Fire
Explosion
Rail-tanker
Petrol
Site clean-up
Vacuum extraction

Derailment of a train transporting hydrocarbons

03 December 1990

CHAVANAY - [Loire]

France

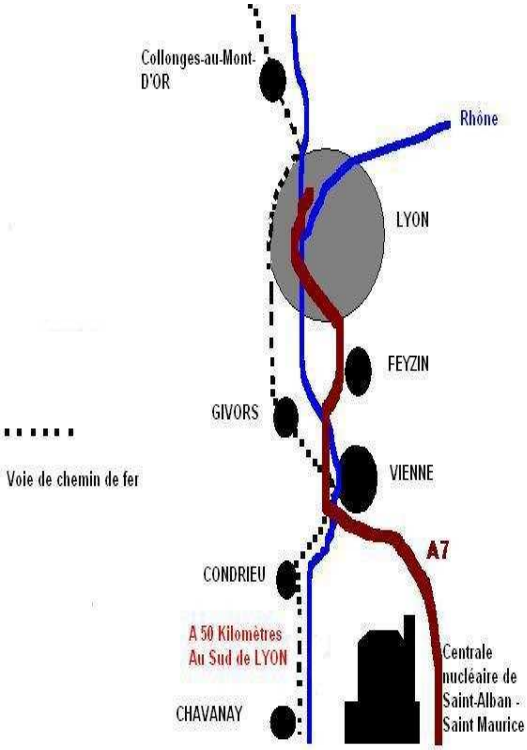
THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident:

Chavanay is a town comprising 2,083 inhabitants and has a well developed industrial and wine-producing activity. The town is located in the south-east region of the Loire county and on the right bank of the Rhône river. The river thus forms the natural border between the counties of Loire and Isère. A railway line cuts across the length of the city and is line is chiefly used to transport goods and hydrocarbons from the Fos-sur-Mer basin to the Lyon region.

On 3 December 1990 at 11.50 pm, a train with 22 rail-tankers passing through the Rhône valley derailed when crossing the village. Nine 80 m^3 tankers filled with unleaded petrol spilt over, caught fire and exploded. The fire spread to the residences near the railway line and to the sewers of the city.

The power supply was cut off and road traffic brought to a halt. 180 fire-fighters used autonomous means (fire pumps, etc.) to fight the flames and prevent them from spreading to other parts of the town.



Chavanay - evening of 3 December 1990

A population census was carried out to ensure that no one was trapped in his home on fire.

The fire was put out on 4 December at around 6.30 am. The town authorities, in coordination with the railway transport company called on the services of a company specialising in soil clean up to protect the drinking water extraction wells located at 100 m from the accident site.

Photograph of the rail-tankers

Consequences:

The accident had several consequences:

Human and social consequences:

Only one inhabitant of the village sustained injuries but eight dwellings, two garages and 30 cars and five houses were destroyed. 34 people were evacuated and re-housed. Rail transport was stopped for a week.

Environmental consequences:

The accident area was 1 km long and 400 m wide. Out of the 720 m³ of petrol in the nine rail tankers, a large portion was consumed by the fire but 250 to 300 m³ seeped into the soil and polluted two hectares of the land. The agricultural wells situated downstream were closed and potable water pumping operations were reduced. The smell of “gas” was reported in several properties. The consumption of fruit and vegetables was banned within a perimeter of 12.5 hectares.

Economic consequences:

The overall cost of this accident borne by the rail transport company rose to approximately 48.5 million francs by the end of 1993 (10 million euros in 2007) including:

- 18 MF to compensate third parties effected by the accident
- 12 MF for site cleanup operations that were carried out until 1993
- 10 MF for several studies on assessing the consequences of the pollution and clean up in 1991
- 6 MF for surveys and emergency operations carried out before floating the call for tender
- 2.5 MF towards compensating the town.

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 II*' directive on handling hazardous substances, and in light of the 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 "dangerous materials released" index is rated at 3 due to the 720 m³ of petrol released during the accident or consumed by the fire (Q1 parameter).

The "social and economic consequence" index is rated at 4 as 34 people were evacuated from their destroyed or severely damaged homes and subsequently rehoused (H6 parameter).

Level 3 is attributed to the "environmental consequences" index on account of the 2 hectares of polluted land (Env 13 parameter).

The « economic consequences » index was rated at 5 due to the damage suffered by third parties and the compensation that amounted to 20.5 MF, i.e. 3.3 millions euros in 1993 (parameter €17).

