Chlorine leak during connection of a rail tanker to prepare for an unloading operation

14 February 2008

Château Arnoux - Saint Auban (Alpes-de-Haute-Provence) France

Chlorine
Joints
Unloading
Procedures
Training
Facility ageing
Spare parts

THE FACILITIES INVOLVED

The site:

The plant, classified as an upper-tier *Seveso* (or AS), is engaged in the following activities:

- fabrication of PVC in the form of either pastes - as a micro-suspension (used for floor coverings, capsule packaging, coated fabrics, etc.) or microbeads - copolymers (used for floor coverings, food or other packaging, vinyl records),
- production of specific chlorine solvents T111 trichloroethane (the only European manufacturer to produce this raw material, which is used at the Pierre Bénite plant),
- incineration of chlorine residue, especially with a high PCB load,
- occasional production of soda and hydrochloric acid.

This site is currently undergoing a major activity reorganisation.

The involved unit:

The material transfer station, where the incident occurred, is located in the northern part of the plant (within the enclosure of the former mercury electrolysis operation). This station was designed to supply site storage areas during the transitional phase underway between shutdown of the mercury electrolysis process (2005) and start-up of the membrane electrolysis process (2009). At the present time, the transfer station is shut down and being dismantled.

THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident:

On Thursday, February 14, around mid-morning (9:28 am), during an operation to hook up a rail tanker containing chlorine for the purpose of proceeding with unloading, a chlorine leak occurred at the level of the joint between the flanges of one of the connections.

One of the technicians closed the valves (cutting off the compressed air) after 30 seconds and then triggered the alarm and water curtains, all within 3 minutes from the time the leak began.

Consequences of the accident:

The leak, which lasted a total of 30 seconds, released some 11 kg of chlorine into the atmosphere, thus creating a cloud on the ground covering approximately 50 m by 10 m. This cloud was partially dispersed by the water curtains.

Four members of the personnel (the 3 technicians and a contractor with an external firm) became slightly intoxicated, yet were still able to return home the same evening.

Since the flanges were not damaged, the rail tanker was normally unloaded during the afternoon

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 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

Level 1 of the index entitled "Hazardous material released" characterises the toxic gas discharge that occurred (parameter Q1: quantity of the substance actually discharged in comparison with "*Seveso*" threshold: 11 kg of chlorine).

The number of slightly intoxicated victims explains the level 1 reached by the index relative to human and social consequences (parameter H5: 4 slightly injured).

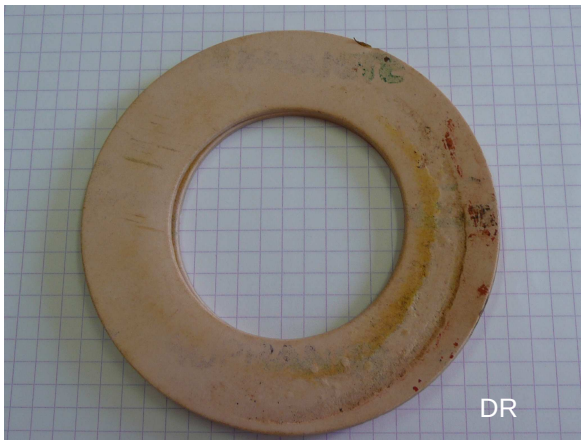
Moreover, since the property damage and operating losses had not been quantified by the site operator (parameters €15 and €16), the index relative to economic consequences could not be rated.

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THE ACCIDENT

The origin of this accident can be traced back to a rupture of the transfer arm flange joint during a seal leak test.

Probable causes of the accident are:

- use of two 2-mm joints instead of one 4-mm joint,
- poor clamping of the sealing ring between the two liquid phase flanges,
- a seal leak test performed in an atmosphere containing chlorine and not nitrogen.



The use of two 2-mm joints instead of one 4-mm joint was due to the preferred product being out of stock. The technician responsible for performing this clamping operation was attending a training class under the supervision of the other two technicians, both of whom were not located nearby given the cluttered workstation configuration. The clamping operation using the bolting machine was unfamiliar. The technicians were not equipped with self-breathing apparatuses because the air compressor package only contained 2 outlets for 3 technicians. The water curtains were not automatically deployed; furthermore, technical staff from external companies was present in the sector during operations.

ACTIONS TAKEN

Subsequent to this accident, the plant operator introduced a number of measures, namely:

- a safety stock of the 4-mm thick joints was constituted, and a directive was issued prohibiting this type of operation from proceeding in the absence of the dedicated joint;
- a special training session devoted to assembling and clamping this type of joint onto test benches, with technician certification;
- reminder of the need for strict application of the guidelines both on wearing the self-breathing apparatus when opening circuits containing toxic products and on the proper procedure to follow when the number of breathing apparatuses falls short of the number of individuals present in the specific sector;

- recall of the strict respect of authorisations granted to external companies by plant managerial staff. As a case in point, the station manager authorised the intervention of external personnel even though the procedures specifically prohibited all such works from being carried out during any chlorine transfer operation;
- recall of the protocol for notifying the company responsible for site safety (failure to activate the general siren for this level 2 alert was observed, though the information had been correctly transmitted);
- a reassignment of the in-plant gathering rooms along with a reminder of the proper steps to follow in the event an alarm is sounded; plus the scheduling of specific drills in order to raise personnel awareness since during the accident, some disused rooms were not notified and a number of technicians did not obey the guidelines for how the staff should assemble.

LESSONS LEARNT

A site comprising older installations or undergoing reorganisation is vulnerable to a sequence of accidental or risky situations due to deteriorated operating conditions or a loss of knowledge of trade practices on the part of technical staff. Such situations do not just concern ageing facilities, but also pertain to respecting procedures and guidelines that may have been forgotten or circumvented over time. Throughout the life of the facility and especially when conditions are deteriorated (e.g. a site undergoing reconversion), special attention must be paid to respecting the safety management system.