11	CAS No.: 13494-80-9 (Tellurium)	Substance: Tellurium and its compounds

Chemical Substances Control Law Reference No.:
PRTR Law Cabinet Order No.:
Chemical symbol: Te
Atomic weight: 127.60

1. General information

Tellurium compounds include tellurium dioxide and sodium tellurate. Concentration tests using tellurium (IV) chloride classify tellurium as a “metal for which concentration is not observed.”

The main uses of tellurium are as an additive for specialty steels (for improving the machinability of steel), in copper telluride, as a catalyst, as a vulcanization accelerator for synthetic rubbers, in adhesives for glass and ceramics, in photosensitive selenium compounds, in cadmium telluride (for photovoltaic solar cells), in bismuth telluride, and in lead telluride (for semiconductors).

Tellurium is extracted in the form of metallic tellurium from the electrolysis slime that is a byproduct of copper refining. Tellurium is not produced from the hydrometallurgical process, which has been increasingly adopted in recent years. The production and import quantity in fiscal 2014 as tellurium dioxide was less than 1,000 t, while the production and import quantity in fiscal 2014 was not disclosed because the number of reporting businesses was less than two.

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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. A Keidanren-sponsored PRTR (Pollutant Release and Transfer Register) survey in 1999 reported environmental emissions and transfers of tellurium and its compounds as 0 t.

Further, Kida et al. estimated annual releases of tellurium from general waste incinerators to be less than 0.3 t assuming three-quarters of Japan’s annual waste volume is incinerated. Further, they estimated releases of less than 6 t when taking into account uncontrolled burning such as open burning. Further, the quantity of tellurium present in printed circuit boards used in nine major types of small home appliances disposed of in Japan is estimated to be 152 kg/y. In addition, the quantity of tellurium present in circuit boards enclosed in desktop and laptop computers manufactured in 1998 and subsequently discarded was reported to be less than 1 mg/kg.

Predicting the proportions distributed to individual media is inappropriate because tellurium and its compounds transform into various chemical forms in the environment. Accordingly, the proportions distributed to individual media for tellurium and its compounds were not predicted.

The maximum expected concentration of exposure to humans via inhalation, based on ambient atmospheric data, was generally 0.00024 µg Te/m^3. The maximum expected oral exposure was estimated to be less than 0.00076 µg Te/kg/day on the basis of calculations from data for public freshwater bodies. Furthermore, the predicted maximum exposure calculated from past data for public freshwater bodies and soil was around 0.12 µg Te/kg/day.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was reported to be less than 0.019 µg Te/L for both public freshwater bodies and seawater. Furthermore, past data indicated around 3 µg Te/L for public freshwater bodies and around less than 1 µg Te/L for seawater.

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3. Initial assessment of health risk

The aerosol of tellurium is irritating to the eyes and respiratory tract, and may cause effects on the liver and central nervous system. Inhalation of the substance causes drowsiness, dry mouth, metallic taste, headache, garlic odor and nausea, and its ingestion causes abdominal pain, constipation and vomiting in addition to the same symptoms as inhalation. Contact with the eyes causes redness and pain.

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

The NOAEL for oral exposure of 2.1 mg Te/kg/day (based on inhibition of body weight gain), determined from medium-term toxicity tests in rats, was divided by a factor of 10 to account for extrapolation from sub-chronic to chronic exposure. The calculated value of 0.21 mg Te/kg/day was deemed to be the lowest reliable dose and was identified as the 'non-toxic level*' of tellurium for oral exposure. The 'non-toxic level*' for inhalation exposure could not be identified.

With regard to oral exposure, assuming the substance is absorbed via public freshwater bodies, the predicted maximum exposure level would be less than 0.00076 µg Te/kg/day. The MOE (Margin of Exposure) would be over 28,000, when calculated from the predicted maximum exposure level and the 'non-toxic level*'of 0.21 mg Te/kg/day, and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. For comparison, based on the concentrations in public freshwater bodies reported in 2003, the predicted maximum exposure level was 0.12 µg Te/kg/day. The MOE would be 180, when calculated from this level. Since neither the exposure level of the substance in environmental media via food nor its contribution to oral exposure is known, it would be required to collect information on exposure level via food.

With regard to inhalation exposure, owing to lack of identified 'non-toxic level*', the health risk could not be assessed. Assuming that 100% of the ingested substances is absorbed, the 'non-toxic level*' for inhalation exposure, derived from the conversion of oral exposure concentration, would be 0.70 mg Te/m^3. The predicted maximum exposure concentration in ambient air was 0.00024 µg Te/m^3. The MOE would be 290,000, when calculated from the predicted maximum exposure concentration in ambient air 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. Therefore, collection of further information would not be required to assess the health risk of this substance 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*'	0.21	mgTe/kg/day	Rats	Inhibition of body weight gain	Drinking water	—	µgTe/kg/day	MOE	—	×	(▲)
						Public Freshwater bodies	<0.00076	µgTe/kg/day	MOE	>28,000	○	
Inhalation	'Non-toxic level*'	—	mgTe/m^3	—	—	Ambient air	0.00024	µgTe/m^3	MOE	—	×	(○)
						Indoor air	—	µgTe/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 for tellurium (IV): a 72-h EC_{50} of more than 11,700 µg Te/L for growth inhibition in the green algae *Pseudokirchneriella subcapitata*, a 48-h EC_{50}

of 1,200 µg Te/L for immobilization in the crustacean *Daphnia magna*, and a 96-h LC_{50} of 37,100 µg Te/L for the fish species *Oncorhynchus mykiss* (rainbow trout). Accordingly, based on these acute toxicity values and an assessment factor of 100, a predicted no effect concentration (PNEC) of 12 µg Te/L was obtained.

With regard to chronic toxicity, the following reliable data was obtained for tellurium (IV): a 72-h NOEC of 3,340 µg Te/L for growth inhibition in the green algae *P. subcapitata*. Accordingly, based on this chronic toxicity value and an assessment factor of 100, a PNEC of 33 µg Te/L was obtained.

Toxicity data that could be utilized in an initial assessment of the ecological risk of tellurium (VI) could not be obtained, and a PNEC could not be determined.

The value of 12 µg Te/L obtained from the chronic toxicity of tellurium (IV) to the crustacean was used as the PNEC for this substance.

Assuming that the total tellurium concentration in the environment is tetravalent, the PEC/PNEC ratio is less than 0.002 for both freshwater bodies and seawater. Further, past data yielded a value of around 3 µg Te/L for freshwater bodies and around 1 µg Te/L for seawater. The ratio of the freshwater body PEC value to the PNEC is 0.3, while the ratio of the seawater PEC value to the PNEC is 0.08, assuming the entire tellurium concentration in the environment is tetravalent. Accordingly, efforts to collect data on this substance are needed; the transfer of production and import quantities, applications, and material flow need to be accurately determined; and more comprehensive environmental concentration data needs to be gathered taking emission sources into consideration.

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)			
Crustacean *Daphnia magna*	Acute	EC_{50} immobilization	100	12	Freshwater	<0.019	<0.002	○	▲
					Seawater	<0.019	<0.002		

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	Collection of further information would be required.	(▲)
	Inhalation exposure	Although risk to human health could not be confirmed, collection of further information would not be required.	(○)
Ecological risk	Requiring information collection.		▲

［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.