MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE
Liberté Égalité Fraternité

FLASH ARIA
May 2020

BARPI DGPR SRT

High temperatures: an increasingly prevalent natural hazard. How can we protect ourselves?

High temperatures in industrial facilities, resulting from either a searing heatwave or unusually high seasonal temperatures, are the cause or an aggravating factor in many industrial events. The phenomenon occurs in all industrial activities and all regions throughout France. There has been a considerable increase in the number of events recorded in the ARIA database over the last five years. The trend is particularly noticeable during the summer season, with 60 events recorded in 2019 alone. All activities are affected, although a significant number of events involve waste treatment plants and waste storage areas in other industries, notably in the manufacturing sector.

The most common hazard encountered is fire. Fire is generated by a variety of phenomena including the fermentation or self-heating of materials, products or waste, magnifying glass effects, electrical or material overheating, an increase in temperature or pressure and brush fires.
Significant water resources are often needed to combat a fire and are sometimes difficult to procure during periods of extreme heat. The emergency-response conditions may also be downgraded during periods of high temperatures combined with strong winds.
Significant human, environmental and economic consequences are observed during periods of high temperature.
The main root causes of these events, recorded in the ARIA database, point to shortcomings in risk management, i.e. the identification, evaluation and prioritisation of risks to reduce and control the probability of undesirable events and to minimise their impact.

For more information: ***Summary of industrial accidentology initiated or aggravated by high temperatures:*** BARPI – May 2020

ARIA 54714 – 25/07/2019 – HAUTE-GARONNE

Self-heating of grease-impregnated rags left in a geobox
A fire broke out at 1:22 a.m. in a **geobox** parked **up against the outside wall** of a workshop in an electronics equipment company. The fire was likely caused by a **self-heating** phenomenon initiated by **exceptionally high temperatures** and the **conditions in which** dirty rags were stored: **in a closed, black geobox, and exposed to the searing heat of the sun**. According to the investigations conducted by the INERIS, it appears that ten or so rags soaked in “MILASOLV BIO” cleaning and degreasing fluid and five rags impregnated with “M4 siccative” grease had been placed in the geobox. The grease and the MILASOLV product had saturated the porous material (rags) which **acted as the fuel** for the combustion. **The air in the geobox thus served as the oxidiser**. The heat source came from an oxidation reaction that was initiated and exacerbated by the outdoor conditions (39 °C in the shade). The oxidation of the grease-impregnated fabric resulted in a **self-heating phenomenon that grew into a fire in just a few hours**. If the heat released cannot be dissipated as fast as it is produced (as in the case of the closed geobox), the temperature increases in the area around where the heat is produced. This is known as a thermal runaway situation. The rags began to **smoulder** once the solvent had reached it's self-ignition temperature (170 °C).

ARIA 52026 – 04/08/2018 – YVELINES

Fire in a chemical plant
At 7:15 pm, an **explosion**, followed by a **fire**, ripped through a 50 m² storage building in a production facility manufacturing synthetic products for chemicals and pharmaceuticals. The products were stored on pallets in metal drums containing propargyl alcohol (flammable and toxic). There were also cardboard drums filled with non-compliant products containing solvents and bags of calcium chloride and sodium chloride.
The site had been shut down for maintenance at the time of the accident. The building in question was typically used to store toxic products. However, non-compliant finished products were also being temporarily stored there while maintenance work was underway in the usual storage building.
After examining the drums, the operator determined that **a drum containing propargyl alcohol (flash point below 60 °C) had exploded due to the thermal polymerisation of the product following an extended storage period at ambient temperatures above 30 °C**. The material safety data sheet did not specify this risk; it mentions that the product should be protected from the action of heat and to avoid exposure to temperatures above 80 °C.


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ARIA 54277 – 01/07/2019 – COTE-D'OR

Fire in a capacitor bank of a food-processing plant
A fire broke out at around 9:15 a.m. on a capacitor bank in the local low-voltage master distribution panel supplying the process side of a food-processing plant, i.e. 50% of the site's production capacity. The fire spread throughout the premises via the cable trays located above the capacitor bank. The personnel were evacuated. The fire was contained in the room, but the smoke managed to spread throughout the plant. The smoke was cleared from the buildings, and the fire brigade was able to bring the fire under control late in the morning. The extinguishing water had been contained in the rainwater system, and was subsequently pumped out. The plant's afternoon and night shifts were cancelled, and the site's security was reinforced throughout the night. It was determined that the fire had been caused **by overheating of the capacitor banks as a result of an exceptional heatwave**.

Risk analysis is a core component of the accidentology. Of course, it must be up to date and consistent with the parameters and operating conditions, particularly if modifications have been made. Concerning high temperatures, the risk analysis must specifically take into account the following points irrespective of the type of industrial installation concerned:

- ✓ identification of **raw materials, finished products or waste susceptible to react with heat** (through decomposition, polymerisation overpressure, etc.). The goal is to be able to store such elements optimally while limiting their exposure to the sun's radiation;
- ✓ identification of all **equipment** stored outdoors and **exposed to direct sunlight**. The aim is to organise the examination of this equipment and particularly evaluate any potential damage due to the high temperatures;
- ✓ **compartmentalisation** or the creation of limited storage areas to restrict the **propagation** of fire, but also to keep **incompatible products** away from each other;
- ✓ implementation of special measures to reinforce surveillance during the outdoor storage of **materials susceptible to fermentation** when exposed to heat;
- ✓ **brush clearing** and maintenance of the site's surroundings or outdoor storage areas to prevent the spread of a brush fire;
- ✓ consideration of potential **electrical overheating** or short-circuits on motors and transformer capacitor banks, as well as the **dimensioning** and maintenance of **cooling units**;
- ✓ establishment of a special procedure for issuing **welding and cutting permits** during periods of high temperature, which includes a list of specific precautions to be taken;
- ✓ consideration of how high temperature affects the site's various operating procedures, with the various **parameters to be monitored for each piece of equipment or installation**. (including temperature and pressure). The procedures governing occasional work and on-site intervention by subcontractors must also take this into account;
- ✓ consideration of the **magnifying effect**. The concentration of the sun's rays through glass (glass waste, windscreen, windows without shades or blinds, etc.) must be avoided;
- ✓ **adaptation of the fill levels** of equipment containing products likely to expand due to heat and inspection of safety accessories (valve type), which can be reinforced during periods of high temperatures;
- ✓ special surveillance measures concerning **cooling towers** and the increase of inspections during periods of high temperature to detect the presence of legionella.

Weather alerts should be closely monitored, and a specific procedure must be defined before high temperatures arrive so as to anticipate the problem. Also, if an accident occurs, particularly a fire, the site must have **sufficient and usable water reserves** that can be quickly replenished. Attention should also be focused on extinguishing water management and the possible use of inert materials.
The **operating procedures** must take into account high-temperature situations, and the specific actions required in the event of a weather alert must be defined. These procedures and the actions to be taken must be reviewed **before the summer season**.