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Beware of smoke from fire!

Whether white (rich in aerosols or water vapour), grey (a mixture of aerosols and solid particles) or black (large solid particles), the smoke released from fires presents several risks. Beyond death from intoxication, fumes are a potential health hazard owing to the substances they contain. Smoke is also corrosive to metal structures or electronic components. Finally, they can accentuate the combustion of surrounding goods by pyrolysis.

Health hazard: *on 22/08/2008, fire of a wood pile in Saint-Cyprien (ARIA 35035):*

In a wood recycling plant, a fire of unknown origin broke out around 4 a.m. on **a stockpile of 2,000 m² of wood**. The watchman alerted the emergency services who intervened with several fire hoses**. A thick cloud of smoke spread over the community of Saint-Cyprien**. On site, the Classified Facilities Installation Authorities also noted that **the stockpile of wood, which was greater than allowed by the declaration, was likely to have been polluted by chemicals.**

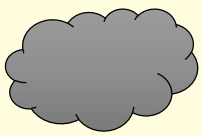
Air quality measurement equipment was installed by a specialised organisation on 15/09. **The analyses, disclosed on 18/11, reported significant atmospheric emissions of dioxins and polychlorinated biphenyls (PCBs**). On 26/11, the veterinary services took milk samples in a neighbouring farm. **Contamination levels were detected which exceeded the regulatory limit values for the marketing of foodstuffs**. **The operation was placed into receivership**.

The investigations were progressively extended from 1 to 2 km in March 2009, and then to 5 km in April. On 25/05/2009, **a prefectoral order was issued extending the monitoring area to 40 communities, then to 42 communities in August 2009**. **914 operations were examined in all**. Clean-up protocols were set up and **2,255 animals were slaughtered** (cattle, sheep, pigs and horses). Rendering flours were incinerated in a local cement factory, and fats likely to contain PCBs were processed in Belgium. Nearly **187 m³ of unprocessed milk was discarded**.

The waste generated during the accident consisted mainly of stocks of shredded wood and sludge from land clearing operations. Considering **the nearly 2 million euros in clean-up costs** and the fact that the owner of the St Cyprien site is now considered **insolvent -** the company began judicial liquidation procedures as of 23/07/2010 **- only the intervention of a public body could secure the operation** and ensure its sustainable management.

As of January 2011, three operations were still partially in receivership. The French food safety agency, which was consulted several times, issued measures to limit contamination of the food chain. **In late January 2011, the investigations (including analyses), destruction of animals and products, as well as compensation were estimated at 4.5 million euros.**

Another risk to be considered: smoke opacity



Smoke can interfere with people's behaviour, especially during the evacuation of a burning building. According to specialists, when visibility is less than 4 m, the evacuation process becomes difficult for an untrained person. And finally, the lack of visibility can delay the response by firefighters. This is why smoke extraction systems are extremely important.

Equipment corrosion: *06/05/2017, fire in a paper mill in Saint-Gaudens (ARIA 50304):*

At roughly 1:30 pm, a fire broke out in an electrical substation in a paper mill. The equipment supplying and controlling the pulp cooking and bleaching unit was impacted. In addition to the automatic extinguishing system (inert gas cylinders), the in-house emergency services teams were able to intervene with fire extinguishers. **The premises were ventilated to evacuate the smoke.**

An inventory of the property damage noted the destruction of an electrical cabinet and other equipment located nearby. **The resulting smoke and fumes resulted in chloride ions being deposited on the electronic components. The humidity in the air on chloride ion deposits facilitated corrosion of the components (corrosion in an acidic medium due to the formation of hydrochloric acid).**

Repair operations were performed over several days and compressed air was needed to clean the faulty components. Restarting the units also took a considerable amount of time due to anomalies or malfunctions observed on several accessories (power units, electronic control boards, etc.). The plant was shut down for 2 days (operating losses and property damage was estimated at over 2 million euros). **Before restarting, the installations were inspected by infrared thermography.**

Pyrolysis phenomenon: *on 28/01/2002, a fire broke out in an archive warehouse in Roye (ARIA 13548):*

The fire destroyed an archive warehouse consisting of 2 cells, one measuring 3,630 m² and 14 m high (5 archive storage levels accessible by walkways) and the other measuring 1,838 m² and 8.5 m high, consisting of a metal structure and separated by a firewall that did not extend past the roof.

As the warehouse was engulfed in smoke, the firefighters attempted to enter the building wearing self-contained breathing apparatus. Upon arriving on the 1st level, they were surprised by a strong stack effect and sudden flash-over and quickly evacuated the premises**; the very hot smoke charged with pyrolysis gas self-ignited (flash-over)**. As the lighting in the cells was switched off, the firefighters had to evacuate the area in the dark; **2 strong explosions occurred after the temperature in the cell increased, resulting in a blast effect that suddenly opened the smoke exhaust hatches and threw the cylinders a distance of 20 m.**

A few questions regarding the anticipation of risks

- **Impact of the smoke on the environment:**

Is the nature of the burning material known (chemical composition)? In the event of combustion, will hazardous substances be released (CO, PAH, dioxin, PCB, etc.)? Do the roofs of the buildings present an asbestos-related risk (fibre cement roof panels for old buildings, for example)?

- **Premature corrosion:**

Has a study been conducted regarding the condition of the electronic components affected by the smoke? Should the elements involved be cleaned or replaced? Has a specific protocol to clean-up or maintain the affected elements been established with an expert?

- **Smoke exhaust:**

Has the Smoke-Developed index of the materials being stored been taken into account when calculating the quantity of smoke control devices? Are the Smoke-Spread index and the Evacuation Time compatible? Is there an order of priority between the smoke extraction and the automatic extinguishing system? Is there a risk that the smoke extraction system will increase the risk of flash-over?

For all comments/suggestions or to report an accident or incident:
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The summaries of accidents recorded in the ARIA base may be consulted at
www.aria.developpement-durable.gouv.fr