Spillage from a semi-buried jet fuel tank

30 December, 2005

Sainte-Marie – [Reunion Island] France

Spillage
Flammable liquid farms
Valves
Jet fuel
Human and organisational factor
Soil contamination
Level detection

THE INSTALLATIONS IN QUESTION

Sites involved:

Two hydrocarbon tank farms, located within the town of Sainte-Marie (Reunion Island) were involved:

1. Depot A

The establishment was created in 1975 for storing and distributing jet fuel (Jet A1) for an airport complex. The facility has 14 employees.

The site features 2 aboveground tanks and an underground tank, as well as a tanker truck unloading station. Jet A1 fuel is delivered to the aircraft via an underground hydrant system from the depot to the airport's tarmac, connected to the aircraft via servicers during fuelling operations, or by a fuel tender for small quantities.

This establishment is subject to authorisation regarding the legislation of the Installations Classed for the Protection of the Environment. It is classified low-level "SEVESO" owing to the products handled. The last prefectoral order authorising the establishment to operate dates back to October 10, 1990.

2. Depot B

The facilities at the depot B include two semi-buried tanks built between 1977 and 1978. These storage tanks are connected via an underground pipeline to the depot A's pumping system whose storage, unloading-loading and distribution installations are just next to the depot B.

An agreement was reached between the two storage facilities to transfer the operational responsibility of the storage tanks B to the depot A provided that a minimum storage quantity is maintained. The hydrocarbon transfer installation between the two depots (pipeline + pumps) was governed by a temporary authorisation order of September 23rd, 2004, which was not renewed.

The facilities involved:

Four facilities were involved in the accident:

- R2 tank (540 m³) of the depot A,
- the truck unloading station,
- the hydrocarbon transfer facility between the two depots (two 100 m³/h pumps each),
- the half-buried SEA2 tank (1,000 m³) of the depot B.

The accident occurred during a fuelling operation at the depot A.

THE ACCIDENT, ITS BEHAVIOUR, EFFECTS AND CONSEQUENCES

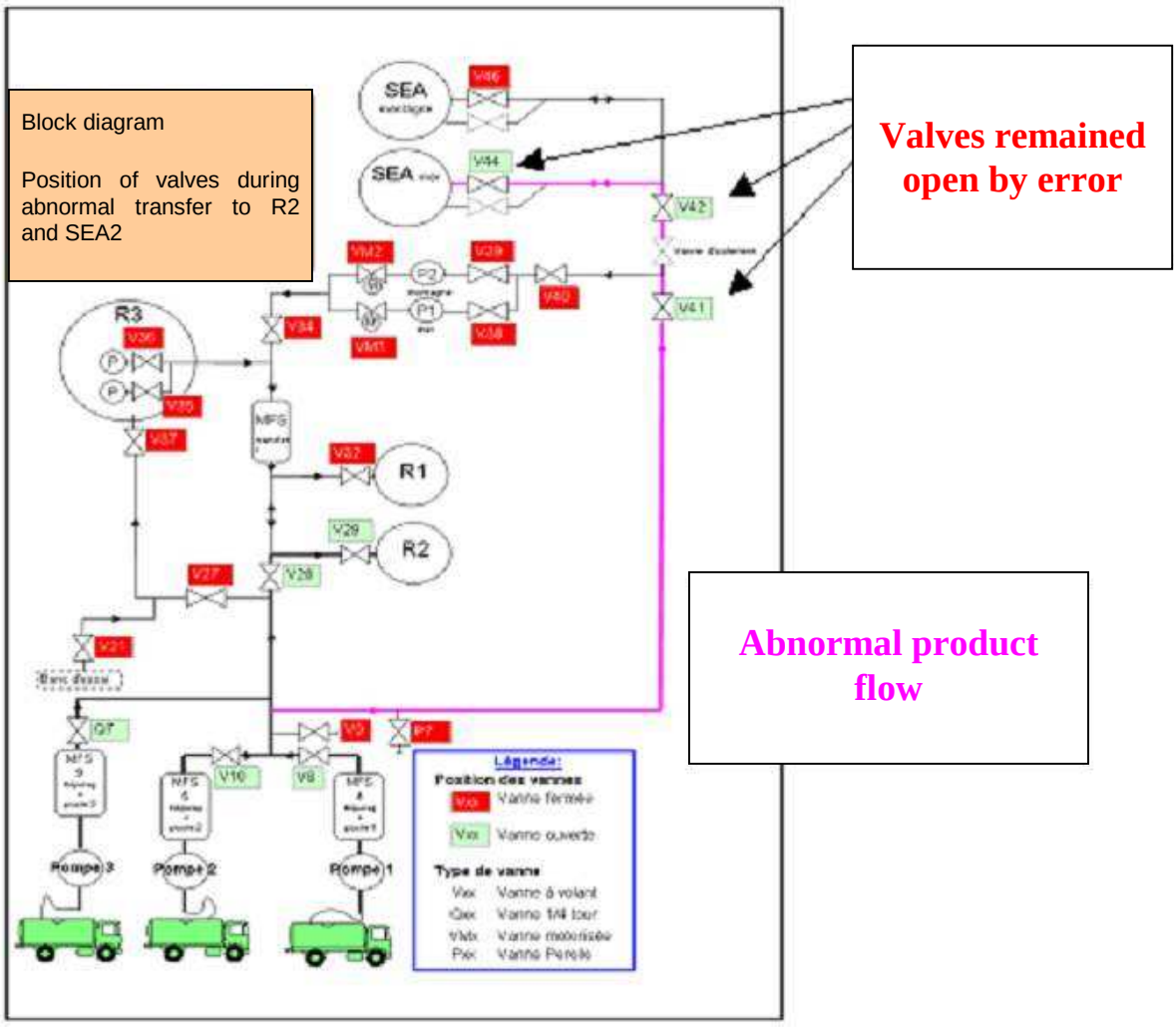
The accident:

