 7.5 μg/L obtained from the chronic toxicity for green algal species was used as the PNEC for this substance.

The PEC/PNEC ratio is 0.01 for freshwater bodies and less than 0.0006 for seawater; accordingly, further work is considered unnecessary at this time. When releases to public freshwater bodies in fiscal 2015 reported according to the PRTR Law 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 value of 0.0088 μg/L (DMT equivalent), assuming all reported releases were dimethyltin compounds. The ratio of this value and PNEC is 0.001.

Hazard assessment (basis for PNEC)			Assessment coefficient	Predicted no effect concentration PNEC (μg/L)	Exposure assessment		PEC/ PNEC ratio	Judgment based on PEC/PNEC ratio	Assessment result
Species	Acute/ chronic	Endpoint			Water body	Predicted environmental concentration PEC (μg/L)			
Green algae	Chronic	NOEC Growth inhibition	100	7.5	Freshwater	0.075	0.01	○	○
					Seawater	<0.0048	<0.0006		

---

5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	No need for further work.	○
	Inhalation exposure	Although risk to human health could not be confirmed, collection of further information would not be required.	(○)
Ecological risk	No need of further work at present.		○

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

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

（○）: Although risk to human health could not be confirmed, collection of further information would not be required.

（▲）: Further information collection would be required for risk characterization.