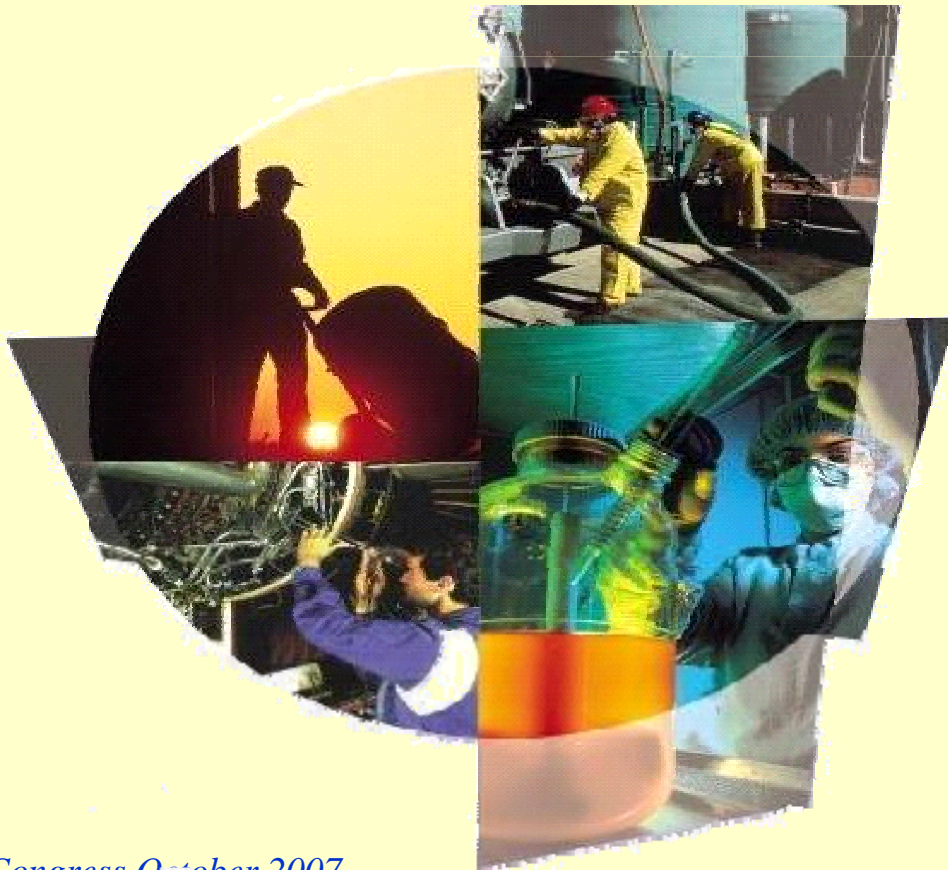
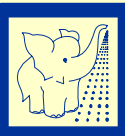


Hydrofluoric acid burns

Clinical results of decontamination and experimental data on living animals



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Scientific Action Group
PREVOR Laboratory
www.prevor.com*



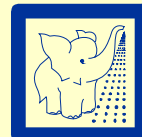
Some data about hydrofluoric acid (HF)

- ◆ **Is used in numerous industries: mineral (uranium), ceramic glass and cristal factory (engraving, polishing frosting), metal industry (cleaning), organic industry (manufacturing of fluoride by-products, catalyst), paper industry, analytical chemistry**
- ☞ **Manufacturing of HF in USA : 375,000 tons in 1998; 400,000 tons in 2002**
- ☞ **More than 1000 incidents per year in USA**
- ☞ **50% of severe chemical burns are due to HF**
- ☞ **A body area of 2% can be fatal with concentrated HF**
- ☞ **Average affected area is $0.5 < 1\% < 10$**
- ☞ **In 64% of the cases, hands are affected and in 10% of the cases, the forearms**