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THE ACCIDENT

An administrative enquiry report suggested that the accident may have occurred due to the passage of the train at an excessively high speed on a distorted railway track. The defect appeared due to the weakening of the railway tract seating following torrential rains.

The passage speed (93 km/h) was normal for a railway track without any defect. However, if this defect was known, the driver would have undoubtedly reduced the train's speed.

ACTIONS TAKEN

According to the assessments made following the accident, 80 to 90% of the spilt hydrocarbons were in gaseous or liquid state on the land surface above the water table ("unsaturated" zone). 10 to 20% of the hydrocarbons were consumed by the fire or evaporated into the atmosphere. Petrol was found on the slope supporting the railway track and on the surface of the water table in a thin clay structure on the foot of a hill.

For safety reasons, several administrative decisions to demolish effected residences were promptly taken. Lastly, once the hydrocarbons were extracted from the wells and caves, the polluted land was treated in three stages:

1) Drawdown to avoid the pollution from spreading into the water table. The 1st pumping operation at a rate of 4 m³/h was carried out on 16/12/90 followed by tow others. On 10/01/91, the total drawdown rate was 16 m³/h.

2) Reduction of the polluted area by precisely characterising the composition of the bottom soil and contamination. Forty surveys were carried out by an organisation specifically appointed for this purpose.

3) Site cleaning in three successive stages:

- Pumping or removing the surface slick. A first drilling operation was carried out in January 1991 to the east of the railway tract. From December 90 to April 92, 30 to 40 m³ of hydrocarbons were recovered from the grounds. The drawdown water whose hydrocarbon concentration was less than 20 ppm was released into the Rhône river.

- Bioleaching tests. Two pilot plots of 350 and 760 m² were tested. The treatment proved to be effective only for a depth of 2 m. The tests were stopped.

- Vacuum extraction. Venting operations were performed on polluted lands. The positive results obtained led to the selection of this type of treatment. A call for tender stating the quantitative objectives to be reached within a stipulated time frame was floated (hydrocarbon concentration in soil less than or equal to 10 ppm, no slick after one year of cleaning operations).

  All drilling sites were operational on 23/07/92. Three mobile gas treatment units by incineration were set up.

Land cleaning operations ended mid-February 93. Vacuum extraction helped recover 146 m³ of hydrocarbons in 45 weeks. To this volume can be added

- 50 m³ of slick removed since December 1990,
- 10 m³ obtained during initial venting,
- 4 to 5 m³ of hydrocarbons neutralised using bioleaching

The total volume of extracted hydrocarbons amounted to about 210 m³.

The cleaned lands were not returned to their owners but recovered by the town authorities and used for town development.

LESSONS LEARNT

Emergency and rescue operations for the public, questions on preventing the pollution from spreading, soil and slick treatment had to be quickly studied. The authorities present (town authorities, rail transport company and administration) were required to take urgent decision on assessing the extent of pollution and its actual and potential effects. Moreover, decisions to implement preventive measures aimed at stopping the hydrocarbons from spreading had to be taken even though responsibilities were not clearly defined and no assessment on the time required and cost involved was available.

Over and above these aspects, the accident is a learning experience in managing polluted sites.

On a technical level, the vacuum extraction process proved to be efficient and was used few months later, a few kilometres south in another railway accident that took place in La Voulte-sur-Rhône (ARIA no. 4225).

The unsuccessful bioleaching tests show that site clean up techniques not only depend on the nature of the pollutant(s) but also on the specificity of the effected site (nature of soils, permeability, depth of water table, flow rate, etc.) and an in-depth study of the above parameters.

This accident also illustrates the positive role played by the municipality in ensuring the smooth running of site clean up operations and its wise decision to purchase the cleaned land. This facilitates the setting of formal restrictions on soil and subsoil usage in urban development documents ensuring compatible use of the land with the prevailing residual pollution.

With regard to feedback that can be applied to classified installations, it is important to note that the seriousness of the potential consequences of such an accident calls for the urgent implementation of resources to prevent the slick from spreading followed by prompt assessment and clean up of the pollution.

The uncontrolled large scale spreading of volatile inflammable liquids poses a serious threat to people, property and the environment especially if the pollutants reach networks generating an explosive atmosphere in a confined medium. These situations need to be taken into account in safety studies and rescue plans.

The ARIA database includes other accidents involving derailing of rail-tankers transporting hydrocarbons:

- La Voulte-sur-Rhône accident (ARIA no. 4225)
- Zurich accident (ARIA no. 5073)
- Lausanne accident (ARIA no. 5515)
- …