

**Hydrofluoric Acid (0.5%-49%)**

Date of Preparation: September 2004

Revision: 3

**Section 1 - Chemical Product and Company Identification**

**Product/Chemical Name:** Hydrofluoric Acid Solution (0.5%-49%)

**Chemical Formula:** HF

**Other Designations:** Hydrofluoric acid, Aqueous hydrogen fluoride, Hydrogen fluoride

**General Use:** Used to manufacture semiconductor devices, etch glass, pickle stainless steel, clean metals, and to determine silicon dioxide in analytical work.

**Manufacturer:** Kanto Corporation, 13424 N. Woodrush Way, Portland, OR 97203

**Non-Emergency Contact:** Kanto Customer Service, Phone (503) 283-0405, FAX (503) 240-0409

**For All Transportation Emergencies Call CHEMTREC 1-800- 424-9300**

**Section 2 - Composition / Information on Ingredients**

Ingredient Name	CAS Number	% by wt
Hydrofluoric Acid	7664-39-3	0.5-49
Water	7732-18-5	Balance

**Occupational Exposure Limits**

Ingredient	OSHA PEL		ACGIH TLV		NIOSH REL		NIOSH
	TWA	STEL	TWA	STEL	TWA	STEL	IDLH
Hydrofluoric Acid	3 ppm 2.5 mg/m <sup>3</sup>	6 ppm 5 mg/m <sup>3</sup>	3 ppm 2.5 mg/m <sup>3</sup> (ceiling)	None established	3 ppm 2.5 mg/m <sup>3</sup>	6 ppm 5 mg/m <sup>3</sup>	30 ppm 25 mg/m <sup>3</sup>

**Section 3 - Hazards Identification**

**☆☆☆☆☆ Emergency Overview ☆☆☆☆☆**

Corrosive, Poison. Extremely hazardous liquid and vapor.

Acute and chronic health hazard. High concentrations cause immediate and severe burns that may be fatal, and concentrations even lower than 2% can permeate skin unnoticed and cause severe burns that may not be painful or visible for several hours, but which still require medical attention. Skin and eye protection is mandated by Oregon-OSHA at concentrations as low as 0.2%.

**HMIS**  
**H** 4  
**F** 0  
**R** 0

**PPE†**  
 †Sec. 8

**Potential Health Effects**

**Primary Entry Routes:** Inhalation, skin, eyes, and ingestion.

**Target Organs:** Skin, eyes, respiratory system, heart, liver, and kidneys.

**Acute Effects**

**Eye:** Severe exposure may cause blindness, severe, pain, and deep burns. If migration goes behind the eye, death can occur.

**Skin:** High concentrations covering 3% of the body reported as fatal. At 49% concentration causes immediate burns and rapid destruction of tissue accompanied by severe pain; in concentrations less than 20%, painful erythema may be delayed 24 hours; latent skin burns and necrosis with slow healing has been reported at concentrations as low as 2%. Readily penetrates the skin where it dissociates into hydrogen ions that cause soft tissue burns and fluoride ions that cause decalcification of bone and blood. Body potassium levels increase at the contact site and affect nerve endings resulting in pain that is out of proportion to outward signs of damage.

**Ingestion:** If swallowed, solution causes burning of the mouth, throat, esophagus and digestive tract. Symptoms include burning sensation, diarrhea, nausea, vomiting, weakness, and possible collapse.

**Inhalation:** Vapors and mists irritate the nose, throat and respiratory tract. Symptoms include a burning sensation, cough, dizziness, headache, nausea, labored breathing, sore throat and vomiting. High concentrations or extended exposure can cause pulmonary edema, which may be fatal. Prolonged overexposure to the vapors can cause fluorosis; symptoms include result in weight loss, anemia, weakness and stiffness of joints. Symptoms may be delayed.

**Carcinogenicity:** IARC, NIOSH, NTP, OSHA, EPA, MAK – not listed. ACGIH – listed, Group 4 – not a human carcinogen.

**Medical Conditions Aggravated by Long-Term Exposure:** Bone density, respiratory disorders.

**Chronic Effects:**

Decrease in tooth enamel; bone and joint changes (osseous fluorosis); chronic respiratory irritation.

