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ARIA News Flash
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Heat waves, intense heat: Risk alerts, and not just for fire!

Periods of intense heat cause many fires, especially within the agricultural sector. But a heat wave can also give rise to other phenomena like: solvent evaporation within warehouses containing sensitive substances (nitrocellulose, peroxides, etc.), the accumulation of inflammable vapours in confined spaces (storage sites, material transfer stations), and the uncontrolled heating of stored materials, wastes or even refrigeration systems.
Major pollution accidents have also been recorded due to heat. Watercourses, when experiencing very low water levels, are in effect more sensitive to the accidental discharge of oxygen-consuming substances (BOD, COD, TOC, NTK) capable of causing high levels of fish mortality.
To prevent such accidents from occurring, organisational measures (including operating procedures, monitoring and analyses) must be prepared and strictly followed; moreover, a series of technical protocols and extinction systems adapted to the specific weather and process hazard characteristics need to be implemented.

1rst Case : 15/08/2003 Le pont-de-Claix (ARIA 25495)

Fire broke out in the nitrocellulose warehouse at a printing ink plant closed for its annual holiday period. Given the absence of onsite personnel and fire detection systems inside the warehouse, notification was given by the plant's neighbours. Fire-fighters arrived quickly at the scene and had the incident under control within 30 min. The premises were destroyed: 3 walls collapsed, only the facade fitted with a metal access door was able to resist the fire. The 4 tonnes of nitrocellulose (including 3.6 tonnes delivered just a week earlier) stored in the depot were destroyed, along with the 6 barrels of substances already in use (accounting for approx. 100 kg), laid out in 2 cores abutting the warehouse. According to the site operator, the products already in use had been adequately packaged in their original plastic containers placed in hermetically sealed barrels. **Given the intense heat recorded during the days leading up to the accident along with the absence of personnel over the preceding 5-plus day period, the evaporation of nitrocellulose impregnation solvent would have caused its self-ignition.** […]

Burned storage zone seen from front and back (ARIA 25495)

2nd Case : 11/08/2003 Cholet (ARIA 25318)

In a plant that prepares meat-based products, an ammonia (NH3) leak from a refrigeration unit occurred at 7:10 pm inside an isolated airtight building with 150 m² of floor space housing the machines running the site's transformation workshops. […] **This incident would have been caused by the overheating of a cold compressor due to its obsolescence (30 years) and/or the intense summer heat, leading to a break in the motor / compressor coupling device.** [...]

3rd Case : 24/06/2005 - USA - Saint Louis (ARIA 30122)

A major fire broke out at a gas storage and bottling facility. Nearly 30,000 bottles (propane, propylene, oxygen, hydrogen, acetylene, carbon dioxide, helium, etc.) were being held onsite. Around 3:20 pm, an employee noticed the presence of a 3-m high flame at the level of a propylene bottle and triggered the fire alarm; within 4 minutes, the fire had encompassed the entire zone occupied by inflammable gas bottles. […]
According to the body assigned to conduct the investigation (US Chemical Safety Board, CSB), **direct solar radiation coupled with radiant heat emanating from the asphalt ground layer on this extremely warm day (36°C) caused a rise in temperature, hence pressure, of the propylene, thereby activating opening of the safety valve and triggering the gas leak that subsequently ignited, most likely as the result of static electricity discharge.**
Following an analysis of 3 similar accidents occurring in 1997, 2003 and 2005 in the United States, the CSB discovered that the safety margin between the vapour saturating pressure and the safety valve set pressure was lower on the propylene bottles than on the propane ones. […]

4th Case : 07/08/2006 Villers-Guillain (ARIA 32163)


ARIA 32163 -photo DREAL

At 8:20 am, upon noticing that a greyish-white smoke was escaping from the upper part of his 24-m³, heat-insulated tank filled with divinylbenzene, the tanker car driver parked his vehicle on the emergency strip of the A26 motorway and sounded the alarm. First responders noticed that the high pressure inside the tank had caused the safety valve to open at 4.25 bar and that the thermometer on the tank had been blocked at its maximum (115°C). […] At 10 am, 3 representatives from the receiving company determined at the site that an **exothermic polymerisation reaction had been initiated within the DVB mass during the maritime transport of the container from the U.S. to Antwerp and then by road haulage.** According to other experts, the product contained an polymerisation inhibitor efficient in the presence of oxygen, with **the oxygen available in the tank's vapour space possibly being too quickly consumed during shipping (35 days) due to the high temperatures experienced during July**; this hypothesis was confirmed at 7 pm that evening by the American supplier. [...]

5th Case : 20/06/2003 Treffieux (ARIA 25387)

Fire broke out around noon inside a dumpsite at the level of an 1,000 m² operable compartment. **The blaze had been caused by a magnifying effect that led to waste ignition.** The levee covered by a geomembrane was also affected over 25 m. The fire was extinguished using both foam and earth. By 4 pm, all of the flames had been snuffed out; the incident was fully brought under control around 5:30 pm. [...]

Questions to be raised in order to prepare for the summer period:

- In order to ensure that your plant is ready to cope with high temperatures, has a list of controls to be performed on the site's zones most sensitive to high temperature been established?
- More specifically, has the equipment (e.g. gas bottles) stored outside, or perhaps exposed directly to the sun and capable of being compromised especially by UV exposure (e.g. plastics, resins), been identified? Has a dedicated monitoring system been set up?
- Have the raw materials, finished products or wastes capable of reacting to heat (by means of decomposition, polymerisation, pressure surge due to vapour tension of the stored product, etc.) been identified? Are these items stored away from direct sunlight?
- Have substances that are not necessarily hazardous, yet still fermentable when exposed to intense heat, undergone close monitoring or more stringent controls?
- Have special procedures (including cooling, constant relative humidity) in the event of high background temperatures been adopted? Has it been verified that the means used for cooling do not degrade other safety functions (e.g. by opening a building's fire doors to increase ventilation, they no longer perform their assigned function of preventing domino effects or limiting the spread of fire)?
- Has a more extensive monitoring of critical temperatures and pressures been introduced? Are the various departments, primarily production and works/maintenance, ready to face the summer period?
- Have unscheduled activities and works been adapted to the potential impacts of hot temperatures?
- Have the site and its adjoining areas been cleared of brush so as to limit the spread of fire?
- Has the filling level of equipment containing products capable of dilating due to heat been dropped accordingly?
- Do window panes on premises where substances sensitive to solar radiation are stored allow sun rays to converge? Have these windows been fitted with blinds or covered by a coating that limits solar radiation?
- Should a heat wave break out, will the reserve supplies of fire water, whether natural or artificial, be usable and sufficient (have the low water level and evaporation been taken into account)?
- Have the refrigeration units been adequately designed? Are the heat exchangers being cleaned on a regular basis?

For more information:

- BARPI - selection of 187 accidents related to intense heat (in French)

- CSB : The US Chemical Safety Board has uploaded on its site two videos (both in English) on accidents occurring during periods of intense heat. The first comments on several accidents involving propylene bottles, including the one presented in this report (ARIA 30122, 3rd case), and moreover raises the issue of safety valves on such pressurised equipment and the appropriate storage practices.

The second video focuses on welding work carried out adjacent to an empty oil tank vent, which still opens onto a partially filled tank, performed on a day of strong sunshine and intense heat (ARIA 33574); this presentation underscores the importance of proper preparation when conducting hotspot work.