Guideline Hydrogen Fluoride and Hydrofluoric Acid

WARNING: HIGHLY CORROSIVE AND TOXIC; HIGH HAZARD THROUGH ALL EXPOSURE ROUTES

Users of hydrofluoric must remain conscious of correct handling and first aid of this highly corrosive chemical. Unlike surface damaging acids (hydrochloric and sulphuric acids) hydrofluoric acid (HF) readily penetrates the skin and deeper tissues, binding to calcium and causing tissue damage including decalcification of bone, if immediate first aid measures are not taken. Hydrogen fluoride may cause severe, painful burns to the skin, eyes, mucous membranes and severe respiratory irritation. Large burns, or exposure to very concentrated solutions may result in gastro intestinal problems, cardiac arrhythmias and death. Guidelines on which HF burns have a high probability of systemic producing toxicity are:

1. Exposure of 1% of body surface area to 50% or greater HF solution
2. Exposure of 5% of body surface area to any HF solution (Kirkpatrick JJR, Enion D.S, Burd D.A.R. Hydrofluoric acid burns; a review, Burns, Vol 21, pp 483-493 1995)

The palm of the casualty’s hand represents approximately 1% of the body’s surface area. The process of tissue destruction can be prolonged for days. Affected students or staff must have immediate first aid and be referred to a doctor even if the injury seems very minor. Any large burn or exposure to a concentrated solution requires specialist medical assessment in a hospital setting.

Persons working with dilute solutions of HF should be aware that delayed pain can occur and it is strongly advised that personnel who are affected by hydrogen fluoride seek medical advice and medical advisers provide calcium gluconate gel to affected, but asymptomatic persons, so that they may use the gel if suffering any symptoms.
PRECAUTIONS FOR USE

The severity of HF burns is largely dependant on the surface area of contact with the substance and the concentration of the acid.

All workplaces and research laboratories throughout the University should ensure the following:

- replace hydrofluoric acid with a less hazardous substance wherever possible. For example, use phosphoric acid for cleaning alloys, or water based products for removing rust;
- totally enclose or contain the process;
- install exhaust ventilation with efficient localised extraction systems that remove fumes away from workers eg. fume cupboards;
- keep containers closed and secured;
- develop, maintain and supervise the safest possible procedures and work practices. Ensure workers do not work alone with hydrofluoric acid of more than 10% concentration;
- provide emergency shower and eye rinsing stations at close range;
- ensure first aid supplies of calcium gluconate gel are available and within use-by date (this product often has a short use by date and so needs regular checking);
- provide personal protective equipment (PPE) to protect eyes and skin, in the form of safety spectacles, long gauntlet PVC gloves and PVC apron. Where there is a risk of breathing in hydrofluoric acid vapour or spray mist, suitable respiratory protection (with Type B* filters) should be worn;
- make material safety data sheets (MSDS) available to all staff to provide information on chemical use. Information and advice on chemical use is available on ** CHEMWATCH and from the Occupational Health and Safety Unit; and
- ensure all staff and students are aware of the hazards, and fully trained in the safe use of HF acid, first aid and emergency procedures.

SPILLS

- Restrict access to area
- Do NOT use water
- Do NOT touch spill material
- Do use emergency PPE --PVC overalls -PVC boots -Half face respirator with Type B* gas filter -Self contained breathing apparatus (for major spills)

Further information on safe work practices to be followed when using hydrofluoric acid can be obtained by contacting the Occupational Health and Safety Unit on ph: 3365 2365.

* Type B gas filter is for use against specified inorganic gases and acid gases
**A computer-based chemical management system providing hazard and safe use information on pure chemicals and commercial chemical formulations. Many departments have access to this database through a UQ network.
**FIRST AID**

**Skin:** for skin contact:
- Remove contaminated clothing using PVC gloves and drench the area with water for a sufficient period of time, usually one to two minutes, to remove all hydrofluoric acid.
- Apply calcium gluconate gel (2.5% - available in 25gm tubes), to and around the contaminated area and massage in with clean, preferably gloved fingers. White specks appearing around the contaminated area indicate that the desired reaction has taken place.
- Continue massage with repeated application for 15 minutes after the pain has subsided or until medical treatment becomes available.
- If no gel is available, continue washing for at least 15 minutes, using soap if available. If patient is conscious, give six calcium gluconate or calcium carbonate tablets in water by mouth.

**Eyes**
- irrigate the eyes immediately and copiously with water for at least 15 minutes;
- continue irrigation with water or isotonic saline (normal saline, 0.9% sodium chloride in sterile water) until the severe pain of the burn is relieved; and
- ALWAYS obtain specialist medical attention.

**Inhalation**
- Rescuers should wear respiratory protection (self contained breathing apparatus in the case of a MAJOR leak or spill)
- Transfer the patient to uncontaminated area.
- If breathing stops, clear airway and give expired air or cardiopulmonary resuscitation as needed. Oxygen should be given by Security, doctor or ambulance officer.

**General first aid treatment**
- Obtain urgent medical advice or transport the patient to hospital by ambulance, explaining to emergency staff and the casualty the importance of early treatment and the risk of a delayed reaction.
- Examine the patient’s skin for burns and treat as above.
- Keep the patient quiet, at rest, warm and comfortable. Do not permit the patient to return to work or to go home without medical examination because of the possibility of delayed symptoms.

*Further information on first aid required for hydrofluoric acid exposure can be obtained by contacting the Occupational Health Nurse Adviser on ph. 33654883.*

*OH&S Unit/University Health Service reissued 8/2009*