

Accident Profile

Title

Release of hydrogen fluoride following power failure at a hydrofluoric acid plant

Date/Time of Major Occurrence

Start Date 30-10-2019 End Date 30-10-2019

Event Type

Near Miss

Reported under

EU Seveso III Directive

Seveso II Status

Upper tier

Industrial Activity

Chemical installations

Reasons for Reporting

- ☐ Substances involved: greater than 5% of quantity in Column 3 of Annex I
- ☐ Injury to persons: >= 1 fatalities, >= 6 hospitalizing injuries, evacuation, shelter-in-place, utility disruption and damage to real estate
- ☐ Immediate damage to the environment (according to Annex VI)
- ☐ Damage to property: on-site >2M €, off-site > 0.5M €;
- ☐ Cross-border damage: transboundary accidents
- ☒ Interesting for lessons learned.

Accident Report

Accident description

Power failure in the Trafogruppe 3 hydrofluoric acid plant caused by a hardware error in an S5 remote control system, with subsequent failure of the visualisation systems and manual plant shutdown.

A resulting increase in pressure in a hydrogen fluoride (HF) drum to over 10 mbar led to the release of HF in the production hall. This was condensed using a deluge system (inside the production building).

Taking into account the effectiveness of the exhaust gas scrubber and the exhaust gas fans – which could be kept powered and in operation throughout the incident apart from the short interruption between the central power failure and the manual switchover to the emergency diesel generator – as well as the monitors (outside the buildings), the additional water curtain installed by the plant fire service and the readings of the emission measurement device before the stack, the total amount of HF emitted to the atmosphere can be estimated at 2.6 kg.

The emission measurement device can display four digits, up to 9,999 mg/m³, with deviations of less than 10%. Between approximately 5:00 and 5:30, staff read values between 700 and 800 mg/m³. Taking into account the fall in HF release of approximately 18% within the first hour following the production stop, it is possible to calculate maximum HF concentrations of approximately 1,040 mg/m³ at the start of the power failure. Based on this, a conservative estimate of the amount emitted from the start of the power outage until the end of the water deployment inside and outside the building would be 4.1 kg HF (1,040 mg/m³ x 1,500 m³/h x 2.6 h).

The transfer of the power supply for safety-critical power units and equipment to the back-up power supply (diesel generator) was delayed due to a parallel failure of the UPS (230 V). The UPS would have been necessary for the automatic transfer of consumers to the emergency power supply. Instead, this had to be done manually. In addition, the manual switch for the emergency coolant supply failed. The continuous HF vapours (up to 2,700 kg in total over approximately 4 hours following the cut-off of the raw materials) had to be absorbed in the operational exhaust gas scrubber in the end, as the emergency scrubber installed for such an event did not work due to the non-opening butterfly valve in the inlet pipe.

The spread of these HF vapours was prevented by condensing using stationary process water monitors and water curtains provided by the plant fire service. The water used to condense the HF vapours was all sent to the internal waste water treatment plant and treated in accordance with the approved discharge parameters.

Accident involving

☐ Domino effects

☐ Natech events

☐ Transboundary effects

☐ Contractors

Release

Major Occurrences

gas/vapour/mist/etc release to air

Site and installation

Site description

Plant for the production of acids including chromic acid and hydrofluoric acid (4.1.13)

Installation/Unit description

Operating process: Process
Operational state: Normal operation
Part affected: Hydrofluoric acid plant

Process

Major occurrences	Equipment Type
chemical continuous reaction	
Initiating Events	Equipment Type

Substances

Substances Involved

Hydrogen fluoride (7664-39-3) | 2.6 kg

Substances Classification

H1. ACUTE TOXIC cat. 1

Substances detail

Substance	CAS Number	Quantities (t.)	
		Involved	Potential
Hydrogen fluoride	7664-39-3	0.00300	

Causes

Power failure caused by a hardware error in a remote control system (see trigger).

Plant/Equipment

Causative Factor	Type
component/machinery failure/malfunction	none

Consequences

Survey of damage / inspection, water damage, corrosion, cleaning; The material damage caused by the release of the HF and the use of the deluge system inside the production hall was recorded separately and, according to current estimates (not all invoices are available yet), is approximately EUR 100,000.

Cost

On site	Cost in Euro	Quantity/Effect
response, cleanup, restoration costs		

Emergency Response

Condensing of vapours inside the building, supported by monitors and fire service water curtains from outside.

Repair and maintenance shutdown, inspection prior to start-up, including expert approval in accordance with Section 29b of the Federal Immission Control Act (BImSchG).

Emergency Response	Quantity	Quantity/Effect
On-site systems		
Off-site external services		
Sheltering		
Evacuation		
Other		

Remedial Measure	Quantity	Quantity/Effect
Decontamination		
Restoration		
Other		

Lessons Learned

Theme of the Lessons Learned

Causes - Plant/Equipment

Causes - Organisational

Other

Lessons Learned

Systematic inspection and improvement of electrical, auxiliary, emergency and uninterruptible power supply systems (230 V and 24 V), optimisation of maintenance plans.

Optimisation of fire-fighting water supply, regular performance tests.

Event Profile

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