



MANAGEMENT OF HYDROGEN FLUORIDE INJURY

Training for First Aiders + Health Professionals
(Part 1 - General Information + First Aid)

CONTENT PART I

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- Usage of hydrogen fluoride
- General Information
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 - Aqueous Hydrofluoric Acid (HF)
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 - Ingestion

INTRODUCTION

- This Recommendation is based on the various measures taken by member companies of Eurofluor.
- It in no way is intended as a substitute for the various national or international regulations, which should be respected in an integral manner.
- It results from the understanding and many years experience of the AHF/HF producers in their respective countries at the date of issue of this particular document.
- Established in good faith, this recommendation should not be used as a standard or a comprehensive specification, but rather as a guide which should, in each particular case, be adapted and utilised in consultation with an AHF/HF manufacturer, supplier or user, or other experts in the field.

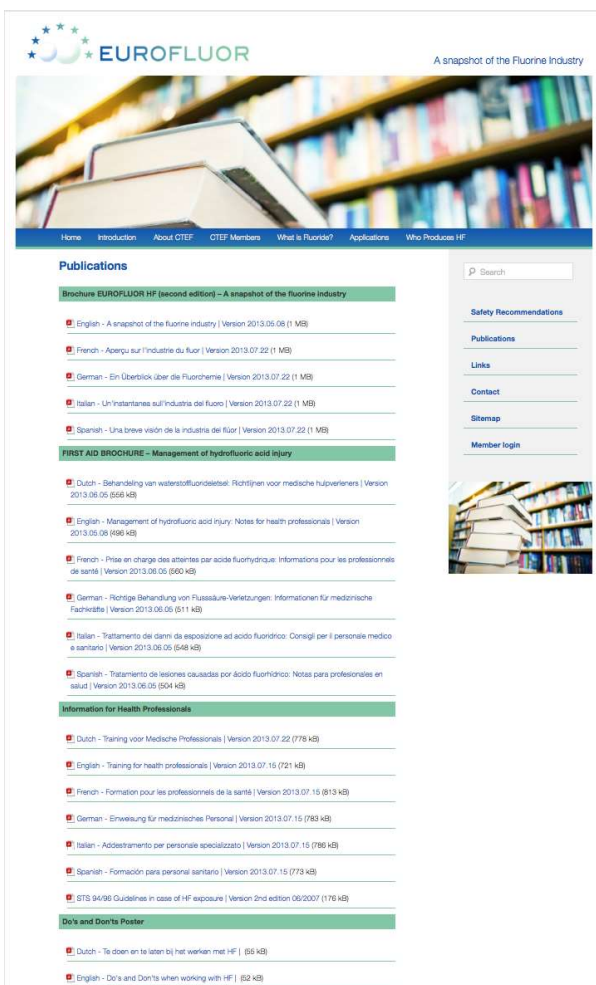
INTRODUCTION

- It has been assumed in the preparation of this publication that the user will ensure that the contents are relevant to the application selected and are correctly applied by appropriately qualified and experienced people for whose guidance it has been prepared.
- Eurofluor does not, and indeed cannot, make any representation or give any warranty of guarantee in connection with material published in Eurofluor publications and expressly disclaims any legal liability or responsibility for damage or loss resulting from the use, or misuse, of information contained in this document.

USAGE OF AHF / HF

Industry	Usage of AHF/HF
ELECTRONICS	Production of microchips, cleaning agents for electronic circuits
METALLURGY	Metal cleaning/aluminium production
PETROCHEMICALS	As catalytic agent when alkalising petrol
GLASS INDUSTRY	Glass etching
COOLANTS	Air conditioning, refrigerators
EXTINGUISHING AGENTS	Fire extinguishers
FLUOROCHEMISTRY	Production of fluoride salts, production of Fluoroplastics
MEDICINES	Propellant for medication, anaesthetic gases, production of antibiotics, production and coating of surgical prostheses, production of medicines
NUCLEAR INDUSTRY	Processing of uranium ore
AGROCHEMISTRY	Pesticides
CLEANING AGENTS	Rust removers, outer wall cleaners

CLASSIFICATION OF AHF / HF



The screenshot shows the EUROFLUOR website. The header includes the EUROFLUOR logo and the tagline 'A snapshot of the Fluorine Industry'. Below the header is a navigation bar with links: Home, Introduction, About CTEF, CTEF Members, What is Fluorine?, Applications, and Who Produces HF. The main content area is divided into two columns. The left column contains a 'Publications' section with a list of documents, including 'Brochure EUROFLUOR HF (second edition) - A snapshot of the fluorine industry' and 'FIRST AID BROCHURE - Management of hydrofluoric acid injury'. The right column contains a 'Safety Recommendations' section with links for Publications, Links, Contact, Sitemap, and Member login. A search bar is located at the top of the right column.



