

IDENTIFICATION

CAS 7664-39-3

UN 1052 (Anhydrous)

UN 1790 (Solution)

Synonyms include fluoric acid, hydrofluoride, hydrofluoric acid, and fluorine monohydride.

Hydrogen fluoride is a colorless, corrosive fuming liquid or gas (boiling temperature 67°F) with a strong irritating odor. It is usually shipped in cylinders as a compressed gas. Hydrogen fluoride readily dissolves in water to form colorless hydrofluoric acid solutions. Dilute solutions are indistinguishable from water. It is present in a variety of over-the-counter products at concentrations of 6% to 12%.

PRECAUTIONS

- A. Victims whose clothing or skin is contaminated with HF liquid, solution or condensed vapor, can secondarily contaminate response personnel by direct contact or through off-gassing vapor.
- B. Inhalation hazards result not only from HF gas but also from fumes arising from concentrated hydrogen fluoride liquid **or from the patient's bodily fluids.**
- C. Rapid flushing of exposed areas with water is critical. HF is water-soluble.

HEALTH EFFECTS

The toxic effects of hydrogen fluoride are due primarily to the fluoride ion. The fluoride ion combines with endogenous calcium and magnesium to form insoluble calcium fluoride and magnesium fluoride.

- A. This results in cell destruction and local bone demineralization
- B. Life threatening hypocalcemia, hypomagnesemia, and hyperkalemia can occur.
- C. The adverse action of the fluoride ion may progress for several days

ACUTE EXPOSURE

- A. **Respiratory**—Due to HF's water solubility, effects of exposure generally occur in the upper airway including the glottis. However, people incapacitated in large clouds of HF can have severe deep lung injury.
 - 1. **Mild effects**—mucous membrane irritation, cough and narrowing of the bronchi.
 - 2. **Severe effects.**
 - a. Almost immediate narrowing and swelling of the throat, causing upper airway obstruction.
 - b. Lung injury may evolve rapidly or may be delayed in onset for 12 to 36 hours.
 - c. Pulmonary edema and constriction of the bronchi. Partial or complete lung collapse can occur
 - d. Pulmonary effects can result even from splashes on the skin.
- B. **Dermal**—Depending on the concentration and duration of exposure, skin contact may produce pain, redness of the skin, and deep, slow healing burns with symptoms delayed up to 24 hours. HF can penetrate tissues deeply, causing both local cellular destruction and systemic toxicity.

C. Ocular

1. **Mild effects**— rapid onset of eye irritation
2. **More severe effects**— may result from even minor hydrofluoric acid splash include, sloughing of the surface of the eye, swelling of the structures of the eye, and cell death due to lack of blood supply. Potentially permanent clouding of the eye surface may develop immediately or after several days

D. Gastrointestinal

1. A small amount of ingested HF is likely to produce systemic effects including acid-base imbalance and may be fatal.
2. Ingestion of hydrofluoric acid may cause corrosive injury to the mouth, throat and esophagus as well as inflammation and bleeding of the stomach.
3. Nausea, vomiting, diarrhea and abdominal pain may occur

- E. **Electrolyte disturbances**—exposure by any route may result in systemic effects: hypocalcemia and/or hypomagnesemia and/or hyperkalemia.

PREHOSPITAL MANAGEMENT

HOT ZONE

Rescuer Protection

- A. SCBA is recommended in response situations that involve exposure to potentially unsafe levels of hydrogen fluoride
- B. Skin protection: Chemical protective clothing, i.e. level A or level B, is recommended because skin exposure to either vapor or liquid may cause severe consequences.

DECONTAMINATION ZONE

- A. Victims exposed only to hydrogen fluoride gas or vapor who have no skin or eye irritation do not need decontamination, they may be transferred immediately to the Treatment Area.
- B. Rescuer Protection: If exposure levels are determined to be safe, personnel wearing a lower level of protection than that worn in the Hot Zone may conduct decontamination.
- C. ABC Reminders
 1. Quickly ensure a patent airway— anticipate airway edema.
 2. Stabilize the cervical spine with a c-collar and a backboard if trauma is suspected
 3. Administer supplemental O₂
 4. Assist ventilation with a bag-valve-mask device if necessary
- D. Basic decontamination
 1. Victims who are able and cooperative may assist with their own decontamination
 - a. **RAPIDLY REMOVE CONTAMINATED CLOTHING** while flushing exposed skin and hair with plain water for 15 minutes.
 - b. If either of the treatments recommended below is available, water flushing may be reduced to 5 minutes and the treatment should be started immediately.
 - I. **2.5 G calcium gluconate in 100 ml of water soluble lubricant such as KY® Jelly, OR,**
 - II. **2 ml of 10% calcium gluconate per ounce of KY® Jelly**
 - c. Double bag contaminated clothing and personal belongings

2. Irrigate exposed or irritated eyes with plain water or saline or 5 minutes
 - a. Continue eye irrigation during other basic care or transport
 - b. Remove contact lenses if present and easily removable without additional trauma to the eye.
3. In case of ingestion, **do not induce emesis or administer activated charcoal**
 - a. Victims who are conscious and able to swallow should be given 4 to 8 ounces of water or milk.
 - b. If available, also give 2 to 4 ounces of an antacid containing magnesium (e.g., Maalox, Milk of Magnesia) or calcium (e.g., TUMS)
4. As soon as basic decontamination is complete, move the victim to the Treatment Area.

TREATMENT

Be certain that victims have been decontaminated properly. Treatment Area personnel require no specialized protective gear if victims have undergone decontamination.

- A. ABCs, C-spine (p.r.n.), Pulse Oximetry, ECG obtain baseline QT interval a (may be of benefit for this).
- B. Treat patients who are or have per existing protocols.
- C. Observe for signs of hypocalcemia and contact OLMC regarding treatment with Calcium Gluconate.
 1. ECG—prolonged Q-T interval or QRS or ventricular dysrhythmias.
 2. Other—Muscular tetany. This is probable after ingestion of even small amounts of HF.
- D. **For inhalation victims.**
 1. Administer 2.5% calcium gluconate by nebulizer. Mix 1cc of 10% Calcium Gluconate with 3ccs of Normal Saline into the nebulizer.
 2. If wheezes are present consider use of Albuterol per Respiratory Distress protocol.
- E. **Minor Burns.**
 1. Initially, the health care provider should wear rubber or latex gloves to prevent secondary contamination
 2. Vigorously massage the burned areas with calcium gluconate gel—2 ml of 10% calcium gluconate per ounce of KY® Jelly
 3. Continue this procedure until pain is relieved or more definitive care is rendered
- F. **Hand Exposure**
 1. Subungual (under the nail) burns often do not respond to immersion treatment. The treatment for hand burns requires expert assistance; consult with OLMC
 2. Treatment of hand exposures can be accomplished by placing calcium gluconate gel into an exam glove and placing the glove on the affected hand.
- G. **Optical Exposure**—Irrigate exposed eyes with a 1% aqueous solution of calcium gluconate (10 ml of 10% solution in 90 ml of sterile saline in Buretrol) using a nasal cannula.
 1. Up to 500 ml over 1 to 2 hours may be used
 2. If calcium gluconate is not available, use normal saline for irrigation.

MULTI-CASUALTY TRIAGE

Consult with the OLMC for advice regarding triage of multiple victims. Persons who have had only minor or brief exposure to hydrogen fluoride gas or vapor and are initially asymptomatic are not likely to develop complications.