



Working with hydrofluoric acid

Hydrofluoric acid is very corrosive, highly irritating and poisonous. Hydrofluoric acid burns can be severe and extremely painful, causing extensive damage or even death.

Uses

Some uses and sources of hydrofluoric acid (also known as HF) include:

- Aluminium cleaner and brightener
- Oil refineries (alkylation process)
- Making fluorine compounds including fluorocarbons and plastics
- Cleaning iron and steel castings
- Laboratory reagent
- Etching glass
- Cleaning mineral sands
- Stain removal (commercial laundries)
- By-product of aluminium production
- By-product of phosphate fertiliser production

Hydrofluoric acid is also transported for these purposes, so may be present on trucks, trains, ships or in courier vehicles. A Poisons Permit from the Department of Health is required for purchase of solutions containing greater than 1 per cent hydrofluoric acid.

Properties

Hydrofluoric acid is available commercially as a solution of up to 70 per cent HF. It is a colourless liquid with a sharp irritating odour. Concentrations above 40 per cent may fume visibly when the container is open. It is dangerous when heated as it gives off highly corrosive and poisonous fumes of hydrogen fluoride. Hydrofluoric acid can also be generated from bifluoride salts when mixed with an acid, for example ammonium bifluoride with sulfuric acid.

Health hazards and first aid

Hydrofluoric acid is very hazardous and the full extent of injuries may not be obvious for some hours. **Urgent first aid is very important**, even for minor exposure.

Exposure route	Health hazards	First aid
<p>Skin</p>	<p>Highly corrosive and toxic by skin contact. The acid is rapidly absorbed through the skin with toxic and potentially fatal effects. Skin contact produces deep and extremely painful burns, with destruction of underlying tissue.</p> <p>Absorption can decalcify bones and cause systemic toxic effects due to calcium and magnesium imbalance, because the HF binds to calcium and magnesium in the body. This can cause heart or other organ damage or failure.</p> <p>It has been estimated that skin exposure to concentrated HF over 2% of body area (about the size of a hand) can be fatal. Recovery from serious non-fatal burns may take a long time.</p> <p>Burns from strong solutions are felt immediately but weaker solutions spilled on the skin may not cause pain for several hours. Workers may have finished work and returned home before feeling pain and realising something is wrong.</p> <p>Fingernails not properly scrubbed can cause acid to be retained under the nails causing burns, absorption into the body and possible nail loss.</p>	<p>Wash Prompt decontamination is essential. Flush with running water to wash off all acid, for up to five minutes (preferably using a shower, otherwise a tap or hose.) Remove contaminated clothing, shoes, watch, rings etc as quickly as possible while still under the running water. Make sure that the acid does not spread to other parts of the body or onto the rescuers. Scrub under nails if contaminated.</p> <p>Calcium gluconate gel Wearing gloves, apply calcium gluconate gel to the burns as soon as possible after drenching. Gently rub the gel into the contaminated areas and continue to apply fresh gel for at least 15 minutes after the pain has stopped.</p> <p>Caution Prevent further contamination of injured person or rescuer. Rescuer protective equipment is essential during decontamination and early management. The injured person may need gloves to prevent hand contamination while showering and applying gel.</p> <p>Note: Even dilute solutions of hydrofluoric acid will rapidly penetrate the skin, destroying the soft tissue and bone underneath. Use of calcium gluconate gel helps to counteract this.</p> <p>Seek urgent medical attention.</p>