EU SAFETY DATA SHEET
according to Regulation (EC) No. 1907/2006 and Regulation (EC) No. 453/2010

Hydrogen fluoride anhydrous
Material number: F001

Disclaimer

The information contained in this document is intended as advice only and whilst the information is provided in utmost good faith and has been based on the best information currently available, is to be relied upon at the user's own risk.

No representations or warranties are made with regards to its completeness or accuracy and no liability will be accepted by the Cefic, the CTEF or its Members for damages of any nature whatsoever resulting from the use of or reliance on the information.

Section 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name: Hydrogen fluoride anhydrous
CAS number: 7664-39-3
EINECS number: 231-634-8
REACH registration No.: 01-2111xxxxxx-xxxx

1.2 Relevant identified uses of the substance or mixture and uses advised against

Chemical basic material

1.3 Details of the supplier of the safety data sheet









Company name: CEFIC / CTEF Sample
Street/POB-No.:
State/city/postal code:
World Wide Web: www.eurofluor.org
Email: info@eurofluor.org
Telephone:
Telefax:
Dept. responsible for information:

1.4 Emergency telephone number







See your national chemical association for this information.

See also documents written by CTEF European security Organisations
(<http://www.eurofluor.org/publications.html>).

GENERAL INFORMATION ABOUT ANHYDROUS HF

Concentration %	CLP CLASSIFICATION CLP – Classification, Labelling and Packaging	ADR / RID CLASSIFICATION ADR - European Agreement on International Carriage of Dangerous Goods RID – Regulations Concerning the International Carriage of Dangerous Goods
AHF HF > 85%	<p>ACUTE TOXICITY (oral, dermal and inhalation) Cat. 1 and 2</p> <p>SKIN CORROSION Cat 1A</p> <div>   </div> <p>Hazard statements (H Statement)</p> <p>H300: Fatal if swallowed H310: Fatal in contact with skin H330: Fatal if inhaled H314: Causes severe skin burns and eye damage</p>	<p>HYDROGEN FLUORIDE, ANHYDROUS CLASS 8 PG I CT1 : CORROSIVE SUBSTANCE, TOXIC, LIQUID</p> <div>    </div> <p>HYDROFLUORIC ACID with more than 85% of hydrogen fluoride CLASS 8 PG I CT1 : CORROSIVE SUBSTANCE, TOXIC, LIQUID</p> <div>    </div>

GENERAL INFORMATION ON AQUEOUS HYDROFLUORIC ACID (HF)

Concentration %	CLP CLASSIFICATION CLP – Classification, Labelling and Packaging	ADR / RID CLASSIFICATION ADR - European Agreement on International Carriage of Dangerous Goods RID – Regulations Concerning the International Carriage of Dangerous Goods
HF > 60% HF < 85%	ACUTE TOXICITY (oral, dermal and inhalation) Cat 1 and 2 SKIN CORROSION Cat 1A  	HYDROFLUORIC ACID with more than 60% but not more than 85% hydrogen fluoride CLASS 8 PG I CT1 : CORROSIVE SUBSTANCE, TOXIC, LIQUID <div> <div>886</div> <div>1790</div> </div>  
HF ≤ 60%	Hazard statements (H Statement) H300: Fatal if swallowed H310: Fatal in contact with skin H330: Fatal if inhaled H314: Causes severe skin burns and eye damage	HYDROFLUORIC ACID with not more than 60% of hydrogen fluoride CLASS 8 PG II CT1 : CORROSIVE SUBSTANCE, TOXIC, LIQUID <div> <div>86</div> <div>1790</div> </div>  

