

# Hose break on a mobile tank containing agricultural ammonia

12<sup>th</sup> May, 1969

Les Grandes Armoises (08)

France

Agricultural anhydrous ammonia (fertilizer)  
 Mobile tank  
 Hose  
 Maintenance / repairs

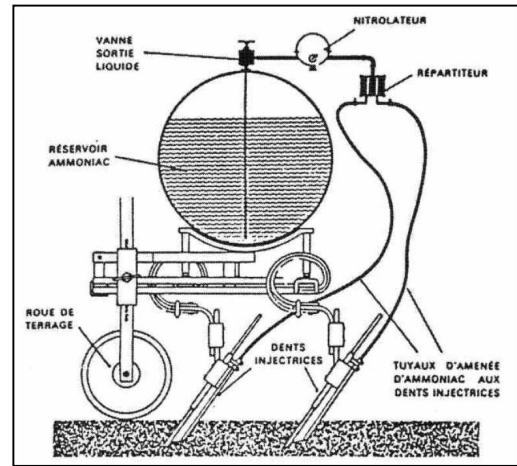
## THE FACILITIES INVOLVED

### The site:

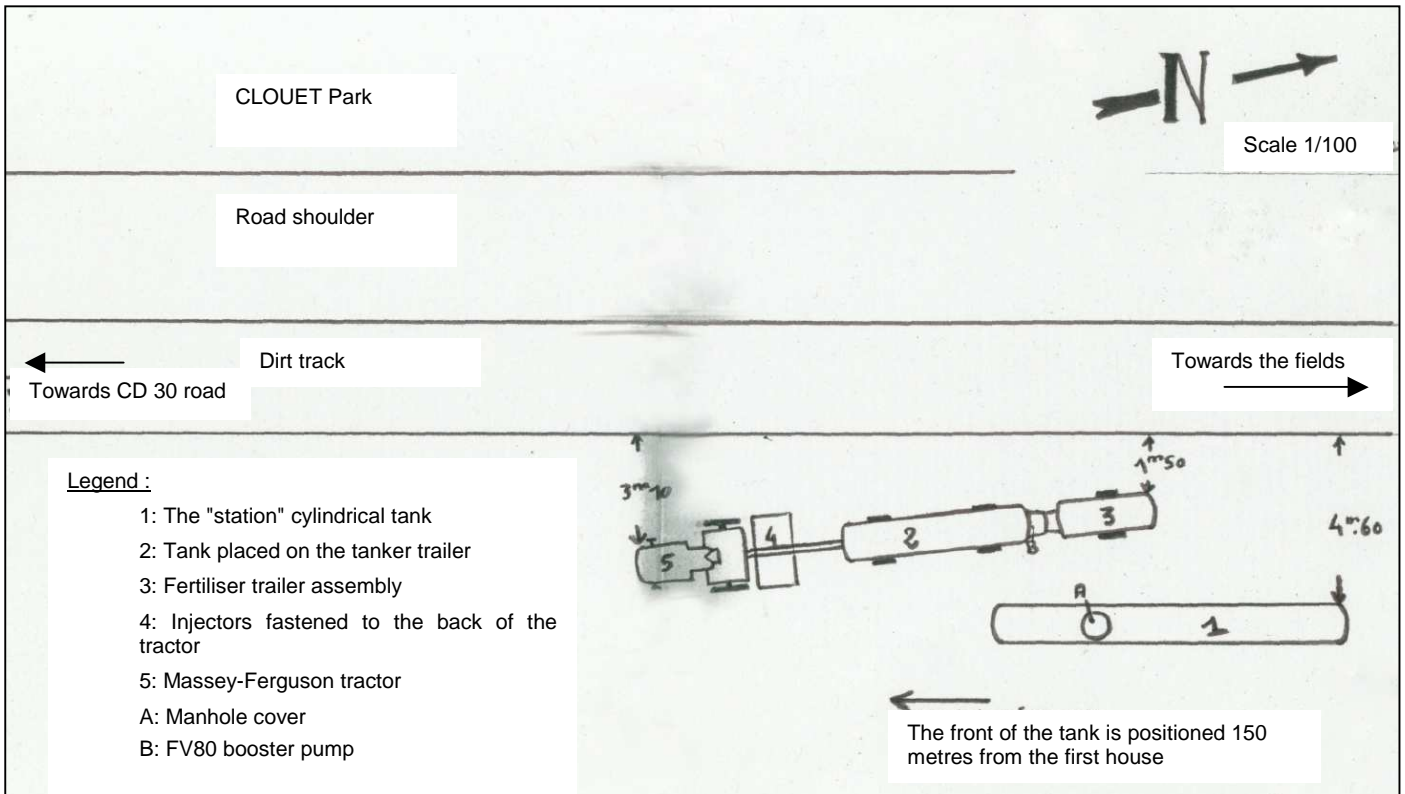
This installation was located along the boundary of a small road, near departmental road CD 30, at the northern edge of the village of Les Grandes Armoises, on the road leading to Stonne (in the Ardennes department).