Exposure route	Health hazards	First aid
Eyes	Hydrofluoric acid fumes can dry out the eyes and cause a burning sensation, redness and secretions. Splashing into the eyes may cause severe and irreversible damage to the cornea, including possible blindness. Splashing into the eyes with dilute HF may cause delayed burns.	<p>Immediately flush with water. Remove contact lenses if possible without causing further trauma. If only one eye is affected, make sure that contaminated water does not run into the other eye. Continue flushing with water or irrigate with normal (isotonic) saline during transport.</p> <p>Get to hospital as soon as possible. Continue flushing the eye with water or normal saline while travelling.</p> <p>Calcium gluconate gel supplied for skin burns is not suitable for use in eyes, however sterile 1% calcium gluconate solution may be used in eyes under medical supervision.</p> <p>Seek urgent medical attention. Consult an ophthalmologist (eye specialist)</p>
Breathing	Breathing in low vapour concentrations may irritate the nose and throat. High vapour concentrations can cause severe burns to the lips, mouth, throat and lungs. Fluid may accumulate in the lungs (pulmonary oedema) and this can lead to death. Effects on the lung may occur immediately or can be delayed for up to 36 hours.	<p>Take precautions to ensure the rescuer's safety, then remove the affected person to fresh air. Give oxygen if available. Use a 2.5% calcium gluconate solution in a nebuliser if available. If breathing has stopped, begin resuscitation immediately avoiding direct mouth-to-mouth breathing.</p> <p>Seek urgent medical attention.</p>
Swallowing	If hydrofluoric acid is swallowed, burning of the digestive tract may occur, with bleeding, vomiting, diarrhoea and collapse of blood pressure. Perforation of the digestive system or organ failure due to calcium imbalance may lead to death.	<p>Do not induce vomiting. Rinse the person's mouth out with cold water. Give half to one cup of water, milk or calcium/ magnesium containing antacid to drink if conscious and able to swallow. Do not give large amounts of fluid or vomiting may occur.</p> <p>If vomiting occurs naturally help the person to lean forward to reduce the risk of breathing in the vomit. Vomited material must be handled as contaminated i.e. Avoid contact; clean up immediately into double sealed bag.</p> <p>Seek urgent medical attention.</p>

Risk management - employers

Identify the hazard

Find out if any of the products that you use or transport contain hydrofluoric acid. It can also be called hydrogen fluoride, fluorohydric acid or HF. It may have a commercial name like 'Rustoff' or 'Aluminium brightener' - so read the labels and material safety data sheet (MSDS). Also look out for any products containing 'bifluoride' such as ammonium bifluoride, sodium bifluoride, potassium bifluoride or similar as these can produce hydrogen fluoride if an acid is present.

Make sure you have a current MSDS (less than five years since date of issue).

Assess the risk

In consultation with staff, carry out a risk assessment to identify any safety and health risks to employees or others in relation to the use of hydrofluoric acid. Use expert assistance, such as an occupational hygienist, if risks are complex, air monitoring is required, or you are uncertain of the risks. Document the risk assessment.

Review the risk assessment when any changes in the task or environment occur, if problems arise, or at least every five years.

Reduce the risk

Wherever possible, **replace** hydrofluoric acid with a less hazardous substance.

Purchase hydrofluoric acid in more **dilute** forms where possible to eliminate handling the concentrate.

Follow the **MSDS** recommendations for safe storage, handling, first aid, spill management and disposal of the material.

Contain or totally enclose the process if possible.

Where fumes may be emitted; install, maintain and use local exhaust **ventilation** close to the work.

Investigate the types of **container** the product is available in. Purchase smaller containers if practicable. Containers with spill proof valves are available from some suppliers. If purchasing in bulk, such as an intermediate bulk container (IBC), ensure the IBC is less than five years old and in good condition, as failure due to UV degradation of the plastic can occur. Ensure all containers are clearly labelled.

If you **store** hydrofluoric acid for any length of time, inspect the container regularly to ensure it is in good condition as some plastic containers become brittle over time. All stored hydrofluoric acid should be in a bund or secondary container sufficient to hold the volume of the largest container, and made of compatible material. Further information on safe storage and handling is available in *AS 3780 Storage and handling of corrosive substances*.

Transferring hydrofluoric acid from one container to another requires a safe dispensing system. **Avoid pouring**. Receiving containers must be stable and secure and the work area should be designed to prevent spilled acid contacting the worker.

