

Fire on a burning area within an explosives plant

July 28, 2006

Pont de buis les Quimerch [29] France

Pyrotechnics
Waste / Destruction
Organisation /
Operating guidelines

THE FACILITIES INVOLVED

The site:

The plant's primary output consists of gunpowder for hunting and recreational shooting, along with a selection of pyrotechnics items, including fumigants and tear gas. The installation requires an authorisation subject to easements, as per Book V of the French National Environmental Code, and must comply with the Seveso II Directive's upper-tier classification.

The facility has an environmental unit (EU) employing four staff members: Head of the Hygiene, Safety and Environment Department, the Assistant Head of this Department, and two technicians.

The involved unit:

The site contains two burning zones for destroying pyrotechnic waste material, as typically authorised under legislation relative to classified facilities. The accident occurred in the first zone, located in the north-eastern part of the site.

This zone is excavated belowground and partially surrounded by a barricade. Its dimensions are approximately 50 m x 30 m. The bottom consists of natural soil; access is made possible by a single entrance at the north-western corner, which is normally fenced off. A sign placed nearby confirms that zone entry is prohibited to anyone not affiliated with the environmental unit (EU). The site is protected by a fire hydrant equipped with hoses and nozzles.

Operations are supervised solely by the EU. All pyrotechnic wastes to be destroyed on this zone can only be transported with a preliminary authorisation from EU. The waste is placed outside the burning zone, adjacent to the entrance. Its transfer inside can only be performed by an EU employee. Among the types of waste eliminated in this manner, besides powders and a range of fireworks, were packaging (plastic bags), over-packaging materials (plastics, cardboard) and pallets.

The operations of this zone were examined in a Workplace Safety Study conducted in 1985; moreover, a workshop regulation issued on February 4, 2005 limited the destroyed quantity to 6 boxes, representing at most 1 tonne on each occasion.

The pyrotechnic waste (approx. 40 tonnes/year) stemmed for the most part from settling tanks located in the finishing workshops.

In addition to its in-house pyrotechnic waste, the site operator also eliminated under the same conditions the pyrotechnic discharge produced by a neighbouring plant.

This category of waste, which is systematically transported through a wet-pipe system, is destroyed by burning. For this operation and in accordance with workshop regulations, the waste is placed in a cord at the base of the excavated area, theoretically on top of a structurally sound material composed of wood (pallets or woodchips). Under certain circumstances, wood and pallets are placed over the waste. The wood and pallets used for this purpose are brought to the site by one of the company's dump trucks, before being unloaded in the middle of the burning area and then redistributed over the burning zone either manually or by use of a farm tractor.

Burning proceeds as dictated by meteorological conditions. It is necessary to achieve a certain level of drying before the wastes can be ignited. Raking and spreading into fine layers are required in order to facilitate the drying. These steps are performed during the morning of the selected day of burning, which takes place mid-afternoon. To execute these tasks, technicians use either manual equipment (garden rake, metal scraper) or forks fitted onto a farm tractor. Ignition involves the use of green powder straps (i.e. with a solvent) recovered during the extrusion steps.

At the time of burning operations, which introduce large quantities of wastes, a fire truck with a powerful pump from the EU fleet is placed on alert at the zone entrance to protect the site.

According to procedure, two technicians need to be present throughout the pyrotechnic waste destruction operation. This procedure, however, is not mentioned in the workshop instruction guide.

THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident:

July 28, 2006 was a particularly hot and sunny day, much like the two or three weeks leading up to it. The two technicians typically assigned from EU were absent from work on that day. The EU unit Manager requested the services of two other technicians from the production division; both replacements were participating for the first time in an operation of this type.

The destruction steps were prepared during the morning. The three team members raked and spread the powder residue over the wooden pallets in order to limit layer thickness and facilitate layer drying.

At the beginning of the afternoon, they supplied pallets, which were subsequently distributed manually over the layers of waste to be destroyed. Three separate deliveries were planned. The pallets were pulled from the stack and then set in place.

During the second loading, around 3 pm, a spontaneous fire ignited adjacent to where the EU Manager was standing, trapping him in flames and smoke. The fire raged over the entire burning zone. The other two employees were able to escape without injury. One of them, a volunteer fire-fighter, proceeded by sounding the alarm and began fighting the fire.

The EU fire truck had not been positioned at the burning site; it took fire-fighters 23 minutes to arrive at the scene.

The EU Manager was found at the base of the embankment slope 30 m from the point of ignition; he died from injuries within the hour.



Burning zone: The combustion source was taken left of the photo; piles of waste and unburned product opposite (source: IPE)

Consequences of this accident:

The EU unit Manager was killed.

The site's installations were not damaged. Traces of unburned pyrotechnic wastes (powders) remained in the zone, thus confirming the "random" nature of their combustibility (depending on their rate of humidity).