## Section 4 - First Aid Measures

**ALTHOUGH IMMEDIATE TREATMENT IS REQUIRED, RESCUERS MUST WEAR APPROPRIATE PPE: Speed in removing exposed personnel from the contaminated area and in removing HF from the skin or eyes is of primary importance. First aid must be started immediately in all cases of contact with hydrofluoric acid in any form. All potentially exposed personnel should be trained in first aid care for HF burns. First aid actions should be planned before beginning work with HF. Calcium gluconate gel should be readily accessible in areas where HF exposure potential exists. Remember that concentrated HF causes immediate pain, but dilute HF solutions may not cause redness, burning or pain until many hours have elapsed.**

**Eye Contact:** Immediately flush eyes with running water for 10 minutes while holding the eyelids apart. Apply an anesthetic (such as topical tetracaine hydrochloride 0.5% or proparacain 0.5%) and then irrigate the eye with calcium gluconate (1%). Seek immediate medical attention, preferably an ophthalmologist.

**Skin Contact:** Immediately remove contaminated clothing, wash exposed area with water, with special attention to areas under the nails. Apply topical fluoride-neutralizing agents such as calcium gluconate (2.5% gel), red zephiran, (0.13%) or Hyamine (0.2%) solutions at the burn site or area contamination by rubbing it in continuously. As it's very important to prevent skin permeation, if a fluoride-neutralizing solution is available, give consideration to reducing the water wash time in order to apply the neutralizer as soon as possible. However never entirely omit the water wash. Seek immediate medical attention.

**Ingestion:** If victim is conscious, give milk or water followed by several ounces of milk of magnesia. Seek immediate medical attention. Never give anything by mouth to an unconscious or convulsing person. Do not induce vomiting. Lavage with calcium chloride or calcium gluconate and treat systemic effects.

**Inhalation:** Remove exposed person to uncontaminated atmosphere and support breathing. If not breathing, give artificial respiration. Seek medical attention immediately. Observe for possible reactions including bronchoconstriction, pulmonary edema and other systemic effects and treat with prophylactic inhalation steroids.

**Note to Physicians:**

The liquid is extremely corrosive to the gastrointestinal tract and contact may cause rapid tissue destruction with severe burns and may be fatal if swallowed unless immediate treatment is applied.

Fluoride is a general protoplasmic poison which appears to produce at least four major functional derangement (1) enzyme inhibition, (2) hypocalcemia, (3) cardiovascular collapse, and (4) specific organ damage. Hypocalcemia which leads to severe reductions in plasma levels of both total calcium, may appear several hours after exposure producing painful and involuntary muscular contractions initially of the extremities (carpedal spasm, twitching of limb muscles, laryngo-spasm, cardiospasm, etc.) Cardiovascular collapse is probably the principal cause of death in acute fluoride poisoning with sinus tachycardia the most common cardiac finding and serious cardiac arrhythmia also common. Poisonings also cause major adverse effects on the brain and kidneys. Toxic effects may include headache, excessive salivation, rapid movements of the eyeball and dilated renal pathology (acute congestion) has been described in human causalities.

- (1) Subcutaneous injections of Calcium Gluconate may be necessary around the burned area. Continued application of Calcium Gluconate Gel or subcutaneous Calcium Gluconate should then continue for 3-4 days at a frequency of 4-6 times per day. If a "burning" sensation reoccurs, apply more frequently.
- (2) Systemic effects of extensive hydrofluoric acid burns include renal damage, hypocalcemia and consequent cardiac arrhythmia. Monitor hematological, respiratory, renal, cardiac and electrolyte status at least daily. Tests should include FBE, blood gases, chest X-ray, creatinine and electrolytes, urine output, calcium ions, magnesium ions and phosphate ions. Continuous ECG monitoring may be required.
- (3) Where serum calcium is low, or ECG signs of hypocalcemia develop, infusions of calcium gluconate, or if less serious, oral Sandocal, should be given. Hydrocortisone 500 mg in a four to six hourly infusion may help.
- (4) Antibiotics should not be given as a routine, but only when indicated.
- (5) Eye contact pain may be excruciating and 2-3 drops of 0.05% pentocaine hydrochloride may be instilled, followed by further irrigation.

## Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable

**Autoignition Temperature:** Not applicable

**LEL:** Not applicable

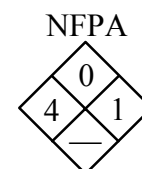
**UEL:** Not applicable

**Flammability Classification:** Nonflammable

**Extinguishing Media:** Dry chemical, carbon dioxide, foam, or water spray.

**Unusual Fire or Explosion Hazards:** Can ignite certain combustible and organic materials. Extremely toxic gases may be present under fire conditions.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard. Prevent spillage from entering drains or waterways. May be violently or explosively reactive. Do not approach containers suspected to be hot. Cool fire-exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire. Avoid spraying water onto liquid pools.



**Fire-Fighting Equipment:** Because fire produces toxic thermal decomposition products at unknown concentrations, self-contained breathing apparatus (SCBA) with a full-face piece operated in pressure-demand or positive-pressure mode is required. Equipment should be thoroughly decontaminated after use.

### Section 6 - Accidental Release Measures

**Small Spills:** Restrict access to area. Wear proper protective equipment including respiratory protection. Clean up spills immediately. Contain with an inert material and neutralize product with soda ash or lime slurry.

**Large Spills:** Clear area of personnel and move upwind. Restrict access to area. Contact fire department and tell them location and nature of hazard. Wear full body protective clothing with breathing apparatus. Dike far ahead of liquid spill. Do not release into sewers or waterways. Collect for recycling as much as possible. Neutralize remaining product with soda ash or lime slurry. Wash area down with large quantity of water and prevent runoff into drains. After cleanup operations, decontaminate and launder all protective clothing and equipment before storing and reusing. If contamination of drains or waterways occurs, advise emergency services.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

### Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist and vapor. Observe manufacturer's storing and handling recommendations. Wear protective equipment including respiratory protection. Avoid contact with incompatible materials. Keep containers securely sealed when not in use. Avoid physical damage to containers.

**Recommended Storage Requirements:** Store in a cool, well-ventilated area with other acids. Keep away from bases and incompatible materials. Compatible drum or container preferably plastic, polyethylene or polypropylene containers or polyliner drum. Packing as recommended by manufacturer. Check that all containers are clearly labeled and free from leaks. Wax, lead and platinum are not corroded. Most other metals are corroded to some degree; glass, ceramics, natural gum rubber and leather are incompatible.

### Section 8 - Exposure Controls / Personal Protection

#### Engineering Controls

**Ventilation:** Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

#### Administrative Controls

**Respiratory Protection:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or non-routine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

*Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

**Protective Clothing/Equipment:** To prevent eye and skin contact, wear chemically protective goggles, face shields, gloves, boots, and acid suits or aprons. **Oregon OSHA's Program Directive A-204 (September 2000) provides detailed PPE guidance when handling concentrations of hydrofluoric acid as low as 0.2%.** (See also OSHA's 29 CFR 1910.132 - General PPE Requirements, and 29 CFR 1910.133 -Eye and Face Protection). Contact lenses should not be worn as they can reduce the immediacy and effectiveness of water irrigation when using an emergency eye wash unit and the addition of Calcium Gluconate eye drops. (Emergency safety showers and eye wash stations should be readily available as per ANSI Z358.1-1998).

**Contaminated clothing:** Separate contaminated work clothes from street clothes. Because of the difficulties of ensuring complete neutralization of the fluoride ion, following decontamination consider disposal over reuse.

**Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

### Section 9 - Physical and Chemical Properties

**Physical State:** Liquid

**Appearance and Odor:** Clear, colorless liquid with a pungent odor

**Odor Threshold:** 0.0333 to 0.1333 mg/m<sup>3</sup>

**Formula Weight:** 20.01

**Specific Gravity:** concentration dependant

**pH:** concentration dependent

**Water Solubility:** 100%

**Boiling Point:** concentration dependant

**Freezing/Melting Point:** concentration dependant

**Volatile Component (% Vol):** concentration dependant

**Evaporation Rate:** concentration dependant

**Vapor Pressure:** concentration dependant

**Vapor Density (Air=1):** concentration dependant

**Section 10 - Stability and Reactivity**

**Stability:** Hydrofluoric acid is stable at room temperature in closed containers under normal storage and handling conditions.