📖 *Segal EB Chemical Health and Safety, 2000, 18-23*

Wedler V et al. J Trauma 2005, 58, 852-857

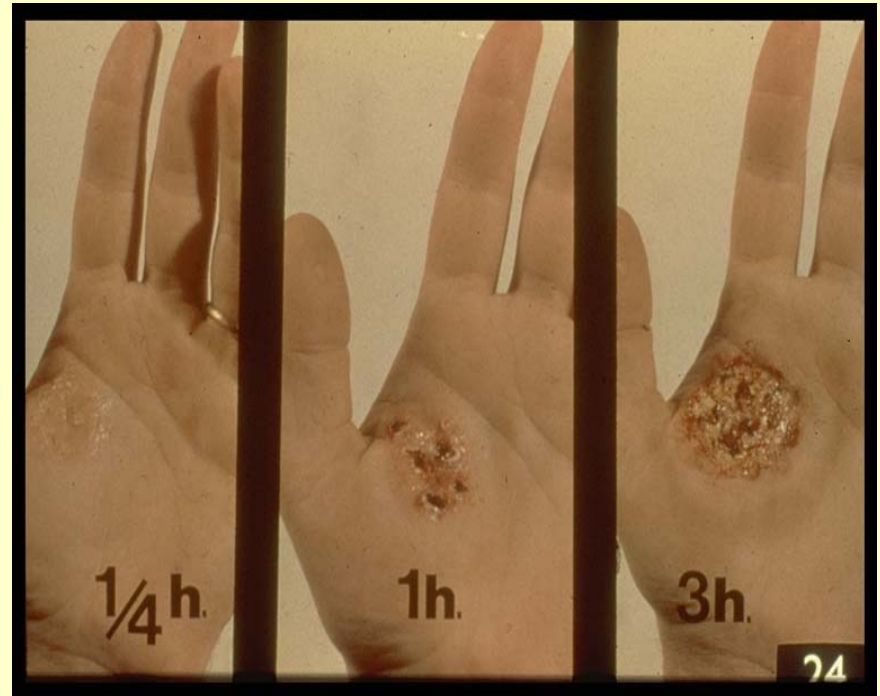
Hatzifotis M et al. Burns 2004, 30, 156-159



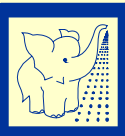
Hydrofluoric acid (HF)

A small and weak acid but a devil chemical

- a corrosive attack
 - due to H^+ ion
- penetration of F^- ion:
 - systemic toxic action
 - chelation of Ca^{2+}
 - chelation of Mg^{2+}
 - Cellular poisoning
 - $F^- + Na^+ \rightarrow NaF$
 - $F^- + K^+ \rightarrow KF$



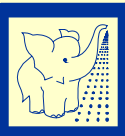
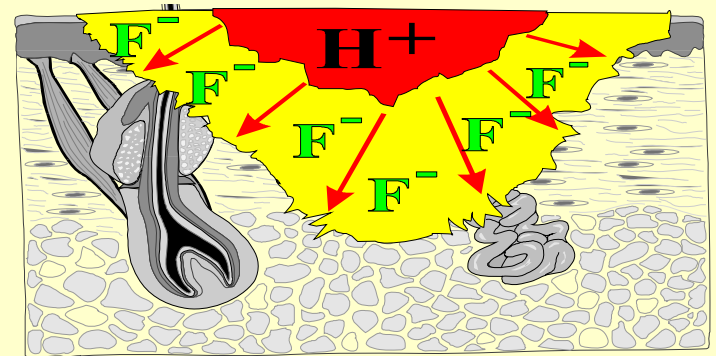
HF will penetrate and then dissociate in H^+ and F^- in the tissue creating necrosis and an evolutive burn similar to bases



Factors of development of HF burn?

The evolution of the burn depends on

- its concentration
- the time of contact
- the surface of the affected area
- if it is used at high temperature



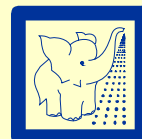


First time HF properties were discovered






 *Thenard and Gay-Lussac. Annals of Chemistry, 1809, 69, 204*

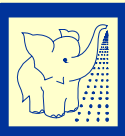
- **Thénard and Gay-Lussac** were the **first researchers** to prepare a concentrated **hydrofluoric acid**, demonstrating its existence (also found boron, cyanide)
- Their product fumed strongly in air, rapidly dissolved glass, and **caused extraordinary burns** on contact with the skin
- They described how a **diluted solution of potassium hydroxide stopped the pain**, so they introduced 200 years before the idea of **neutralising the acid burning**.



Effects due to HF burns

 *Segal EB Chemical Health and Safety, 2000, 18-23*

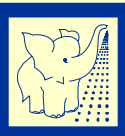
-  Concentration $> 50\%$:
Immediate pain and rapid necrosis
-  Concentration 20%-50% :
Delayed burn from 1 to 8 hours
-  Concentration $< 20\%$:
Delayed pain and necrosis until 24 hours



HF burns with a lethal risk

Penetration	% affected surface	HF Concentration
Burn due to contact	1	anhydrous
Burn due to contact	5	> 70%
Burn due to contact	7	50-70%
Burn due to contact	10	20-50%
Burn due to contact	20	< 20%
Prolonged exposure or long delay before treatment	Minor burns	
HF Ingestion		>5%
HF Inhalation		>5%

 *Dunser MW, Burns, 2004, 391-398*



Examples of HF cutaneous burns

