

**Buffered Hydrogen Fluoride**

Date of Preparation: October 2003

Revision: 6

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

**Product/Chemical Name:** Buffered Hydrogen Fluoride

**Chemical Formula:** Not Applicable (Aqueous mixture)

**Other Designations:** Buffered Hydrofluoric Acid; Buffered Oxide Etch (BOE); Buffered Hydrogen Fluoride with Surfactant BHF-S 10:1; BHF-S 9.1; BHF and BHF ##### where # represents custom-specific weight percentages of ingredients - for example, BHF 63U; BHF 6:1; BHF 7:1; BHF 9:1; BHF 10:1; BHF 20:1, BHF 30:1, BHF 115; BHF 120; BHF 14-00; BHF 120; BHF 1200.

**General Use:** Used as an etchant in the manufacture of semiconductor devices

**Manufacturer:** Kanto Corporation, 13424 N. Woodrush Way, Portland, OR 97203  
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
Ammonium Fluoride	12125-01-8	1 - 40
Hydrofluoric Acid	7664-39-3	0.1 - 10
De-ionized Water	7732-18-5	Balance

**Occupational Exposure Limits**

Ingredient	OSHA PEL		ACGIH TLV		NIOSH REL		NIOSH
	TWA	STEL	TWA	STEL	TWA	STEL	IDLH
Ammonium Fluoride	3 ppm 2.5 mg/m <sup>3</sup>	None established	3 ppm 2.5 mg/m <sup>3</sup>	None established	3 ppm 2.5 mg/m <sup>3</sup>	None established	None established
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>	None established	3 ppm 2.5 mg/m <sup>3</sup>	6 ppm 5 mg/m <sup>3</sup>	30ppm 25 mg/m <sup>3</sup>

**Section 3 - Hazards Identification**

**☆☆☆☆☆ Emergency Overview ☆☆☆☆☆**

Corrosive, Poison. Extremely hazardous liquid and vapor. Causes severe burns which may not be immediately painful or visible. Liquid and vapor can burn skin, eyes and respiratory tract. May be fatal if swallowed or inhaled. Causes bone damage. Reaction with certain metals generates flammable and explosive hydrogen gas. Reaction with glass and concrete can generate poisonous vapors.

**HMIS**  
**H** 4  
**F** 0  
**R** 1

**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:** Causes severe burns, with the possibility of delayed symptoms. It causes immediate burns and rapid destruction of tissue accompanied by severe pain at concentrations of 50%; in concentrations less than 20%, painful erythema may be delayed 24 hours; latent skin burns and necrosis with slow healing can occur even at concentrations of 2%. The fluoride ion readily penetrates the skin and deep tissue causing destruction of soft tissue, decalcification of bone and blood.

**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 Group 3 listed as fluoride compounds

**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, calcification in the tendons and bones, and anemia.

## Section 4 - First Aid Measures

**DO NOT DELAY:** 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 several minutes or even hours have elapsed.**

**Eye Contact:** Immediately flush eyes with running water for 10 minutes while holding the eyelids apart. If possible, remove contact lenses. 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 for at least 10 minutes, 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. Seek immediate medical attention.

**Ingestion:** If victim is conscious, give milk or water followed by several ounces of milk of magnesium. 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 casualties.

- (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:** Not applicable

**Auto ignition Temperature:** Not applicable

**LEL:** Not applicable

**UEL:** Not applicable

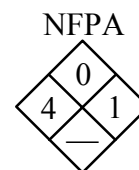
**Flammability Classification:** Nonflammable

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

**Unusual Fire or Explosion Hazards:** Can ignite certain combustible and organic materials. Toxic gases may be present in a fire.

**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, wear a self-contained breathing apparatus (SCBA) with a full-face piece operated in pressure-demand or positive-pressure mode. Equipment should be thoroughly decontaminated after use.



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### 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 an 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:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

**Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

**Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

**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, and pungent

**Vapor Pressure (kPA):** Not applicable

**Vapor Density (Air=1):** Not applicable

**Formula Weight:** Aqueous mixture

**Specific Gravity:** Composition dependant

**Water Solubility:** 100%

**Boiling Point:** Approx. >212°F (100.3°C)

**Freezing/Melting Point:** Composition dependant

**Volatile Component (% Vol):** Not applicable

**Evaporation Rate:** Not applicable

**pH:** Composition dependant

### Section 10 - Stability and Reactivity

**Stability:** 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. Reacts with chlorine trifluoride causing an explosion hazard

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

**Hazardous Decomposition Products:** Thermal oxidative decomposition of mixture can produce ammonia, ammonium bifluoride, hydrogen fluoride gas, fluorine gas and mists, and nitrogen oxides.