On **Thursday, December 29th, 2005**, the SEA2 tank at the depot B was filled via the depot A. Upon completion of the filling operation, the worker of the facility A neglected to close the two valves on the interconnection piping and the supply valve on the SEA2 tank.

On **Friday, December 30th,** another worker at the facility A was instructed to fill one of the aboveground tanks of the depot A. The worker opened the valves to fill R2 aboveground tank although neglected to check if the valves, operated the day before had been properly closed. The unloading pumps propelled the jet fuel into the facility A's aboveground tank and into the SEA2 tank of the depot B.

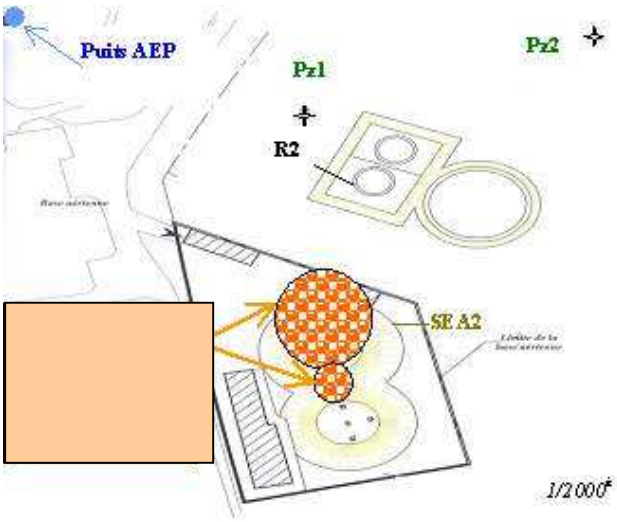
The high level detection safety alarm on the SEA2 tank did not function.

At around 8.30 am, a worker of the depot B noted jet fuel pouring from the two vents on the SEA2 tank: a phone call was made to the facility A to stop the transfer operation. The facility's emergency shutdown was activated which immediately stopped the transfer operation.



The consequences:

The quantity of jet fuel spilled was estimated at 33 m^3. The product spilled onto the surface covering the underground tank and seeped into the ground, outside the bund and into the common parking lot in the zone B. The parking lot is connected to a hydrocarbon separator, which quickly became saturated. Roughly one hundred litres of hydrocarbons thus entered the rainwater drainage system that spills into the sea.



Between 8.40 and 9.15 am, the personnel from both depots blocked off the rainwater drainage system with sand and other oleophilic materials. However, after noting that jet fuel was present in the rainwater network, a worker of the depot B rinsed the drainage system with a large quantity of water at around 9.30 am to prevent the risk of fire, causing sand and jet fuel to be conveyed toward the sea.

A drinking water well, located on zone B approximately 100-150 m downstream from the SEA2 tank, was shut down that same morning.

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.

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

With the 33 m^3 of jet fuel spilled, the "dangerous materials released" rating is thus 2 (parameter Q1).

