ARIA NEWS FLASH
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Anticipating fire and explosion risks in wood silos

Over the past 3 years, more than 40 fires involving silos containing wood chips or sawdust have been recorded in the ARIA database. In such instances, operational difficulties are commonly encountered by emergency services (lengthy interventions, vulnerability of storage structures, etc.). Each response is therefore unique and requires comprehensive knowledge of all potential risks.

1st case, date: 29th Oct 2014, Heat flashes and risk of collapse in Casteljaloux (ARIA 45896):

Fire broke out at a wood board factory around 5 pm in **an 800-m³ concrete silo** (height: 26 m, diameter: 8 m) containing 240 tonnes of sawdust feeding a biomass boiler. Both the internal emergency plan and **the silo's sprinkling system** were activated. Temperature in the silo was estimated at 250°C. **First responders decided to drain the silo from its lower part using an auger**.


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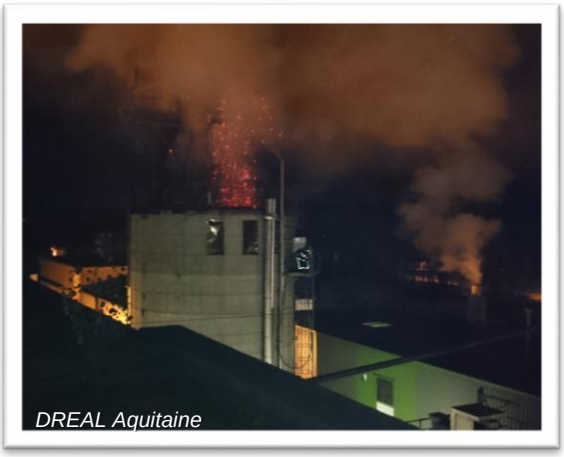
On 30th Oct at 3 am, the sawdust ignited. **Falling blocks of sawdust caused several heat flashes.** Fire-fighters proceeded by **flushing the inside of the silo in order to contain the flames**. **At 6:30 pm, the situation deteriorated with: the silo engulfed in flames over its entire height**, destruction of the drain screw, **and the appearance of cracks at the top of the silo**. Given the **risk of silo collapse, a 60-m safety perimeter was set up**.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Sprinkling inside the silo resumed. Emergency responders cooled the silo from the outside, as **several explosions were occurring in the cell**. **Holes were drilled so as to discharge the accumulated sawdust.**

The fire was extinguished on 1st Nov around 10 am; **4,000 m³ of water were required**. **Since the site's retention capacities were insufficient, a portion of the water, with high concentrations of suspended solids, was channelled into the retention basin of a neighbouring site**.

During this extinction effort, **a fire-fighter sustained serious burns by a pile of incandescent sawdust**, while 2 others fell ill due to odours stemming from an electric generating set. The operator estimated **factory losses at €600,000** (operating loss: 9-day site shutdown, property damage, water treatment issues). The silo needed to be either demolished or slated for structural reinforcement.

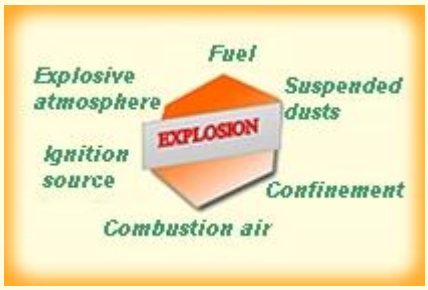
This accident appears to have been caused by the onset of fire in a cyclone separator subsequent to a stripping operation. **The scenario of a silo fire had not been raised when drafting the site's safety report**.

What are the risks involved?

While **fires** are the most frequent of the hazardous phenomena, **explosions** should be feared most.

The mechanical effects induced lead to the **spraying of fragments**, **structural collapse** and a **blast wave**; moreover, such effects can **injure or kill** first responders.

Large volumes of extinction water might, in some cases, be generated; it would be highly useful to capture these volumes within a suitable basin and then treat them in order to avoid **polluting the natural environment**.



2nd case, date: 25th Jan 2005, Smouldering fires not fully extinguished in Corbenay (ARIA 29011):

Inside a board factory, a wood **dust explosion** occurred at 6:10 am in a 360-m³ silo containing 30 m³ of dry wood chips (Silo A). **The accident took place while draining the same tank that 5 days prior had been the scene of a fire** (ARIA 28990). The damaged silo was adjacent to a second silo with the same capacity and also storing dry wood chips (Silo B). First responders initiated manual water injections both in and around Silos A and B, as well as within the Silo A feeder devices. At 6:24 am, an external crew of 30 fire-fighters, called in as backup, installed a fire hose turret on Silo A, **but the cooling step triggered a 2nd explosion (vapours, water gas, suspended dusts?). The accident tripped the opening of silo vents and projected dusts and flames onto the adjacent production building.**

According to the investigation report, **smouldering fires had not been fully extinguished** following the fire on 20th Jan underneath a 2-tonne bell-shaped part located at the silo bottom. Even though the tank had been emptied of its contents, sprinkled and cleaned, this part had never been raised.

3rd case, date: 9th June 1997, Fatal explosion in Saillat-Sur-Vienne (ARIA 11436):

Inside a paper pulp mill, the conveyor feeder of a boiler burning tree bark had been shut down for maintenance. Upon restarting the equipment, **a fouled high-level sensor required repair by a technician working from the feeder silo roof**. After announcing that the installation could be restarted, this technician began to climb down from the roof when the **silo exploded, killing him instantaneously**. Both the roof and grating were deformed and metal siding was torn off.

The expert assessment conducted suggested that **a deposit of bark dust sticking to the silo walls underwent self-heating, most likely initiated by a rise of hot air originating from the boiler**. At the time of restart, this deposit became dislodged and created a cloud of ignited dust particles, thus leading to the explosion.

Several questions to raise in an effort to mitigate the various risks

Fire:

- Is a system in place to block the entrance of foreign objects into the silo (i.e. a barrier grid)?
- Has a device preventing the flow of hot air been installed, especially in the event of connection with a biomass boiler (a so-called "lock" device)?
- Has a hot spot detection system, servo-controlled to an extinction system, been set up?
- Has the risk of fire spreading to the various facilities been studied (i.e. a decoupling system)?
- Do all hot spot tasks (welding, grinding, etc.) require a hot work permit?
- Was the strategy for the case of fire inside a silo (draining, flushing, inerting, etc.) defined in coordination with emergency response units? Has an adequately sized retention basin been allocated to collect the fire extinction water?

Explosion:

- Has the risk of dust accumulation been taken into account in silo operations (at the storage level, ease and frequency of cleaning dusty zones, height of product drop during a potential transfer, etc.)?
- Has the "ATEX" (explosive atmosphere) zoning been performed? Have zones been appropriately marked?
- Have protection measures been adopted (vents, devices to eliminate or limit the spread of explosion, e.g. quick-closing valves)?

Silo design and structure:

- Is the silo far enough away from the other installations?
- Have the risk of airborne heavy objects and the missile effect been properly taken into account?
- If it were necessary to perforate the structure in order to drain the enclosure, have the silo manufacturer's data been archived and are they easily accessible?

For any comment / suggestion or to report an accident or incident :
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The summaries of accidents recorded in ARIA are available on
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