PHYSICO – CHEMICAL PROPERTIES

SUBSTANCE NAME	HYDROGEN FLUORIDE (AHF) HYDROFLUORIC ACID (HF)
CHEMICAL FORMULA	HF
IDENTIFICATION	CAS NUMBER: 7654-39-3 EINECS NUMBER: 231-634-8 UN NUMBER: 1052 / 1790 RTCES/NIOSH NUMBER: MW 7875000
STATE OF MATTER	Liquid. When its vapours get in touch with humidity create abundant and dense white fumes.
COLOUR	Colourless
ODOUR	Sharp Pungent Odour. Odour Threshold: 0.04 – 0.13 p.p.m.
PH	<1
STABILITY	Stable under normal conditions. There is a great tendency to polymerization, not considered dangerous
SOLUBILITY IN WATER	100% by weight

GENERAL HAZARDS OF AHF/HF

HAZARDS FOR HUMAN HEALTH



- Fatal if inhaled, if swallowed and in contact with skin
- Causes severe skin burns and eye damage
- It needs specific medical treatment
- In case of prolonged exposure may cause occupational disease
- Sharp, pungent and suffocating odour

HAZARDS FOR ENVIRONMENT



- It can pollute surface and groundwater and the soil
- Air pollutant
- Hazardous for aquatic life

EXPOSURE TO AHF / HF

ANY EXPOSURE OF AHF / HF
MUST BE CONSIDERED AS BEING
SEVERE!

RISKS OF AHF/HF



Properties of AHF/HF:

Corrosive (acid)	→	serious tissue destruction/burns
Toxic	→	systemic effects
Dangerous in the event of inhalation (gas)	→	inhalation trauma

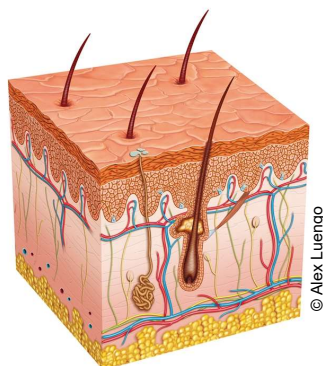
Types of exposure by AHF/HF:

Liquid (Note: also a risk in low concentrations!)
Gas
Combination of liquid and gas

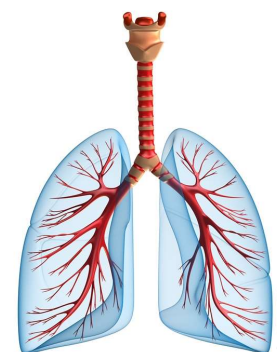
PHYSIOPATHOLOGY & TOXICOLOGY

CONTACT THROUGH:

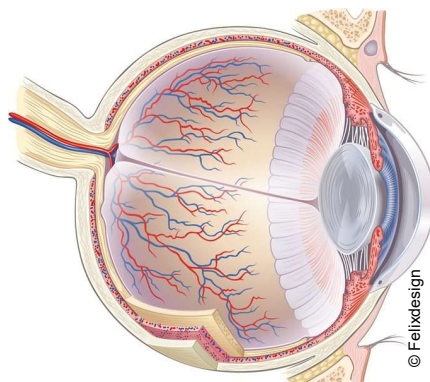
SKIN



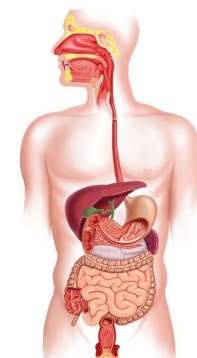
AIRWAYS



EYES

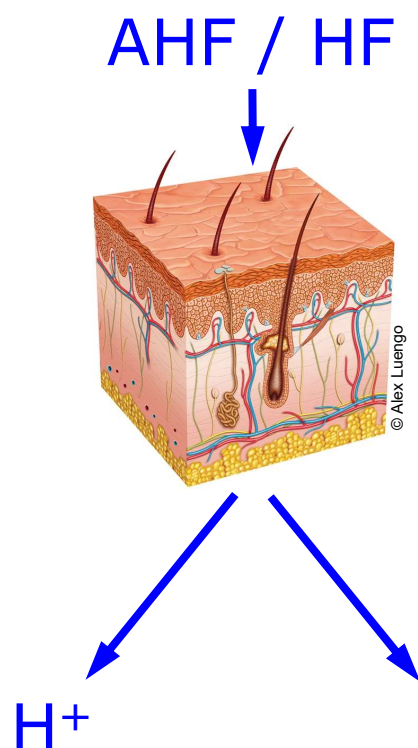


MOUTH
(gastrointestinal
system)

