



Ansell

HYDROFLUORIC ACID PROCEED WITH (EXTRA) CAUTION

**DISCOVER THE RISKS OF
HYDROGEN FLUORIDE AND
LEARN HOW TO STAY PROTECTED**



**SAFETY
BRIEFING**

DO YOU KNOW THE RISKS OF USING HYDROFLUORIC ACID IN INDUSTRIAL SETTINGS?

“ Hydrofluoric acid is known to pose serious health risks, but it plays an important role in manufacturing processes. ”

Hydrogen fluoride is a chemical compound used in a range of industrial settings. **It is found as a liquid under pressure (anhydrous hydrofluoric acid), but more commonly as an aqueous solution with a max strength of 70% – aqueous hydrofluoric acid¹.** Hydrofluoric acid is known to pose serious health risks, but it plays an important role in manufacturing processes. Mitigating the risks of exposure is vital to ensure health and safety in industrial operations that involve this dangerous compound.



Because hydrogen fluoride mixes readily with water – becoming hydrofluoric acid – the risks to safety can be considered interchangeably.



WHY IS HYDROFLUORIC ACID NEEDED?



“ 60% of the hydrogen fluoride used in manufacturing is for processes to make refrigerants.² ”

Hydrogen fluoride is used in the manufacturing of refrigerants for freezers and air conditioning units, herbicides, pharmaceuticals, high-octane gasoline, aluminium, plastics, electrical components, and fluorescent light bulbs.

AREAS OF USE



Refrigerants for freezers



Air conditioning units



Herbicides



Pharmaceuticals



High-octane gasoline



Aluminium



Plastics



Electrical components



Fluorescent light bulbs

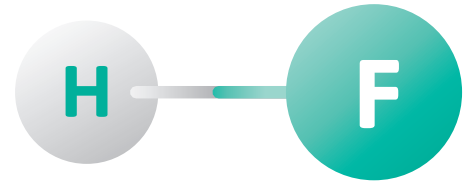


Etching glass & metal

WHY IS HYDROFLUORIC ACID SO DANGEROUS?

The 'double danger' effect

Hydrofluoric acid is particularly dangerous due to the combination of corrosive **hydrogen ions (H⁺)** and the toxicity of **fluoride ions (F⁻)** that can penetrate deep tissue and cause cell death.³



H300 Fatal if swallowed

H310 Fatal upon skin contact

H314 Contact causes severe skin burns and eye damage

H318 Causes serious eye damage

H330 Fatal if inhaled



HEALTH RISKS ASSOCIATED WITH HYDROFLUORIC ACID



SKIN CONTACT

Because hydrofluoric acid is so corrosive, it quickly and easily burns through the skin and enters the body. Skin contact may cause severe and painful burns and skin ulcers that take several hours to develop.



GAS INHALATION

Inhaling hydrogen fluoride can damage lung tissue and cause swelling or pulmonary edema – the buildup of fluid in the lungs.



EXTRA CAUTION

Based on the experience of firefighters, there's a risk that exposure to hydrogen fluoride gas may also react with sweat on a person's skin, so we can't say for certain whether its risk is contained to inhalation.⁴

It is therefore recommended that anyone working with or at risk of coming into contact with

hydrofluoric acid (or hydrogen fluoride in any of its forms) wears a full-body, gas-tight protective suit (hazmat).

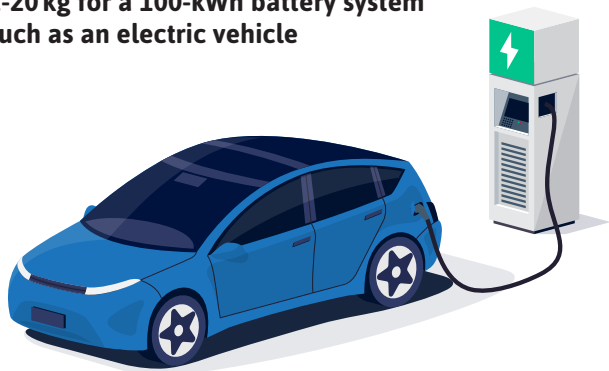
HYDROGEN FLUORIDE EXPOSURE RISKS AS A RESULT OF LITHIUM-ION BATTERIES

Lithium-ion batteries are considered safe for use in many industrial settings, **but they do present a fire risk when overcharged, overheated, damaged or short-circuited.** This is where hydrogen fluoride comes in.

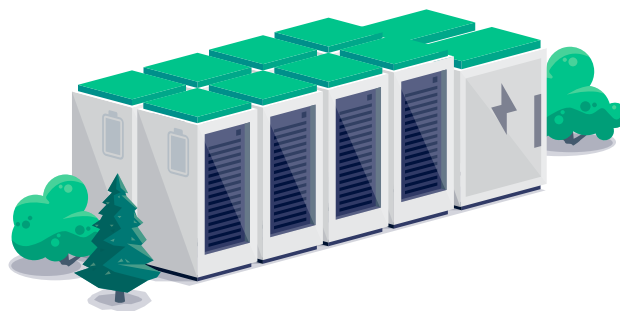
Research from Chalmers Institute of Technology and RISE⁵ shows that between 280 g and 2.8 kg of hydrogen fluoride forms when a 14-kWh lithium-ion energy storage unit combusts.

