

10	CAS No: 7440-50-8 (Copper)	Substance: Copper and its compounds
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Chemical Substances Control Law Reference No.:

PRTR Law Cabinet Order: 1-272 (as soluble copper salts (excluding complex salts))

Chemical symbol: Cu

Atomic weight: 63.55

1. General information

Cuprous (I) oxide, cupric (II) oxide, and copper (I) cyanide are insoluble in water. The aqueous solubilities of cuprous (I) chloride, cupric (II) chloride, copper (II) nitrate, and copper (II) sulfate are 47 mg/1,000 g (20°C), 7.57×10^5 mg/1,000 g (25°C), 1.45×10^6 mg/1,000 g (25°C), and 2.20×10^5 mg/1,000 g (25°C), respectively.

Environmental standards have been prescribed for copper concentration in soil while effluent standards also prescribe copper concentration. Soluble copper salts (excluding complex salts) are designated as Class 1 Designated Chemical Substances under the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law). The main uses of copper are in electrical wire and in rolled, drawn, and extruded copper products. The main uses of copper sulfate are as a raw material for agricultural chemicals (bactericide), cupra (fiber), pigments, batteries, pharmaceuticals, metal alloys, and copper salts, and as a mordant or agent for copper plating and leather tanning. The main uses of copper (II) chloride are as a raw material for bactericides, dyestuff auxiliaries, and pigments; as a synthesis catalyst for chloroethylene; and as a raw material for synthesizing copper chlorophyll. The production and import category under the PRTR Law is more than 100 t (as a soluble copper salt (excluding complex salts)).

2. Exposure assessment

Total release to the environment in fiscal 2012 under the PRTR Law was approximately 204 t, of which approximately 136 t or 67% of overall releases were reported. The major destination of reported releases was public water bodies. In addition, approximately 967 t was transferred to waste materials and approximately 4.8 t was transferred to sewage. Industry types with large reported releases were nonferrous metal manufacturing and metal product manufacturing for the atmosphere, and the sewage treatment industry, the chemical industry, and nonferrous metal manufacturing for public water bodies. The largest release among releases to the environment including those unreported was to water bodies. Predicting the proportions distributed to individual media is inappropriate because copper and its compounds transform into various chemical forms in the environment. Accordingly, the proportions distributed to individual media for copper and its compounds were not predicted.

To carry out an initial assessment of health risk due to inhalation of these substances, measured atmospheric values were used to estimate exposure to humans via inhalation. The maximum expected concentration of exposure to humans via inhalation, based on ambient air, was around $0.31 \mu\text{g}/\text{m}^3$. The mean annual value for atmospheric concentration in fiscal 2012 was calculated by using a plume-puff model on the basis of reported releases to the atmosphere (as soluble copper salts (excluding complex salts)) according to the PRTR Law; this model predicted a maximum level of $0.22 \mu\text{g}/\text{m}^3$.

Estimates of exposure to aqueous organisms were not carried out because initial assessments of ecological risk towards aqueous organisms were not conducted for these substances.

3. Initial assessment of health risk

Copper (powder) fumes may possibly cause metal fume fever when inhaled. It may also induce coughing, headache, shortness of breath and sore throat, while abdominal pain, nausea and vomiting may occur when

ingested. Contact of the substance with the skin may cause redness, while contact with the eyes may cause redness and pain.

Copper sulfate may cause significant irritation to the skin and the eyes, and its aerosol may cause irritation to the respiratory tract. The substance is corrosive. Its ingestion may affect blood, kidneys and liver, resulting in hemolytic anemia, renal impairment and hepatic impairment. When inhaled, coughing and sore throat may occur, while abdominal pain, burning sensation, nausea, vomiting, diarrhea, shock or collapse may occur when ingested. Contact of the substance with the skin may cause redness and pain, while contact with the eyes may cause redness, pain and blurred vision.

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

With regard to the oral exposure, the substance was not subject to evaluation, as the tolerable intake level through diet and water quality standards for drinking water existed already. As for the inhalation exposure to the substance, the 'non-toxic level*' could not be established.

Regarding the inhalation exposure to the substance, the absence of information on the 'non-toxic level*' did not allow the health risk assessment. In addition, the NOAEL of 0.4 mg/m³ based on the observations of effects on humans, was adjusted according to the exposure conditions, to obtain 0.08 mg/m³, and this level was considered to be equivalent to the 'non-toxic level*' of the substance. The MOE (Margin of Exposure) of 260 was derived from the 'non-toxic level*' of 0.08 mg/m³ and the predicted maximum exposure concentration in ambient air of 0.31 µg/m³. The MOE of 360 was derived from the maximum atmospheric concentration of 0.22 µg/m³ (annual mean) in the high discharging plants area, estimated from the reported emissions in FY 2012 under the PRTR Law. Therefore, collection of information would not be required to assess the health risk for the inhalation exposure to this substance 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*' (–) mg/kg/day	(–)	(–)	Drinking water	(–) µg/kg/day	MOE	(–)	(–)	(–)
				Groundwater	(–) µg/kg/day	MOE	(–)	(–)	
Inhalation	'Non-toxic level*' – mg/m ³	–	–	Ambient air	0.31 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

Initial assessments of the ecological risk posed to aqueous organisms were not conducted for these substances because water quality target values related to the preservation of aqueous organisms had not yet been investigated as of fiscal 2014.

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	End point			Water body	Predicted environmental concentration PEC (µg/L)			
(–)	(–)	(–)	(–)	(–)	Freshwater	(–)	(–)	(–)	(–)
					Seawater	(–)	(–)		

5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	The substance was not subject to evaluation.	(-)
	Inhalation exposure	Although risk to human health could not be confirmed, collection of further information would not be required.	(○)
Ecological risk	Initial assessment of ecological risk to aqueous organisms for this substance was not carried out.		(-)

[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.
(-) : The substance was not subject to evaluation