5	CAS No.: 7664-39-3 (Hydrogen fluoride)	Substance: Hydrogen fluoride and its water-soluble salts

Chemical Substances Control Law Reference No.: 1-306
PRTR Law Cabinet Order No.: 1-283 (As hydrogen fluoride and its water-soluble salts)

Structural Formula:

Molecular Formula: HF
Molecular Weight: 20.01

H-F

1. General Information

Hydrogen fluoride is freely miscible, and the water solubility of sodium fluoride and potassium fluoride were 3.97 × 10^4 mg/1000g to 4.3 × 10^4 mg/L (25°C) and 5.04 × 10^5 mg/1000g (25°C) to 9.64 × 10^5 mg/L (21°C), respectively. The vapor pressure of hydrogen fluoride is 774.8 mmHg (= 1.033 x 10^5 Pa) (20°C).

The environmental quality standards for water, soil, and groundwater for fluorine have been established. The drinking water quality standards for fluoride have been established. In addition, hydrogen fluoride and its water-soluble salts belong to Class 1 Designated Chemical Substance under the Law concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law).

Hydrogen fluoride is mainly used for CFC substitute materials, grinding of the insides of bulbs, glass surface treatment, surface treatment of titanium heads of golf clubs and stainless steel pans, surface treatment agents for semiconductor manufacturing processes, and fluorine resin materials for fluorine resin pans. Some dentists use sodium fluoride for cavity prevention.

The anthropogenic sources of fluorides are coal combustion, drainage and waste from various industry processes, including manufacturing of steel, aluminum, copper, and nickel, treatment of phosphate rocks, manufacturing and use of phosphate fertilizers, manufacturing of glass, bricks, and ceramics, adhesive manufacturing, and agriculture chemicals containing fluorine. Fluorides are naturally released from dissolved or weathered minerals, volcanoes, and ocean aerosols.

The totals of production (shipment) and imports in FY2001 were 10,000 to less than 100,000 tons/yr for hydrogen fluoride and 1,000 to less than 10,000 tons/yr for sodium fluoride and potassium fluoride, and in FY2004, 10,000 to less than 100,000 tons/yr for hydrogen fluoride and sodium fluoride and 1,000 to less than 10,000 tons/yr for potassium fluoride.

The quantity of hydrofluoric acid in FY2005 was 202,789 tons (50 percent equivalent) and production and import quantities under the Law concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law) came to 100,000 tons.

Hydrogen fluoride is primarily present in the state of a dissociated fluoride ion when flowing into freshwater bodies (pH > 5).

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2. Exposure assessment

Total release to the environment in FY2005 under the PRTR Law came to approximately 3,500 tons, of which approximately 2,900 tons (over 82% of the total) was reported. Release to public water bodies accounted for a large part of the reported release. In addition, the landfill disposal was six tons and transfers to sewage and waste were approximately 140 and 4,500 tons, respectively. Large releases to air were reported by industries involved with manufacturing of ceramics and soil and stone products, manufacturing of electric machinery and apparatuses, and steel. Large releases to public water bodies by sewerage, steel, and electric machinery and apparatus manufacturing industries. It should be noted, however, that the releases from the sewerage industry might be overestimated because they are sometimes calculated based on a lower limit of quantitation.

When unreported releases are included, releases to water bodies accounted for the greatest quantity of releases to the environment.

The ratio of distribution to each media of hydrogen fluoride should not be predicted because the relevant chemical forms are changed in the environment. Therefore, the ratio of distribution to each medium of hydrogen fluoride was not estimated.

The predicted environment concentration (PEC), which indicates exposure to aquatic organisms, was determined to be 2,200 μg/L for fluorine for public freshwater bodies based on the data on possibly artificial releases.

Because the average concentration of seawater bodies of approximately 900 to 1,000 μg/L is higher than that of freshwater bodies and there have been insufficient ecological toxicity studies on aquatic organisms, no immediate exposure assessments for seawater bodies will be conducted.

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3. Initial assessment of ecological risk

With regard to acute toxicity, reliable information of a 72-hour median effective concentration (EC_{50}) growth inhibition value exceeding 1,000,000 μg F/L was found for the algae *Desmodesmus subspicatus*, a 48-hour EC_{50} immobilization value of 97,700 μg F/L was found for the crustacea *Daphnia magna* (water flea), a 96-hour median lethal concentration (LC_{50}) value of 51,000 μg F/L was found for the fish *Oncorhynchus mykiss* (rainbow trout), and a 96-hour LC_{50} value of 17,000 μg F/L was found for another organism, *Hydropsyche bronta*. Accordingly, an assessment factor of 100 was used, and a predicted no effect concentration (PNEC) of 510 μg/L was obtained based on the acute toxicity values. With regard to chronic toxicity, reliable information of a 21-day no observed effect concentration (NOEC) reproduction value of 14,000 μg F/L was found for the crustacea *D. magna*. Accordingly, an assessment factor of 100 was used, and a PNEC value of 140 μg F/L was obtained based on the chronic toxicity values. As the PNEC for the substance, a value of 140 μg F/L obtained from the chronic toxicity for the crustacea was used.

The PEC/PNEC ratio was 16 for freshwater bodies. This substance is thought to be a candidate for further work. It would be advisable to further work this substance, collecting findings of chronic toxicity for algae and fish. The data collection of hazard information on marine organisms should also be considered.

Hazard assessment (basis for PNEC)			Assessment factor	Predicted no effect concentration PNEC (μg/L)	Exposure assessment		PEC/ PNEC ratio	Result of assessment
Species	Acute / chronic	Endpoint			Water body	Predicted environmental concentration PEC (μg/L)		
Crustacea (water flea)	Chronic	NOEC reproduction	100	140	Freshwater	2,200	16	■
					Seawater	—	—	

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4. Conclusion

	Conclusions	Judgment
Ecological risk	This substance is thought to be a candidate for further work. It would be advisable to further work this substance, collecting findings of chronic toxicity for algae and fish. The data collection of hazard information on marine organisms should also be considered.	■

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

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

（○）: Though a risk characterization cannot be determined, there would be little necessity of collecting information.

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