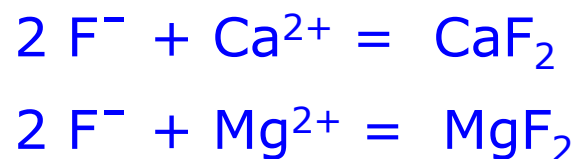


PHYSIOPATHOLOGY & TOXICOLOGY

SKIN CONTACT:



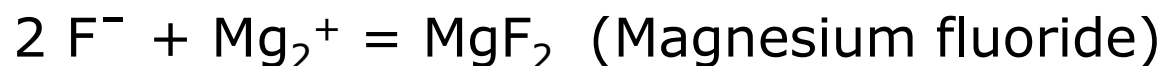
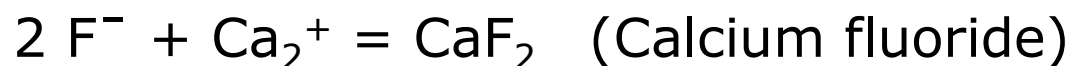
- Rapid dissociation at pH 7.4 (body)
- Fluoride forms salts



PHYSIOPATHOLOGY & TOXICOLOGY

After ionisation the fluorine forms insoluble and soluble salts

Insoluble salts:



Soluble salts:



PHYSIOPATHOLOGY & TOXICOLOGY

Acute/primary



- Corrosive effects
 - Concentration >50% results in immediate serious tissue destruction/blisters,
 - exceptionally painful



- Systemic effects
 - Low calcium level in the blood (cardiac rhythm disorders/arrest) and
 - fluoride intoxication (hepatic and renal disorders)

PHYSIOPATHOLOGY & TOXICOLOGY

Sub-acute/secondary



- Symptoms depending on concentrations of AHF/HF
 - HF > ~14%: symptoms immediately evident
 - HF ~12%: symptoms not evident until an hour later
 - HF < ~ 7%: symptoms possible >24 hours after exposure!
- Systemic effects
 - Low calcium level in the blood
(cardiac rhythm disorders/arrest) and
 - fluoride intoxication
(hepatic and renal disorders)

PHYSIOPATHOLOGY & TOXICOLOGY



Sub-acute/secondary

- Tightness of the chest
(sometimes not occurring until hours after exposure),
- Lung oedema
- **Danger:** delayed pain and skin destruction

PHYSIOPATHOLOGY & TOXICOLOGY



Long term

- Effects of tissue damage through the corrosive and toxic effect
(scar formation and hepatic and renal disorders)
- **Note:** no effects documented or reported in the case of chronic exposure to very low concentrations of HF

PHYSIOPATHOLOGY & TOXICOLOGY

Exposure controls / Personal protection (see MSDS)

Control parameters

Type Limit value

IOELV = indicative occupational exposure limit values

TWA = Time-weighted average concentration (8 hours)

STEL = Short Term Exposure Limit (15 minutes)

Europe, IOELV: TWA (hydrogen fluoride) 1,5 mg/m³; 1,8 ppm

Europe, IOELV: STEL (hydrogen fluoride) 2,5 mg/m³; 3 ppm

DNEL: Derived no effect level (AHF) Exposure pattern	Route	DNEL	SYMPTOMS	
Acute and systemic local effects)	Inhalation	2.5 mg/m ³	Irritation (respiratory tract)	Workers
Long-term acute and systemic effects	Inhalation	1.5 mg/m ³	Irritation (respiratory tract)	Workers

PHYSIOPATHOLOGY & TOXICOLOGY

ERPG 1 (Emergency Response Planning Guideline)

“The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odour = 2 ppm”

ERPG 2 (Emergency Response Planning Guideline)

“The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual’s ability to take protective action = 20 ppm”

ERPG 3 (Emergency Response Planning Guideline)

“The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to an hour without experiencing or developing life-threatening health effects = 50 ppm”

AHF/HF IS CORROSIVE AND TOXIC AND MAY CAUSE:



1. Severe and painful burns of the skin
2. Irritation of air ways that can lead to bronchitis or even pulmonary oedema
3. Asphyxia (severely deficient supply of oxygen)
4. Severe and painful burns of the eyes
5. Blindness
6. Severe and painful burns of the digestive track and,
7. Serious Toxic Systemic Effects, that will require specialized (intensive) care
 - metabolic,
 - surgical,
 - thoracic,
 - ophthalmic intervention

