Hydrofluoric Acid Facts

What Is Hydrofluoric Acid?

Hydrofluoric Acid (CAS#7664-39-3), or HF, is one of the most aggressive and corrosive acids known. It is used in a variety of applications including preparing plates for semiconductor research, mineral processing, metal finishing, glassmaking and manufacturing of electrical components.

HF is similar to other acids in that the initial extent of a burn depends on the concentration, the temperature and the duration of contact with the acid.

Both anhydrous hydrofluoric acid (hydrogen fluoride) and its solutions are clear, colorless liquids.

Why is Hydrofluoric Acid a concern?

HF is very aggressive physiologically because the fluoride ion readily penetrates the skin, causing destruction of deep tissue layers. Unlike other acids which are rapidly neutralized, this process may continue for days if left untreated.

When exposed to air, concentrated solutions and anhydrous HF produce pungent fumes which are especially dangerous.

Skin contact with HF can cause serious, penetrating burns of the skin that may not be painful or visible for several hours.

HF exposures require immediate and specialized first aid and medical treatment.

Signs and Symptoms of HF Exposure

Skin Exposure – Strong HF acid concentrations (over 50%), particularly anhydrous HF, cause immediate, severe, burning pain and a whitish discoloration of the skin that usually proceeds to blister formation.

In contrast to the immediate effects of concentrated HF, the effects of contact with more dilute solutions or their vapors may be delayed. Skin contact with acid concentrations in the 20% to 50% range may not produce clinical signs or symptoms for one to eight hours. With concentrations less than 20%, the latent period may be up to twenty-four hours.

The usual initial signs of a dilute solution HF burn are redness, swelling and blistering, accompanied by severe throbbing pain.

Burns larger than 25 square inches (160 square cm) may result in *serious systemic toxicity.*

Eye Contact – HF can cause severe eye burns with destruction or opacification of the cornea. Blindness may result from severe or untreated exposures.

Inhalation – Acute symptoms of inhalation may include coughing, choking, chest tightness, chills, fever and cyanosis (blue lips and skin). All individuals suspected of having inhaled HF should seek medical attention and observation for pulmonary effects. This includes any individuals with HF exposure to the head, chest or neck areas.

It has been reported that pulmonary edema may be delayed for several hours and even up to two days. For this reason, it is recommended that all individuals with such exposures be hospitalized for observation and/or treatment. If there is no initial upper respiratory irritation, significant inhalation exposure can generally be ruled out.

Ingestion – If HF is ingested, severe burns to the mouth, esophagus and stomach may occur. Ingestion of even small amounts of dilute HF have resulted in death.

Systemic Toxicity – The reaction of fluoride with body calcium is one of the major toxic effects and forms the basis for many treatment recommendations.

One of the most serious consequences of severe exposure to HF by any route is the marked lowering of serum calcium (hypocalcemia) and other metabolic changes, which may result in a fatal outcome if not recognized and treated. Hypocalcemia should be considered a potential risk in all instances of inhalation or ingestion, and whenever skin burns exceed 25 square inches.

Treatment for shock may also be required.

What to Do if You Are Exposed to HF

Note: Speed of treatment is of the utmost importance. Delay in first aid or medical treatment will likely result in greater damage.

Skin Contact

1. Immediately start rinsing under safety shower or other water source and flush affected area thoroughly with large amounts of water. Speed and thoroughness in washing off the acid is of primary importance
2. Begin flushing even before removing contaminated clothing. Remove contaminated clothing while rinsing.
3. Rinse with large amounts of water for 5 minutes.
4. While the victim is rinsing, someone should call Public Safety at 911 to arrange for transport to Health Services or UMCP
5. Immediately after rinsing, begin <u>one</u> of the following treatments:
    a. Iced 0.13% Benzalkonium chloride (Zephiran®) solution soaks or compresses.
    b. 2.5% Calcium gluconate gel massage. Note: It is advisable for the individual applying the calcium gluconate gel to wear gloves to prevent a possible secondary HF burn.
6. Seek medical attention immediately

Eye Contact

1. **Immediately** flush the eyes for at least 5 minutes with large amounts of gently flowing water.
2. Seek medical attention as soon as possible. Ice water compresses may be applied to the eyes while transporting the victim.
3. Medical staff should apply 1% calcium gluconate solution repeatedly to irrigate the eye.

Inhalation

Immediately move victim to fresh air and call 911

Ingestion

1. Drink large amounts of water as quickly as possible to dilute the acid. Do not induce vomiting. Do not give emetics or baking soda. Never give anything by mouth to an unconscious person.
2. Drink several glasses of milk or several ounces of milk of magnesia, Mylanta®, Maalox®, etc. or grind up and administer up to 30 Tums™, Caltrate™ or other antacid tablets with water.
3. Seek immediate medical attention. Ingestion of HF is a life-threatening emergency.

Where Do I Get First Aid and Medical Supplies?

The following supplies should be maintained near HF handling and storage areas:

1. Calcium gluconate gel, 2.5% - Calcium gluconate gel is available commercially from:

Pharmascience Inc.
6111 Royalmount Ave.
Montreal, Quebec H4P 2T4
Canada
Telephone: 800-207-4477
Fax: 514-340-9290
www.pharmascience.com

Attard's Minerals
San Diego, California.
Tel: (619) 275-2016
E-mail: attard@attminerals.com
http://attminerals.com/other_items.htm

2. Benzalkonium chloride (Zephiran®) solution is available as a non-prescription drug from Princeton Pharmacy at the U-Store. It is recommended that it be stored in properly labeled light-resistant containers and be replaced before the expiration date on the label. Zephiran® is available in 8 oz. bottles ($27.77) or 128 oz. bottles ($235).

How Do I Prevent Exposure to HF?

There are a number of ways to prevent HF exposure:

- Only use HF when necessary. Consider substitution of a less hazardous substance whenever possible.
- Establish written standard operating procedures for work with HF.
- Ensure all workers in a lab where HF is used are informed about the hazards and first aid procedures involved.
- Only use HF in a chemical fume hood.
- Protect your skin: Depending on the concentration used, workers should wear butyl rubber, neoprene, PVC, 4H® or Silvershield® gloves. Protective lab coats or aprons are also recommended.
- Protect your eyes: As a minimum, workers should wear chemical splash goggles when working with HF. A face shield is also recommended when there is a splash hazard.
- Depending on the work involved, respiratory protection may be recommended. Contact EHS at 258-5294 for more information.

How Do I Store HF?

HF should be stored in tightly closed polyethylene containers. HF attacks glass and therefore should **never** be stored in a glass container. Containers of HF may be hazardous when empty since they retain product residues.

How Do I Dispose of HF?

HF-specific spill control materials are required for spills.

HF and HF-contaminated materials should be disposed of as hazardous waste according to Princeton University's general waste procedures.

References

1. Recommended Medical Treatment for Hydrofluoric Acid Exposure Ver. 1.0, Honeywell Inc., May 2000
2. Hydrofluoric Acid Product Literature, Honeywell Inc.