Explosion and fire in a warehouse containing phytosanitary products

September 11, 1998

Sorgues (Vaucluse)

France

Ammonium nitrates
Explosion
Shattered glass
Incompatible products
Access constraints
Groundwater pollution

THE FACILITIES INVOLVED

The site:

The site, comprising 3 warehouses, was located in an industrial park, at the edge of a densely-urbanised zone, and employed a workforce of 35.

This facility stored, among other things, 1,700 tonnes of phytosanitary products, 17 tonnes of highly toxic products, 150 tonnes of toxic products and combustive products.

The site layout was constrained by easements, and development activity in surrounding urban areas was covered under a land use plan; a safety radius of 100 m, then 200 m, was established around the building storing phytosanitary products.

The unit involved:

The installation where the accident occurred was a storage building (the oldest of the 3 warehouses), with 1,600 m^2 of covered floor area on a single story. This building contained, along with other products, 26 tonnes of sodium chlorate.

THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident:

While the facility was closed, fire broke out around 6 pm inside one of the buildings. Ten minutes later, a violent explosion occurred, followed by smaller blasts. The initial fire turned into a conflagration and the resulting plume of smoke reached 50 m into the air.

On the scene within 15 minutes, fire-fighters needed 5 hours to fully control the blaze. Their response was hampered by subsequent explosions due to the presence of sodium chlorate.

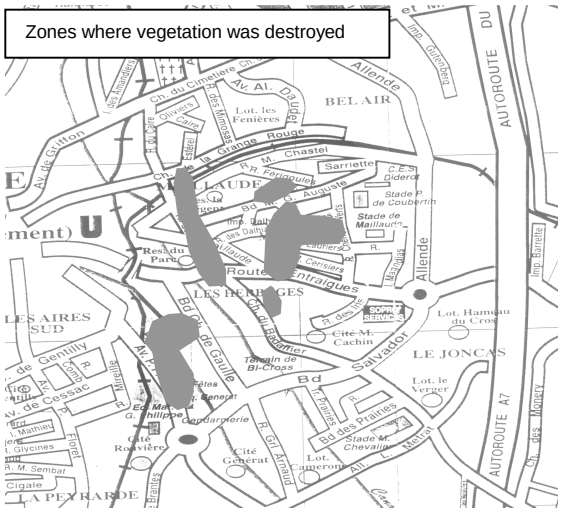
This accident caused the evacuation of 70 individuals. Families living in the residential units opposite the damaged building had to be housed elsewhere. Electricity service was cut off until much later in the evening.

Consequences of this accident:

The installations were heavily damaged:

- √ A wall was blown out 20 m,
- √ 1,000 m² of roof were destroyed,
- √ Window panes were shattered,
- √ Cans and jugs were sent flying as far as 150 m.

Outside the facility, roofs and partition walls were ripped off in the nearby employee dwellings. Shattered glass panes were projected over a radius of approx. 100 m, reaching a single-family neighbourhood to the north as well as residential buildings at the north-eastern and eastern periphery of the site: in all, some 50 families were affected and property damage was valued at between 30,000 and 50,000 francs.



One person was thrown onto the floor by the blast of the explosion and suffered a double fracture; 19 others were shocked by the event yet able to return home either the same day or the next day.

The surrounding vegetation along a 700-m swath along the prevailing wind direction was destroyed (due to the cloud of acid smoke combined with precipitation).

The quantity of water used by fire-fighters, which for the most part was pumped from the 2,000 m³ basin, was estimated at 1,000 m³; some of this fire-fighting water reached the groundwater supply.

The cost of internal property damage amounted to 10 million francs.

The European scale of industrial accidents:

By applying the rating rules applicable to the 18 parameters of the scale officially adopted in February 1994 by the Member States' Competent Authority Committee for implementing the '*SEVESO*' Directive on handling hazardous substances, and in light of information available, this accident can be characterised by the four following indices:

The parameters composing these indices and their corresponding rating protocol are available from the following Website: http://www.aria.developpement-durable.gouv.fr.

The violence of this explosion could be evaluated by the distance over which broken glass was sprayed (150 m): the TNT equivalent was less than 0.1 tonne (parameter Q2). Consequently, the overall value of the "Hazardous materials released" index was assigned a "1".

The "Human and social consequences" index scored a "3", as 70 neighbours had to be evacuated (H7) and about 20 among them sustained slight injuries (H5).

Due to a lack of information, the "environmental consequences" index could not be rated.

The overall level of the "economic consequences" index was given a "1" rating, as internal property damage (parameter €15) and external damage amounted respectively to 10 million francs and 50,000 francs (parameter €17).

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THE ACCIDENT

The compound sodium chlorate caused the explosion; a significant quantity was being stored inside the warehouse. While sodium chlorate served as the combustible, the ignition source remains unknown. Several suggestions have been forwarded:

- √ improperly stored waste, which would have reacted with the sodium chlorate,
- √ incompatibility of the chlorate with other products onsite.

ACTIONS TAKEN

A prefectural emergency order was issued, specifically aimed at: site safety, removal of waste subsequent to the accident, and mandated groundwater inspections. This order also laid out steps to ensure that the site's other warehouses were safety compliant. According to the site survey, it was noted that quantities stored at the facility exceeded limits authorised by the order (26.6 tonnes stored vs. 8.1 tonnes authorised).

The consequences of the smoke cloud were forecasted by an expert using models, based on actual meteorological conditions affecting the fire; the critical concentration levels corresponding to the threshold of significant effects on human health were deemed not to have been reached.

A specialised firm was contracted to remove debris from the site between September 17 and October 21 in order to eliminate the risk of building collapse, in addition to sorting and disposing the various wastes via authorised means; 147 tonnes of hazardous waste (phytosanitary products, chlorate and sulphur) were discharged, along with: 13.5 tonnes of other phytosanitary products, 51.2 tonnes of soiled debris, 1,140 tonnes of ordinary industrial waste and inert debris, and 79 m^3 of asbestos cement.

At the same time, another specialised company provided an expert assessment of both the groundwater and soil pollution risks. The investigations conducted revealed that this accident was not responsible for any noteworthy consequence on groundwater flowing beneath the site.

The damaged building was demolished and replaced by a new warehouse containing fire-resistant systems adapted to the types of products stored, as well as an offset retention basin, smoke aeration and venting, extinguishers, and fire protection and foam protection systems.

LESSONS LEARNT

Sodium chlorate (which merely needs to be notified for quantities between 2 and 100 tonnes) can trigger a major accident (see detailed accident report ARIA 4987: "Fire and explosion at an industrial goods warehouse in 1981").

The most toxic fumes appear during the least devastating phases of the fire, at a time when combustion is incomplete and the plume remains close to the ground.

Heat release aids the airborne dispersion of pollutants.

Under these modelled accident conditions, the maximum concentration of toxic products is found between 400 m and 500 m from the origin of the blaze, which corresponds to where the plume actually falls.

Lastly, a good warehousing practice consists of separating combustibles from combustion fuels.