

Explosion of an alcohol-tank in a sugar factory/distillery

24 July, 2000

Villette-sur-Aube (10)

France

Explosion
Sugar factory /
Distillery
Storage tank
Alcohol / Ethanol
Lightning
Flame arrestors

THE INSTALLATIONS IN QUESTION

The factory / distillery, located in Villette sur Aube (10), France, is composed of, amongst other things, a workshop that produces alcohol by distillation and an alcohol rectification workshop that has a capacity of 1,600 hl per day. On the regulation plan, when the accident happened, the company is operating with a prefectorial decree of July 4th, 1997. The plant is under the condition of Safety Report presentation, due to the french decree implementing the "Seveso II" european directive.

Since 1984, it has had a category 1 inflammable liquid storage capacity of 24,000 m³, consisting of 10 tanks of volumes ranging from 1,000 m³ to 5,000 m³.

THE ACCIDENT, ITS BEHAVIOUR, ITS EFFECTS AND CONSEQUENCES

The accident

On July 24th, the weather was stormy. The company had stopped loading the trucks and the valve at the base of the tank was closed at around 4.35 p.m.

Ten minutes later, the roof of the alcohol tank no. 211, was struck by lightning. The tank, which has a capacity of 5,000 m³, contained 1,000 m³ of 96 % absolute ethanol.

An explosion occurred, the roof blew off and fell onto the tank. A fire broke out. The tank shell remained intact and the fire does not propagate to the other storage tanks. However, the valve at the base of the tank cracked as a result of the impact.



Photo DRIRE Champagne-Ardenne



Photo DRIRE Champagne-Ardenne

The bound did not catch fire thanks to the pouring of foam concentrates. The tanks located nearby were sprayed down, in order to cool them down. The fire was considered to be extinguished at about 7.45 p.m.

The tanks were sprayed down until 11 p.m., at which time the fire brigade were called off. The on-site storage of 23,000 litres of foam concentrates was sufficient to extinguish the fire. The extinguishing water was retained in the bund.



Photo DRIRE Champagne-Ardenne

The consequences

The damage caused as a result of the accident is estimated to be more than 15 million French francs, i.e. 2,29 million euros.

No one was injured.



Photo DRIRE Champagne-Ardenne

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 checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

The level 3 of the index concerning the quantity of dangerous materials released (in the meaning of the SEVESO Directive) expresses the 1,000 m3 of 96% absolute ethanol released during the tank destruction (parameter Q1).

The level 3 given to the economic consequences is due to the high cost of the material damages the company have to face with, which raises 15 million French francs, i.e. 2.29 million euros (parameter €15).

Finally, there is not any noticeable consequence regarding the human, social and environmental aspects.

ORIGIN, CAUSES AND CIRCUMSTANCES OF THE ACCIDENT

The accident was caused by lightning that struck the tank, but the exact causes and circumstances could not be evaluated by experts. However, some elements which probably contributed to the accident can be put forward:

- ✓ Direct protection devices designed to attract the lightning (lightning rods) had been installed, but the channelling of the currents of atmospheric discharge (equipotential connections between the different tanks and the grounding terminals) at pre-determined points, in such a way as to spare the protected zones from the lightning, was probably insufficient.
- ✓ It should be noted that the tank was not fitted with flame arrestors on the vents, despite the study against lightening realised previously by the operator.
- ✓ According to witnesses' accounts, it would appear that lightning first struck near an overhead electrical power supply pylon a few moments previously. The energy which was brought to the earth certainly resulted in a modification of the ground in the area nearby.
- ✓ In addition, as the tank was 80% empty, the gaseous atmosphere volume must have been considerable.

The operator had previously, during the month of May, carried out a POI ("Plan d'Organisation Interne", internal contingency plan drill), in which the scenario was that of a fire on one of the alcohol tanks. The fire and emergency services therefore knew the site well, and the means of intervention were able to be put rapidly and calmly into operation.

The administration made no particular comment on the way in which the operations were carried out.

Lastly, it should be noted that 23,000 litres of foam concentrates and 7,000 m³ of water were used during this accident.



Photo DRIRE Champagne-Ardenne

ACTIONS TAKEN

The fire protection water tank was filled up during the course of the evening, by pumping water from the Aube river which is located approximately 500 m from the site. New foam concentrates were ordered.

As the installation was classified as at-risk, the sugar factory - distillery was covered by the provisions of the ministerial order dated January 28th, 1993 concerning lightning protection for certain installations that are classified for the protection of the environment (an obligation that is also provided for in article 1.8 of the prefectorial order pertaining to the site).

Article 2 of the ministerial order specifies that the lightning protection devices must be in conformity with French standard C 17-100, and in article 6 it provides for a 6-year time limit for existing installations to comply with these conformity regulations.

Memorandum No. 93-17 dated January 28th, 1993 provides for a preliminary study concerning lightning protection to be supplied by the manufacturer.

The study for this installation was carried out on December 9th, 1998. The recommendations included the installation of fire resistors on the vents and breather valves for the various alcohol storage tanks. These devices had not been installed. The operator has been put on formal notice of installing these devices within one month by a prefectorial decree dated August 10th, 2000.

In order to take into account all possible effects of the fire on the totality of the storage facilities, an emergency order was issued on 10th August, requiring:

- ✓ Checking of the soundness of the tanks (hermetic seal, strength), as the 3 tanks of 2,500 m³ capacity that were next to the damaged tank had been subjected to a high amount of thermal radiation.
- ✓ Checking of the electrical installations, by a qualified agency before the restart of any activity, in the whole storage farm.



Photo Internet Press

The quality of the water table was monitored daily over a period of 7 days, then weekly for a period of 3 weeks. There was no evidence of any impact on the water table.

The 1,500 m³ of extinguishing waters were transferred into one of the company's leakproof retaining pools, after analysis.

LESSONS LEARNT

On the basis of this accident, the lessons that could be learnt and worth being highlighted are:

- ✓ Consider the risk caused by lightning as dangerous as it could be;
- ✓ Make sure that the protection devices against the direct and indirect effects of the lightning, defined in the French standard C 17-10, have been placed and are regularly controlled.