The facility was composed of a stationary tank of pressurised liquid ammonia used as the primary means of storage during fertilisation campaigns, along with 2 mobile tanks hitched to a tractor. An "incorporator" attached to the tractor served to inject the ammonia in liquid phase directly into the soil.

The site layout was rather basic; no fence or valve lock had been installed, and the various equipment was accessible to the public (even to children) [3].



Sketch of an incorporator



The stationary tank (marked no. 1 on the sketch), built in 1966, had a capacity of 7,176 litres, a length of 9.45 m and a 1-m diameter. Its maximum service pressure was equal to 20 bar, with the most recent equipment test under pressurised conditions dating back to December 19, 1966. Its 8-mm thick shell was composed of 6 elements. Filled just 2 days prior, the shell was nearly full. The tank was owned by the industrial firm that performed the installation on behalf of the contracting farmer. The tank and its accessories (manometer, safety valve, etc.) were in good working order [3].

The mobile tank (indicated as no. 2 on the sketch), also built in 1966 and installed onto a farm trailer, featured a capacity of 3,680 litres for a maximum service pressure of 20 bar. This assembly was in good condition as well and belonged to the farm. The most recent equipment inspection by the industrial firm was logged on 15 February, 1968 [3].

The "fertilising trailer" set-up (no. 3 on the sketch) was cylindrical with a dimension of 2.10 m and hitched to tanker trailer no. 2. It was pressurised (at 6 bar, according to the manometer) yet not connected to any pipes. The larger trailer was used as a backup in the fields, while the smaller one was more convenient during actual spreading operations.

### The specific unit involved:

During material transfer, two hoses were connected (via a coupling) between the stationary tank and the receiving mobile tank:

- a "gas phase" pipe with a 15-mm internal diameter,
- a "liquid phase" pipe with a 35-mm internal diameter.

Valves allowed cutting the circuits and completely drain, at the end of the operation, the liquid part of the pipe dedicated to transferring the "liquid phase".

The pipe used for liquid transfer was in a poor state of repair.

3.20 metres in length, this pipe assembly was composed of a rubber duct surrounded by a cotton braid, a steel braid and lastly a cotton braid covered by vulcanised rubber. According to the industrial firm, these hoses were its property, but all maintenance costs were passed on to the farm.



Red dot = stationary tank assembly (no. 1), red line = "working" trailer (no. 3), red cross = tanker trailer (no. 2)

## THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

### The accident:

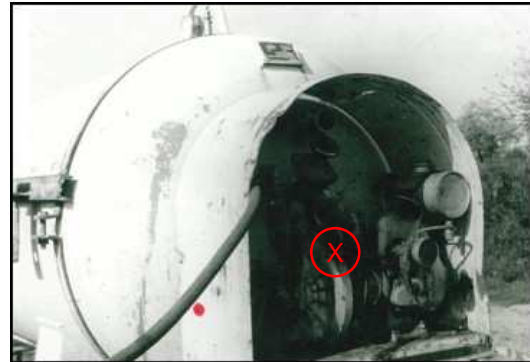
At 7:15 pm, anhydrous ammonia was transferred from the stationary tank into mobile tank no. 2 when the hose connecting the liquid part suddenly broke, producing a loud whistling noise (due to decompression of the ammonia). The outside temperature at the time was 24°C and the pressure hovered around 8 bar [1]. Some 7,000 litres of anhydrous ammonia (equivalent to 4 tonnes) spread over the ground and evaporated, forming a whitish cloud that would continue to be fed by the leak for another hour.

The technician, hit by the pipe, was thrust 5 m in back of the main tank. Burned on the neck and left arm and intoxicated, he was unable to close the valve since his protective gear (i.e. mask and gloves) were still in the tractor hitched to the trailer.