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							
Human and social consequences							
Environmental consequences							
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>

The quantity of burned substance could not be accurately determined. Since the explosive was classified "Seveso", the "quantities of hazardous materials released" index was ascribed by default a "1" level.

The explosion resulted in a death, thus the "human and social consequences" index was assigned a "2".

Given that no information was available on environmental consequences, this parameter could not be rated; the same applies to the "economic consequences" index.

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THE ACCIDENT

It should be pointed out that an uncontrolled outbreak of fire under similar conditions occurred on Monday, July 24, 2006. The EU unit Manager had notified the two staff members usually on hand at the burning site by phone discussion of the extreme sensitivity of wastes. Moreover, he had recommended upholding access restrictions to anyone outside the EU unit and recalled to all personnel concerned the need for a preliminary agreement from EU before any introduction of pyrotechnic waste, in addition to prohibiting all burning in his absence and without the fire truck positioned at the site.

The unit manager seemed entirely aware of the high-risk situation created by the pyrotechnic wastes stored at the zone. Perhaps he had not expected a destruction operation to take place on that fateful afternoon since the unit's fire truck was offsite and another round of pallets was still scheduled for 3 pm, even though the accompanying technicians would be off work at 4 pm. Nonetheless, the manager had ordered his regular technicians "to complete as much as possible in order to leave [them] as little as possible".

The source of ignition would have been friction of the powder (which was dry and polluted, hence more sensitive) due to a falling or shifting pallet, or the footsteps of the deceased manager... The local gendarmerie later found an undamaged, yet inoperable, disposable lighter adjacent to the fire source; its presence was never explained.

The Armament Division's Powders and Explosives Inspection Office (IPE) subsequently confirmed the product's sensitivity, or more likely its "instability". As a matter of fact, the absence or loss of stabiliser on a pyrotechnic material makes the material highly unstable, which in turn can lead to self-ignition in the presence of a dry product. For various reasons, it is commonplace that the material to be destroyed first undergoes "destabilisation". Extended time spent in water could have triggered the loss of stabiliser (settling pit wastes, other wastes exposed to surface water, etc.), just as a waste extracted during fabrication might not have been processed via a stabilisation step.



Overview of the burning zone, photograph shot from the entrance: the fire propagated from right to left (the body was found towards the back on the left) - Source: IPE

ACTIONS TAKEN

All burning activities at the facility were halted, including those scheduled for the second zone.
Administrative and legal investigations were carried out.

Plant reactivation was contingent upon adopting a number of remedial measures, namely the operator was required to:

- Conduct a waste study under the set of conditions stipulated in the circular dated December 28, 1990, i.e.:
 - 1/ a site status report providing an exhaustive list of all wastes produced onsite. For each type of waste identified, the elimination technique applied was to be specified as well;
 - 2/ a file proposing, for each elimination technique identified, an alternative solution (or non-solution), in compliance with current regulations;
 - 3/ implementation schedule for the set of solutions selected to make the site compliant;
- Cease the activity of destroying the neighbouring company's wastes,
- Perform tests to characterise the sensitivity of pyrotechnic wastes and the sensitivity of wastes produced, as regards not only friction and shocks, but also the level of stabilisation when destroyed. These analyses are to rely on testing the most representative samples possible of treated wastes, with this step leading to a risk analysis of burning operations,
- Redefine operating conditions applicable to the burning zone prior to envisaging eventual remedial action to restart the plant; this includes a study of the zone's soils and the fenced zone (pyrotechnic and chemical pollution), as per recommendations contained in the methodological guide entitled "Management of (potentially) polluted sites", published by the Ministry of Ecology and Sustainable Development.

During the hearing held at the Quimper criminal court on November 6, 2009, the prosecutor requested a €20,000 fine, €10,000 of which to be suspended, for "negligence and imprudence" (absence of precise guidelines relative to wetting the powder in the event of a heat wave). The defence pleaded for acquittal of the company's Managing Director and recalled that the victim had been a safety unit manager and, as such, had undergone extensive training. The court's ruling relaxed the company of the charge of manslaughter on December 3, 2009.

LESSONS LEARNT

This tragic accident serves as a reminder that pyrotechnic waste burning operations are among the most dangerous. It turns out that pyrotechnic wastes are less well characterised and generally more sensitive than the corresponding nominal substances, with the choice of treatment relying heavily on the judgment and experience of the team of burning technicians.

A good knowledge of the products undergoing destruction, along with a risk analysis of burning operations, proves essential in any attempt to limit this type of accident.

In addition to these considerations are the accident circumstances themselves: occurring on the eve of the August holiday period, combined with the absence of usual personnel plus exceptional meteorological conditions. Such operations are not required to be performed when qualified personnel are not available nor when conditions are deemed unfavourable.