Malfunction of safety devices at an LPG depot

October 7, 2004

Le Blanc [Indre]

France

LPG depot
Propane
Tests
Shut-off valve
Equipment failure
Utilities / compressed air
Organisation / verifications
Insects

THE INSTALLATIONS IN QUESTION

The site :

The site concerned in this brief is an LPG storage site, which features a tractor-trailer unloading zone.

It was created in 1963 and, until 1987, a cylinder filling operation was operating at the same location. The depot is authorised to operate with several hundred tons of propane, corresponding to a sphere and 2 storage tanks.

The site is located in an industrial zone: Approximately 15,000 tons transit this depot each year. Procurement operations are carried out exclusively by road. There are only 3 employees at the site.

The devices :

The connection used for truck loading operations is equipped with safety valves which, in the event of an emergency, allow them to be shut off. The system uses automated valves controlled by a pneumatic motor which is purged by the closure of a "three-way" solenoid valve connected to the site's safety system. In the case of the event in question, this solenoid valve is of Joucomatic MPV1 type.

These devices are visually inspected biannually to check their opening and closing operation. The solenoid alarm triggering test is not specifically requested. The results are logged in a period inspection register. The last verification of these elements was performed Sept. 8, 2004 and no anomaly was detected.

THE ACCIDENT, ITS BEHAVIOUR, EFFECTS AND CONSEQUENCES

The incident :

During security testing at the site's truck unloading station, an automatic valve at the base of the arm is not operate. Under normal circumstances, this [positive safety type] valve, is used to shut down the installation in the event of an unloading problem.

The consequences :

No release occurred, as the malfunction occurred during a simulated test.

European scale of industrial accidents

Due to the absence of any effect and consequence (simulated trial), none of the 4 rating rules 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 apply.

The 18 parameters that comprise these indices and the corresponding rating method are available at the following address : http://www.aria.ecologie.gouv.fr.

Dangerous materials released	☐ ☐ ☐ ☐ ☐ ☐
Human and social consequences	☐ ☐ ☐ ☐ ☐ ☐
Environmental consequences	☐ ☐ ☐ ☐ ☐ ☐
Economic consequences	☐ ☐ ☐ ☐ ☐ ☐

ORIGIN, CAUSES AND CIRCUMSTANCES OF THE ACCIDENT

After verifications, the problem is caused by the presence of a wasp nest built inside the air system's depressurisation solenoid valve, preventing it from working properly. The pneumatic distributor is mechanically blocked by the earthy residue built by the wasps. The evacuation device releases directly to the atmosphere.

The insects are entered by this small unprotected orifice.

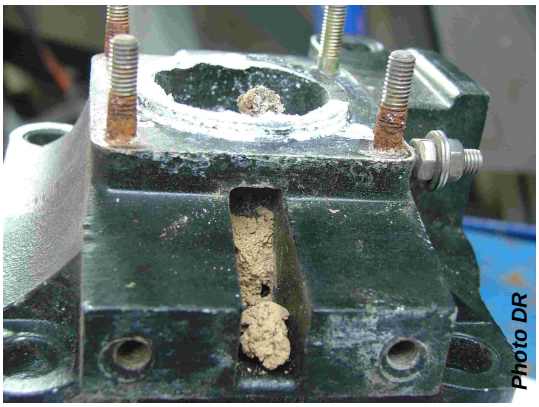


Photo DR

ACTION TAKEN

Pending investigations, the operator stopped using the unloading station until the installation could be refurbished.

Additional checks, conducted on the site's other solenoid valves of the same type, found additional nests in another device but did not prevent it from operating.

Brass mesh were thus installed on the vent holes (see photo opposite).

The group informed the other sites at the national level, and verifications were performed on valves of this type. The tests showed that only the solenoid valves of the same model were prone to this type of problem. They were also equipped with protective mesh inserts.

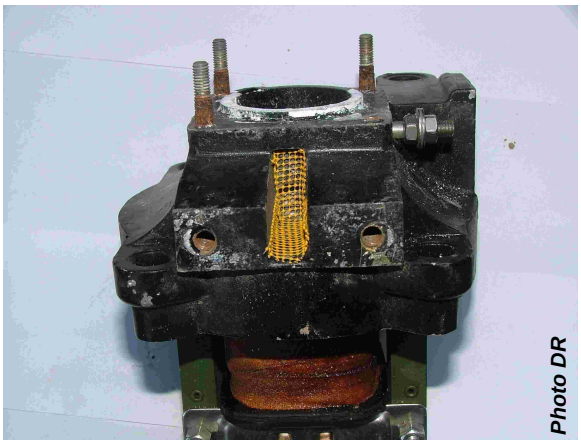


Photo DR

From the organisational perspective :

- an exhaustive list of automatic valves is drawn up site by site and the traceability of the inspections reinforced.

- the inspection procedure for automatic valves and solenoid valves is updated to clearly define the procedure in order to ensure that the valve closes when the alarm sounds.

LESSONS LEARNED

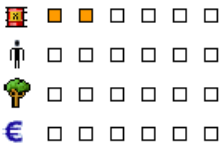
Although uneventful, this incident illustrates the high degree of vigilance that must be given to known although dangerous problems whose extent may initially appear rather minimal. The case of the problems caused by the intrusion of miscellaneous animal, insects in this case, are also included.

The need for tests that are representative of the equipment's operating conditions or emergency situations is highlighted here ; indeed, in this case, the operator conducted tests of the main safety devices on a regular biannual basis : closure of the shut-off valves,…

Other events caused by the presence of insects :

- see Balan accident of April 5, 2003 – No. 24891

APPENDIX



No. 24891 - 04/05/2003 - Ain – BALAN

24.1 - Basic chemical industry

A black cloud was released on the polyethylene production line No. 1 at a basic plastic materials plant. The plant had resumed operations on March 31 following a ten-year inspection lasting 4 weeks, only to be shut down due to an incident after just 4 days of production. The unit restarted April 5th at around 2.20 pm. At 4.49 pm, overpressure on the unit's medium-pressure separator led to the emergency shutdown and then the opening of a rupture disc. A cloud of gas and black particles located within the separator (roughly 310 kg) were released. Actuated simultaneously by the automatic sequence, the reactor's safety valves opened in order to decompress it. The ethylene released by the reactor's 2 stacks caught fire; the 2 torches which formed were put out by the water injection system and the incident was brought under control in less than 10 minutes by the operating crew on site. There was no property damage. Only a loud noise (caused by the opening of the rupture disc, then the ethylene catching fire) caused some worry among the local residents who alerted the external rescue services. The unit was shut down at 6.10 pm, decompressed and inerted with nitrogen. Several operations were then performed: a pressure reducing valve was removed for inspection (a polymer of normal colour at the valve's inlet and black at the outlet); the primary separator of the apparatus' bottom trap was removed to purge the residual polymer; removal and replacement of the rupture disc of the medium-pressure separator. All the inspections conducted on the various elements (seals, safety devices...) showed no sign of anomaly. The findings relative to the pressure reducing valve show that it had opened although it was slowed down slightly (~1 sec) due to the partial obstruction of the pneumatic exhaust by an insect next. As the temperature of the gas at the stacks' outlets were less than the ethylene's self-ignition temperature, it is probable that it was ignited by incandescent soot released through the chimney from the rupture disc or by the residual gases in the event of insufficient cooling. Several measures were taken: the valve was protected against insect intrusion, recording of valve parameters in the event of a replacement for at least one week, temperature recorded before and after the valve, and a valve repair log.