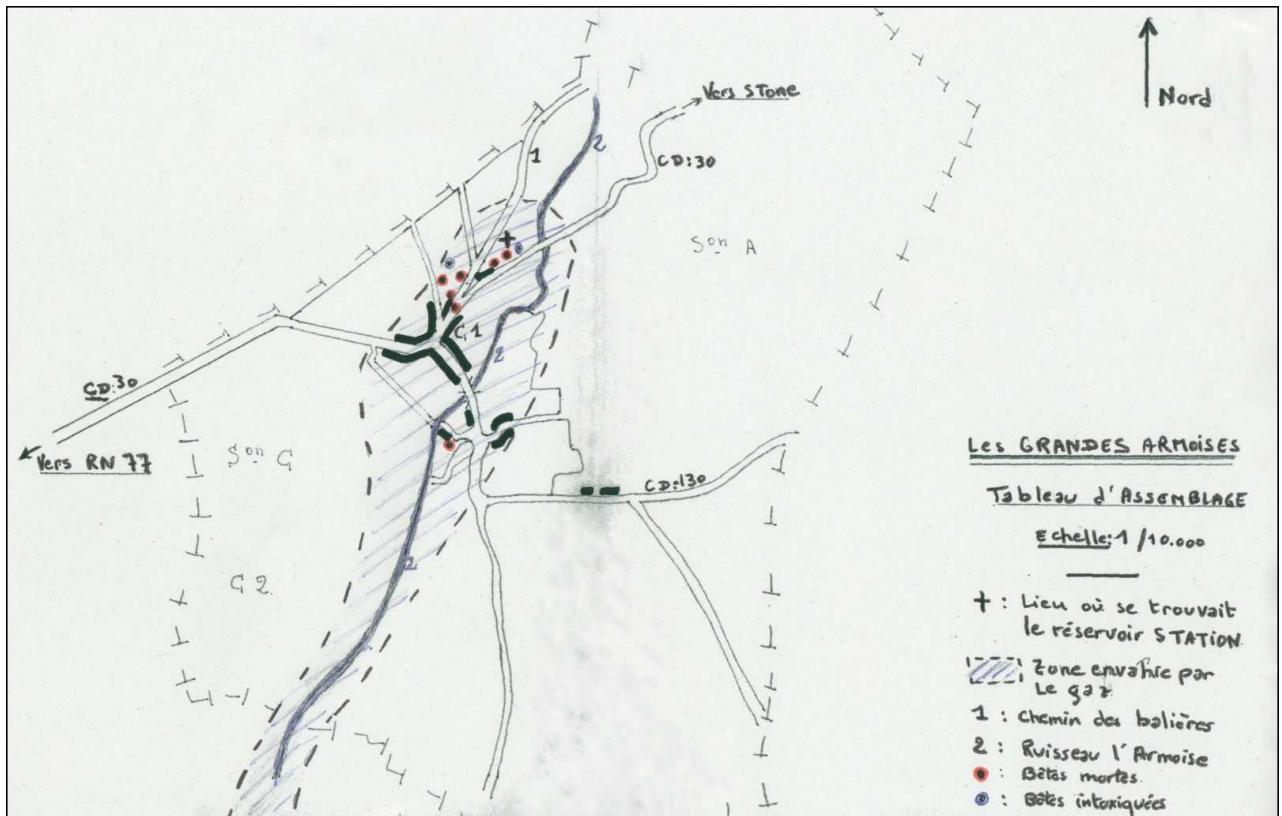
Rather than return to the trailer for his gear then shut the valve once properly equipped, the technician ran to the closest village 150 metres away to sound the alarm.

After the alarm was triggered, the local population made its way to high ground and neighbouring hilltops. 66 village residents found protection from the hazard by reaching high ground.

Later, the technician, accompanied by gendarme officers, attempted to return to the area near the tank in order to stop the leak, but they were forced to abandon the effort due to a lack of appropriate protective gear. The intoxicated technician was driven by the village mayor to Vouziers Hospital at 8:20 pm.



"Station" valves (cross = broken liquid hose, dot = gas hose); valves on the booster side in back of the tanker trailer (2)



Shown in blue stripes is the zone affected by the cloud. The red dots correspond to dead animal sightings (6 cows in the village) - the southernmost red dot corresponds to the dead foal.

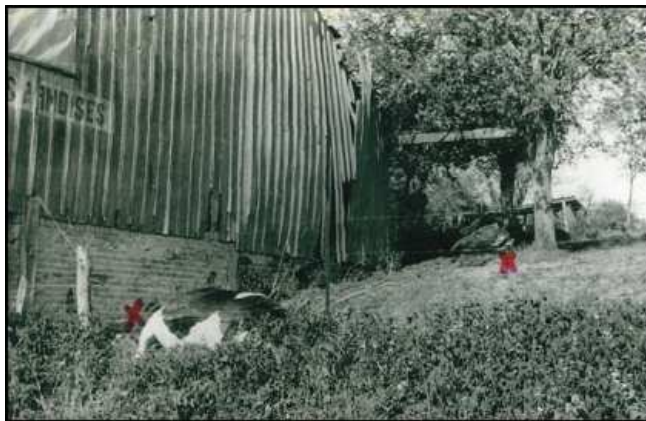
The region is rather hilly; after crossing the CD 30 local road, the cloud drifted around the northern edge of the village before following the Armoise Valley southward in the direction of the village of Suy, while dissipating along the way [1].