In large battery packs, the equivalent would be:

**2-20 kg for a 100-kWh battery system
such as an electric vehicle**



**20-200 kg for a 1000-kWh battery system
e.g. a small stationary energy storage**



The immediate risk to life or health (IDLH) level for hydrogen fluoride is 0.025 g/m³ (30 ppm) and the lethal 10 minutes HF toxicity value (AEGL-3)* is 0.0139 g/m³ (170 ppm).⁶

*Acute Exposure Guideline Level 3 (AEGL-3) is the airborne concentration (expressed as ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The release of hydrogen fluoride from a lithium-ion battery fire can therefore be a severe risk and an even greater risk in confined or semi-confined spaces.

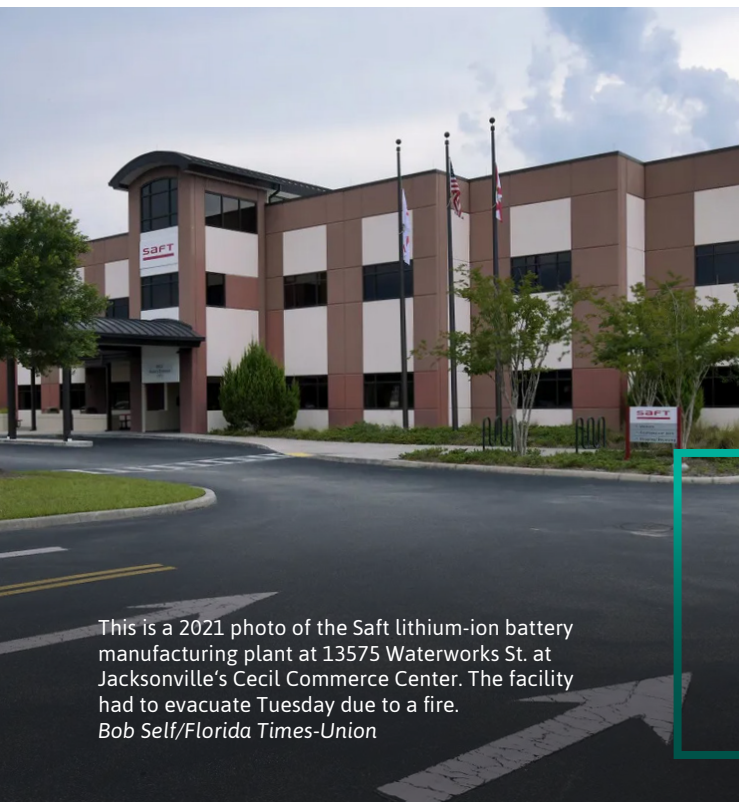
Is hydrofluoric acid used in lithium-ion batteries?

While hydrogen fluoride gas is associated with lithium-ion battery fires, it's important to note that it is **not intentionally included as a component of lithium-ion batteries.** Instead, it is generated as a byproduct under certain conditions, particularly during a thermal event like a fire.²

5. <https://www.nature.com/articles/s41598-017-09784-z>

6. https://publications.lib.chalmers.se/records/fulltext/251555/local_251555.pdf

TWO SERIOUS INCIDENTS REPORTED IN THE SPACE OF TWO DAYS



This is a 2021 photo of the Saft lithium-ion battery manufacturing plant at 13575 Waterworks St. at Jacksonville's Cecil Commerce Center. The facility had to evacuate Tuesday due to a fire.
Bob Self/Florida Times-Union

April 25 2023 – Jacksonville, Florida (USA)

A factory producing and storing lithium-ion batteries as large as 9072 kg reported a serious incident after a battery caught fire. According to reports⁷, **the building didn't show signs of flames externally, but needed to be evacuated due to the potential dangers of explosions, the risk of rapid fire development and toxic smoke.** The crew wore hazmat suits as they moved and cooled a large number of batteries, and the fire chief cited the risk of hydrogen fluoride as a key factor.

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April 26 2023 – Gothenburg (SWEDEN)

Many smaller lithium-ion batteries were involved in a shipping container fire on an industrial park near Gothenburg just one day after the Jacksonville incident. Reports⁸ counted 9000 kg of lithium-ion batteries, and 10 fire crews spent multiple days cooling them down.

One person had to be treated at hospital for breathing problems and possible lung damage.

The Swedish Civil Contingencies Agency had the Swedish Defence Research Agency to investigate how regular firefighter turnout gear resists penetration from gaseous hydrogen fluoride. **The research⁹ found that the gear cannot resist for more than one minute.** They conclude that high-risk environments, like indoor lithium-ion battery fires, should only be handled while wearing a hazmat suit.



7. <https://eu.jacksonville.com/story/news/crime/2023/04/25/hazmat-crews-contain-saft-battery-plant-fire-in-jacksonville/70151045007/>

8. <https://www.gp.se/nyheter/goteborg/brand-i-container-roken-bedoms-vara-farlig.7c2eb797-9713-44de-8dca-a6f42bc83f7b>

9. <https://www.nature.com/articles/s41598-017-09784-z>

CONCLUSION



The health impacts of hydrogen fluoride gas inhalation or skin exposure are severe and even fatal, making it essential to mitigate risk wherever possible. For this reason, hazmat suits are the recommended precaution where exposure risk is anticipated.

Dangers of exposure in industrial settings can be managed with robust health and safety protocols and appropriate PPE, but there are also risks posed by lithium-ion battery fires which are less predictable and are becoming increasingly common.

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