Approximately 1,000 m^2 of soil required specific clean-up operations, thus resulting in a level 1 rating for the "environmental consequences" index (parameter Env13).

The cost of the environmental clean-up and rehabilitation operations is estimated at 800,000 €, i.e. level 3 for the "economic consequences" index (parameter € 18).

ORIGIN, CAUSES AND CIRCUMSTANCES OF THE ACCIDENT

The operating incident, which led to the pollution, was caused by a **series of human errors** committed during the verifications conducted prior to all tank-filling operations, **followed by the failure of a safety device**.

The series of human errors include:

- ✓ Failure to close the valves on the SEA2 tank upon completion of the transfer by the worker of the depot A who conducted operations on the day prior to the accident,
- ✓ Failure to inspect the position of the valves by the worker of the depot A in charge of the unloading tanker trucks before starting the operation.

The depot A had drawn up instructions for the transfer operations in May 2005, which did not include any verification to be conducted by the operator the site B. The personnel at the depot A were repeatedly advised of these instructions. However, it should be noted that the tanks of the depot A are filled very frequently (several times per day) while the tanks of the depot B are filled only twice per year. The above-mentioned instructions could not be put into practice by all of the workers at the depot A, as just one filling operation had taken place between May 2005 and the day of the accident. Since this operation is rarely performed, both the workers involved in the December 30th 2005 accident had overlooked the valve checking procedure associated with the transfer operations. The operator had not implemented special measures regarding the risks associated with this exceptional operation.

At the organisational level, the high level detector, installed on the depot B tank had not functioned due to faulty maintenance: new level detectors were supposed to have been installed but were not in place at the time of the accident.

ACTIONS TAKEN

With the advent of rainy season and given that the zone is located in a very rainy tropical region; tarps were installed at the site within 24 hours following the accident.

Following emergency operations that involved stopping the spillage, containing the fuel, shutting down the drinking water supply well, waste collection and the superficial clean-up of the zone, the initial digging operations were undertaken to remove the highly polluted soil as soon as possible. This required the tank's casing to be uncovered and the tank drained. The soiled earth was stored in bins on the site B prior to cleanup, and an initial review was conducted to determine the environmental impact of the accident. Research projects to install and equip a facility to treat the soil were undertaken.

▲ Product infiltration zones (photo DR)

▲ Digging operations round the SEA2 tank (Photo DR)

Awaiting validation of these studies, operations at the drinking water station were suspended and the polluted soil, still in place, was covered with tarps to protect it from the cyclonic rains of the island.

An order was issued to define the restoration measures to be implemented.

In October 2006, the polluted soil storage bins were removed from the depot B parking lot to a site specially equipped to process the soil. The removal of the earth continued to the polluted zone. Treatment of the polluted soil using bio-venting was started in December 2006. Approximately 1,000 m^3 of soil has been removed since the day of the accident.

▲ Backfill around tank SEA2 (photo DR)

▲ Treatment of polluted soil (photo DR)

At the same time, the town of Sainte-Marie expressed its difficulty in procuring water following the closure of the well located at the depot B site. Analyses conducted by the operator of the depot A, and validated by the health authorities, show that the well water is not polluted. However, the drinking water supply well has not been placed back into service since the accident.

LESSONS LEARNT

The accident resulted from a series of malfunctions in the risk control measures (2 human errors + 1 organisational failure resulting in the malfunction of the level detector).

Several lessons can be learnt from this accident:

✓ The human factor:

- A decrease in worker vigilance when the same inspection is frequently repeated. A series of different workers, in charge of a similar inspection may increase the risk of negligence. Blindly “trusting” a colleague's verification is dangerous, even if it helps build relations and expedites operations. It is important to be vigilant during inspection.
- A procedure is not a protection against all human errors. Despite its circulation among staff, the reliability of an operating instruction remains fairly low.
- The frequency of an operation is to be considered in training and in the circulation of the instructions to workers. In small structures, where a verifier is not present, all operations at risk must be identified to determine those that require the implementation of passive measures.
- The consideration of the human factor is a necessary and crucial step.

✓ Concerning the organisational factor, this accident once again underscores the importance of inspection and keeping risk control measurements efficient over time.

In addition, the operators of both the depots A and B have started thinking along the following lines:

✓ The alarm report, in each of the structures, safety devices used in operations common to both depots,

✓ The exact description of actions to be performed by workers of both depots,

✓ The carrying out of common safety exercises.

No transfer operations have been conducted between the 2 depots since the accident.