Note: *All or any of the above effects may be delayed in onset and/or be accompanied by toxic systemic effects.*

APPROACH TO MEDICAL TREATMENT



- Industrial experience indicates that prompt treatment, as described, will prevent the development of serious injury
- Therefore, speed is essential.
- Delays in decontamination, first aid care or medical treatment or improper medical treatment will likely result in greater damage or may, in some cases, result in a fatal outcome.
- Relief of pain is an important guide to the success of the treatment; therefore local anaesthesia should be avoided

APPROACH TO MEDICAL TREATMENT



AHF/HF exposures are different from other acid exposures:

- AHF/HF penetrates all tissue it comes in contact with and does not remain on their surface.
- Once absorbed AHF/HF rapidly dissociates into ionic Hydrogen and Fluoride. Hydrogen is in this context of little importance.
- Fluoride migrates and continues to destroy deep tissue layers as it migrates and will create soluble and insoluble compounds that are the basis for the systemic toxic effects.
- And unlike other acids that are rapidly removed or neutralized, the corrosive and toxic effects may continue for days if left untreated.

ADVICE FOR FIRST AIDERS



Pay attention not to get yourself
contaminated

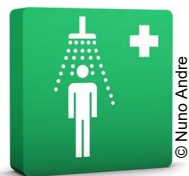
Wear appropriate PPE and
AHF / HF resistant gloves

FIRST AID



- DO NOT DELAY
- Demands immediate contact with First Aid Team
- Remove victim from exposure area, and
- START WITHOUT DELAY FIRST AID TREATMENT
- As a rescuer: PROTECT YOURSELF
- Ensure that the victim is accompanied by a rescuer
- Obtain medical attention immediately

DECONTAMINATION



- Use huge amounts of water of a safety shower / eyewash to decontaminate the affected areas
- AHF/HF is very water soluble, so water decontamination is highly effective
- Begin decontamination as soon as possible
- Clothing, personal protective equipment and jewellery/ watches/ shoes should be assumed to be contaminated and removed during showering
- Check with pH paper (on skin and in eye) if decontamination was efficient

FIRST AID - SKIN



- Principle: flush off and dilute
- Remove all contaminated clothing (jewellery/watches/shoes etc.!) under the safety shower
- Finally, remove protective goggles, looking towards the shower spray with closed eyes.
- 1 minute of flush after undressing is sufficient!
- Continue with showering until Calcium Gluconate is available!
- Rub in Calcium Gluconate 2.5% gel as soon as possible
- Continue massaging for at least 15 additional minutes after the pain disappears
- Transport to hospital:

“WET & NAKED.....”
(completely decontaminated)



DECONTAMINATION - EYES



- Initial decontamination with huge amounts of water from an eyewash or similar high flow device
- Flow and open and close your eye lids. It must be assured that there is adequate irrigation under the lids and in the corners of the eyes
- There is considerable discomfort associated with irrigating under the eyelids and in the corners of the eyes
- Therefore, if available for application by trained personnel, use of a topical anesthetic is recommended after an initial brief decontamination

FIRST AID - EYES



- Once decontamination has been completed, continue irrigation with a low flow solution
- Irrigate each eye with 0,9% saline solution (Ringer solution)
- This should be continued while the individual is transported for medical evaluation by an eye specialist.
- Obtain medical attention **immediately**, especially specialised ophthalmic attention.

FIRST AID - INHALATION



- Administer 100% oxygen by mask.
- Nebulize 2.5% calcium gluconate in normal saline solution continuously until medical evaluation.
- If respiratory assistance is needed use indirect methods such as „microshields®“ or „ambu“ bag

FIRST AID - INGESTION



- Do not induce vomiting
- Maintain life support
- Bring to medical attention immediately

SYSTEMIC EFFECTS



- Monitor for signs of systemic fluoride toxicity, especially low serum calcium
- strongly consider the infusion of calcium gluconate intravenously as presumptive treatment for impending systemic effects of AHF/HF (hypocalcemia being the most immediate).

END OF PART 1

More information/brochures

It is strongly recommended to download

- First Aid Brochure (Management of hydrogen fluoride injury)
- Guidelines in Case of AHF/HF Exposure
- AHF / HF Safety Data Sheets

on website www.eurofluor.org under Publications & Recommendations

PART 2 (for medical professionals) can only be obtained through:

Eurofluor

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