

Fire and explosion in a chemical plant

February 19th ,2000

Manerbio

Italy

Fine chemistry
Batch process
Distillation column
Nitric acid
Thermal runaway
Property damage

THE INSTALLATIONS IN QUESTION

The site :

The company where the accident occurred is located in Manerbio (Brescia) and manufactures pesticides and other products (drug products). In light of its activity and products stored, the company is subject to the Seveso 2 directive.

The installations concerned

The accident occurred in the pendimethalin production unit (pendimethalin is an active ingredient in the manufacture of a selective herbicide). The manufacturing process consists of the following phases :

- ① mononitration,
- ② alkylation of 4-nitroxylene,
- ③ denitration of the intermediate chemical,
- ④ purification and washing of the pendimethalin.

The fabrication process takes place in 3 buildings in the following manner:

- ⇒ in building 1, denitration and recovery of nitric acid,
- ⇒ in building 2, mononitration of orthoxylene, purification of the pendimethalin, 1st and 2nd distillation operations.
- ⇒ in building 3, reduction of 4-nitroxylene.

THE ACCIDENT, ITS BEHAVIOUR, EFFECTS AND CONSEQUENCES

The accident

On February 19th at approximately 2 am, the nitric acid concentration unit exploded. As of June 2000, the inquiry is not yet finished although the scenario is most likely as follows:

- ⇒ An explosion occurred on the lower part of the distillation column and the associated heating tank.
- ⇒ 2 tanks are located not far away: one containing nitric acid (40% solution) and derivative products resulting from cleaning the distillation column. The other was empty. The explosion caused the acid tank to be projected against the other tank. The full tank suffered damage (cracks) due to projectiles from the explosion and began to leak.
- ⇒ A fire was reported in the zone where the explosion occurred: the flames reached heights of several meters.
- ⇒ The smoke column from the fire reached twenty or so meters and, due to the wind, was directed toward the highway nearby.
- ⇒ The residual products from the process as well as the products contained in the tank were diluted by the fire-fighting water, and then were drained into a treatment container prior to discharge.

According to the company, the quantities involved in the accident were as follows :

- ⇒ 1,000 to 1200 litres of nitric acid mixture (30 to 40%) / organic substances in solution: these were products contained in the distillation column and the associated heating tank. The volume of the piping is approximately 300 litres.
- ⇒ The nitric acid tank contained 6,000 litres of acid and a small quantity of diluted organic substances. However, the organic fraction consists of nitro-pendimethalin, nitrous pendimethalin and pendimethalin which are classified as harmful and toxic products.
- ⇒ In addition, the establishment also uses substances which are classified as very toxic, such as hydrofluoric acid.

The consequences :

The consequences were particularly visible in building 1; buildings 2 and 3 were only indirectly damaged by projectiles from the explosion (a few pieces of equipment and structures damaged). The control room was damaged (exterior walls damaged as well as the windows and ceilings) as well as the fire-protection pump room.

The accident claimed no victims.

On the outside of the establishment, damage was visible over a perimeter of 400m: this damage was essentially windows broken by the shock wave and facades damaged by flying projectiles.

As far as the cloud is concerned, which was apparently comprised of combustion products from the insulating materials covering the surrounding structures, its diffusion into the environment was no longer apparent as of 4:30 am, as reported by the competent authority.

European scale of industrial accidents

By applying the rating rules of the 18 parameters of the scale made official in February 1994 by the Committee of Competent Authorities of the Member States which oversees the application of the 'SEVESO' directive, the accident can be characterised by the following 4 indices, based on the information available.

Dangerous materials released		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Human and social consequences		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Environmental consequences		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Economic consequences		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The parameters that comprise these indices and the corresponding rating method are indicated in the appendix hereto and are available at the following address: <http://www.aria.ecologie.gouv.fr>

Nitric acid is a combustive substance and classified such in the 'SEVESO' directive. The threshold is 200 t. As the accident involved 6,000 litres of acid (8.4 t), or 4.2% of the threshold, the 'dangerous materials released' index was given a rating of 3 (see parameter Q1).

ORIGIN, CAUSES AND CIRCUMSTANCES OF THE ACCIDENT

An inquiry was ordered to clarify the exact causes of the accident and the installation was sealed. However, after the initial meetings with the operator, it was indicated that just prior to the explosion, the shift operator observed a sudden increase in pressure. This allows us to suppose that there was an uncontrolled reaction that developed within the process which then lead to the explosion.

ACTION TAKEN

An administrative inquiry has been started as well as a judicial inquiry conducted by the Brescia authorities.