At 9:15 pm, it was announced that no potential danger remained, and village residents began to return home after 9:30, in adhering to the recommendation of ventilating their houses thoroughly [2].

**Consequences of this accident:**

The farmer, who was seriously intoxicated, remained hospitalised for 5 days. Five other individuals also suffered slightly. The gas cloud burned vegetation over a swath 450 m wide by 2 km long. Vegetable gardens were impacted, 40 ha of prairieland were contaminated, and 300 to 400 fruit trees and bushes were damaged.

Six cows, a foal, a dog and poultry succumbed near the village dwellings. The cows were located at distances from the tank station of 150, 200 and 300 m, respectively. Eight other heifers, another breeding cow and a fattening calf, all intoxicated by the cloud, had to be slaughtered on 14<sup>th</sup> May, 1969. Moreover, 25 beehives showed no signs of life.



**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:

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

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

Approximately 4 tonnes of anhydrous ammonia were released, which corresponds to 2 % of the Seveso threshold for this substance. The "hazardous substances released" index therefore rose to a level "3" (with parameter Q1 lying between 1% and 10%).

The technician was seriously intoxicated (parameter H4 = 1) and 5 members of the public sustained slight afflictions (parameter H5 = 2): the "human and social consequences" index was rated a level "2".

Local flora and fauna were affected over a zone nearly 90 ha. Without any precise indications regarding parameters Env 10 through Env 14 on the scale, the "environmental consequences" index was assigned a level "1" by default.

Without any available estimation of property damage, the "economic consequences" index could not be scored.

## THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THIS ACCIDENT

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The liquid transfer pipe was in a poor state of repair: decomposed fabric in spots, the metal braid completely worn away and rusted.

The pipe burst at the level of the end fittings and moreover revealed a 4-cm burst hole at mid-length of the section.

This pipe had obviously been exposed to adverse weather conditions<sup>1</sup> and displayed signs of erosion due to rubbing as if it had been dragged along the ground [1].

The firm would have notified the farmer of the defective condition of the hose during an exchange held 3 days prior to the accident; the farmer had planned on changing this hose at the end of the growing season [3].



## ACTIONS TAKEN

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The administrative and judicial investigations undertaken confirmed the poor condition of the hose as the accident source.

The technician's insurance policy compensated for the operating losses sustained, while the policies of the farmer and industrial company were written to cover this type of loss (up to a 150,000-franc limit for the farmer's policy).

## LESSONS LEARNT

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This accident, which illustrates a case of poor maintenance [1], underscores the need for proper technician training, as well as the importance of handling hazardous substances while wearing the appropriate personal protective gear.

The firm responsible for the installation redesigned its plans and layout (protection of depots by a fence, sufficient distance from population centres, etc.) and modified its handling instructions. The equipment involved was gradually replaced by a new set-up featuring safety devices for dealing with the event of a hose break (e.g. a check valve).

<sup>1</sup> According to the technician's deposition, the pipe had been stored outdoors next to the tank during the ammonia spreading campaigns, i.e. from February to May.

From a regulatory standpoint, a reassessment of the classification of these installations as classified facilities was initiated. Despite the magnitude of the quantities in storage, they had been exempted from compliance with the Law of 19 December, 1917 on the grounds that these stockpiles had been constituted by farmers for the needs of their farms. In 2010, mobile tanks are still not included within the scope of classified facilities, yet the conditions of equipment application and parking were reinforced through modifications to an Appendix of the Order relative to the transport of hazardous substances (29<sup>th</sup> September, 2009, modified thereafter).

## REFERENCES (INCLUDING PHOTOGRAPHS)

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- [1] Robert Andurand, *Eléments de sûreté chimique and de désastologie*, Tome 2, pp. 394-395, December 1989.
- [2] Report issued on 12<sup>th</sup> May, 1969 (including photos and situation drawings/sketches) by the Chesne Gendarmerie.
- [3] Reports issued by the Engineering Division of the Office of Mines.
- [4] *Report on a mission relative to pursuit of the direct use of liquefied ammonia as part of farming practices*, CGDD Report, January 2011, available for consultation on:  
[http://portail.documentation.developpement-durable.gouv.fr/documents/cgedd/007016-01\\_rapport.pdf](http://portail.documentation.developpement-durable.gouv.fr/documents/cgedd/007016-01_rapport.pdf)