**Polymerization:** Hazardous polymerization will not occur.

**Chemical Incompatibilities:** Contact with glass, concrete, and other silicon-bearing materials yield silicon tetrafluoride gas. Pressure may build-up from the formation of silicon tetrafluoride gas causing containers to burst. Carbonates, sulfides, and cyanides yield toxic gases: carbon dioxide, hydrogen sulfide and hydrogen cyanide. Incompatible with most metals and hydrogen sulfide, wood, paper, cotton and similar organic materials, alkalis, amines, ammonia gas, carbonates, cyanides, diborane, fluorine, phosphine, sulfides and thiocyanates, and silicon-bearing materials. Incompatible with sulfuric acid 96%.

**Conditions to Avoid:** Increasing temperatures and direct sunlight as it causes the rapid evolution of gases and chemical decomposition. Contact with most metals will release flammable and explosive hydrogen gas.

**Hazardous Decomposition Products:** Thermal oxidative decomposition can produce poisonous fluorine gases and mist.

**Section 11- Toxicological Information****Acute Effects:**

Man, oral, TC<sub>LO</sub>: 143 mg/kg

Mouse, inhalation, LC<sub>50</sub>: 3742 ppm/1 hour

Human, inhalation, TC: 50 ppm / 30 min

Rat, inhalation, LC<sub>50</sub>: 1276 ppm/1 hour

Rat, inhalation, LC<sub>50</sub>: 4970 ppm /5 min

Human, eye, 50mg – Severe irritation

**Chronic Effects:** Decrease in tooth enamel; bone and joint changes; chronic respiratory irritation

**Carcinogenicity:** IARC Group 3 listed as fluoride compounds

**Mutagenicity:** DNA damage, sex chromosome loss and nondisjunction.

**Reproductive:** Fertility: pre/post implantation mortality, fetal death.

\* See NIOSH, *RTECS (MW78750000)*, for additional toxicity data.

**Section 12 - Ecological Information**

**Environmental Toxicity:** Fish, lethal concentration: 60ppm/fresh water. Expected to be slightly toxic to aquatic organisms due to the pH of the acid.

**Environmental Fate:** Mineral salts form when released into the soil forming strong associations. Gas will be absorbed by the rain and fall as hydrofluoric acid. Fluoride accumulation will occur in plants and animals.

**Section 13 - Disposal Considerations**

**Disposal:** Contact a licensed contractor for detailed recommendations. Treat/neutralize before releasing to a wastewater treatment facility. May be classified as toxic or corrosive waste. Follow applicable Federal, state, and local regulations.

**Disposal Regulatory Requirements:** See Federal, state, and local requirements for disposal.

**Section 14 - Transport Information****DOT Transportation Data (49 CFR 172.101):**

<p><b>Shipping Name:</b> Hydrofluoric acid  <b>Hazard Class:</b> 8  <b>ID No.:</b> UN 1790  <b>Packing Group:</b> II  <b>Label:</b> 8, 6.1  <b>Special Provisions (172.102):</b> A6, A7, B15, IB2, N5, N34, T8, TP2, TP12</p>	<p><b>Packaging Authorizations</b>  <b>Exceptions:</b> None  <b>Non-bulk Packaging:</b> 173.202  <b>Bulk Packaging:</b> 173.243</p>	<p><b>Quantity Limitations</b>  <b>Passenger, Aircraft, or Railcar:</b> 1L  <b>Cargo Aircraft Only:</b> 30 L    <b>Vessel Stowage Requirements</b>  <b>Vessel Stowage:</b> D  <b>Other:</b> 12, 40    <b>Emergency Response Guidebook #: 157</b></p>
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**Section 15 - Regulatory Information****EPA Regulations:**

EPA Hazardous Waste Number and Classification (40 CFR 261.22): D002, Characteristics of Corrosivity

RCRA Hazardous Waste Number (40 CFR 302.4): U134

RCRA Hazardous Waste Classification (40 CFR 302.4): Toxic Waste; Corrosive Waste

CERCLA Hazardous Substance (40 CFR 302.4) listed specific per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307(a), CAA, Sec. 112

CERCLA Reportable Quantity (RQ), 100 lb (45.4 kg) as 100% HF

SARA 311/312 Codes: Immediate, Delayed

SARA Toxic Chemical (40 CFR 372.65): Listed

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): 100 lb (45.4 kg) as 100% HF

TSCA: Listed

**OSHA Regulations:**

Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Listed

**Section 16 - Other Information**

**Revision Notes:** Revision 2 - Sections 8, 9, 14, and 15.

Revision 3 – As required for the addition of 0.5% hydrofluoric acid.

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