**Section 11- Toxicological Information**

<p><b>Ammonium Fluoride</b>                  Rat, inhalation: 1600 µg/m<sup>3</sup>/6 hour/39 weeks – intermittent                  Rat, intraperitoneal, LD<sub>50</sub>: 31 mg/kg                  Frog, subcutaneous: 280 mg/kg</p> <p><b>Hydrogen Fluoride</b>                  Man, oral, TC<sub>Lo</sub>: 143 mg/kg                  Human, inhalation, TC: 50 ppm / 30 min                  Rat, inhalation, LC<sub>50</sub>: 1276 ppm/1 hour                  Human, eye, 50mg – Severe irritation</p>	<p><b>Chronic Effects:</b> Tooth enamel decay; bone or joint changes; respiratory irritation.</p> <p><b>Carcinogenicity:</b> IARC Group 3 listed as fluoride compounds</p> <p><b>Mutagenicity:</b> DNA damage, sex chromosome loss and nondisjunction.</p> <p><b>Reproductive:</b> Fertility: pre/post implantation mortality, fetal death.</p>
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\* See NIOSH, RTECS (MW7875000 – Hydrogen Fluoride; BQ6300000 – Ammonium Fluoride), for additional toxicity data.

**Section 12 - Ecological Information**

**Ecotoxicity:** Fish, LC<sub>50</sub>: 100mg/l /96-hour.

**Environmental Fate:** Fluorides do not degrade in the environment but change form by forming salts with minerals in the soil. If the pH is > 6.5, soil can bind fluorides tightly. High calcium content will immobilize fluorides, which can be damaging to plants when present in acid soils.

**Section 13 - Disposal Considerations**

**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Treat and neutralize before releasing to 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> Corrosive, liquid, toxic, n.o.s. (ammonium fluoride, hydrofluoric acid)</p> <p><b>Hazard Class:</b> 8</p> <p><b>ID No.:</b> UN 2922</p> <p><b>Packing Group:</b> II</p> <p><b>Label:</b> 8, 6.1</p> <p><b>Special Provisions (172.102):</b> B3, IB2, T7, TP2</p>	<p><b>Packaging Authorizations</b></p> <p><b>Exceptions:</b> none</p> <p><b>Non-bulk Packaging:</b> 173.202</p> <p><b>Bulk Packaging:</b> 173.243</p>	<p><b>Quantity Limitations</b></p> <p><b>Passenger, Aircraft, or Railcar:</b> 1L</p> <p><b>Cargo Aircraft Only:</b> 30 L</p> <p><b>Vessel Stowage Requirements</b></p> <p><b>Vessel Stowage:</b> B</p> <p><b>Other:</b> 40</p> <p><b>Emergency Response Guidebook # 154</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 (composition dependent)

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

RCRA Hazardous Waste Number (40 CFR 302.4): U134

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

CERCLA Reportable Quantity (RQ): Ammonium Fluoride 100 lb (45.4 kg); Hydrofluoric Acid 100 lb (45.5 kg) as 100% HF

SARA 311/312 Codes: Immediate, Delayed, Chronic

a) EHS (Extremely Hazardous Substance) (40 CFR 355) TPQ: Hydrofluoric Acid 100 lb (45.5 kg) as 100% HF

**Section 313 Supplier Notification:**

This product contains the following EPCRA section 313 chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know-Act of 1986 (40 CFR 372):

<i>Chemical Name</i>	<i>CAS Number</i>	<i>Percent by Weight</i>
Hydrofluoric Acid	7664-39-3	0.1 – 10

For hydrofluoric acid BHF 50:1, BHF 120, and BHF 200:1 are exempted under the de minimis rule (40 CFR 372.38a). This information must be included in all MSDSs that are copied and distributed for this material.

**OSHA Regulations:**

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

**Section 16 - Other Information**

**Revision Notes:** Rev 6. Section 1, Other Designations (Addition of BHF 30:1)

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