Develop, document, maintain and supervise **safe work procedures**.

Workers should not handle concentrated hydrofluoric acid while working alone.

Make sure that all workers are aware of the hazards associated with hydrofluoric acid and they are fully **trained** in the safe use of the material, correct use of equipment including personal protective equipment and in emergency and first aid procedures. Keep records of the training.

Provide **personal protective equipment** and clothing. Provide appropriate respiratory protection where there is any risk of breathing in hydrofluoric acid fumes or spray mist. To protect the eyes and skin, safety equipment and clothing should be provided and used, eg chemical safety goggles, face shield, hats and hoods, sleeve protectors, gloves, long aprons, coveralls and/or safety boots as necessary. Have appropriate respirators ready for use in emergencies.

Make sure that all protective clothing and equipment is made of materials that are resistant to hydrofluoric acid, such as PVC.

Make sure protective clothing and equipment is thoroughly decontaminated after use.

Provide **safety showers and eye wash** facilities that are quick and easy to get to and operate in an emergency.

Always keep **calcium gluconate gel** in the first aid supplies in areas where hydrofluoric acid is used or stored. It is advisable to carry the gel when **transporting** hydrofluoric acid, in case of an accident or leak occurring during transit. Calcium gluconate gel has an expiry date and should be stored in cool conditions.

Advise your local **medical service** that you are using hydrofluoric acid and ensure they are equipped to provide treatment. If using large quantities, also inform the Fire and Emergency Services Authority.

Guidance for employees

- Follow your employer's instructions and training in the safe use of hydrofluoric acid.
- Use the personal protective equipment and clothing provided. Check it for damage before use.
- Make sure you know where safety showers, eye wash and calcium gluconate gel are located.
- Tell your employer about any situation that may be dangerous so that something can be done before an accident happens.
- Report any accidents, spills or leaks immediately.

Further information

In the event of exposure:

Poisons Information Centre (Australia) Telephone 13 11 26

AS 2243 Safety in Laboratories series is available for purchase from Standards Australia at www.saiglobal.com/online/ or telephone 131 242.

AS 3780 Storage and handling of corrosive substances is available for purchase from Standards Australia at www.saiglobal.com/online/ or telephone 131 242.

Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace [NOHSC:3017(1994)], www.ascc.gov.au

Poisons permit for use of >1per cent hydrofluoric acid in WA: Department of Health Telephone: 9222 4222 or www.health.wa.gov.au

Priority Existing Chemical Assessment Reports: PEC No. 19 Hydrofluoric Acid is available at www.nicnas.gov.au under Publications.

Safe Work Australia Guide: *Hydrogen Fluoride*, available at www.safeworkaustralia.gov.au under Guidance Material.

Segal, Eileen, 1998. *First Aid for a Unique Acid: HF*, American Chemical Society, available at: membership.acs.org/C/chas/techarchive/hffirstaid/firstaidhf.htm

Storage and transport of hydrofluoric acid: Resources Safety division of the Department of Minerals and Petroleum, Telephone: 9358 8001 or www.dmp.wa.gov.au

The *Australian Dangerous Goods Code* is available at www.ntc.gov.au/ViewPage.aspx?DocumentId=01147

The *Occupational Safety and Health Act 1984* and the *Occupational Safety and Health Regulations 1996* are available at www.slp.wa.gov.au

The *Standard for the Uniform Scheduling of Drugs and Poisons* is available for purchase at www.tga.health.gov.au/ndpsc/susdp.htm

WorkSafe *Safety and Health Alert: Fatal accident - Hydrofluoric acid* is available at www.worksafe.wa.gov.au under Publications → Safety and Health Alerts → 1994.

US Agency for Toxic Substances and Disease Registry, www.atsdr.cdc.gov/

National Relay Service: 13 36 77
Quality of service feedback line: 1800 30 40 59

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