

## Biomass boiler wood silos

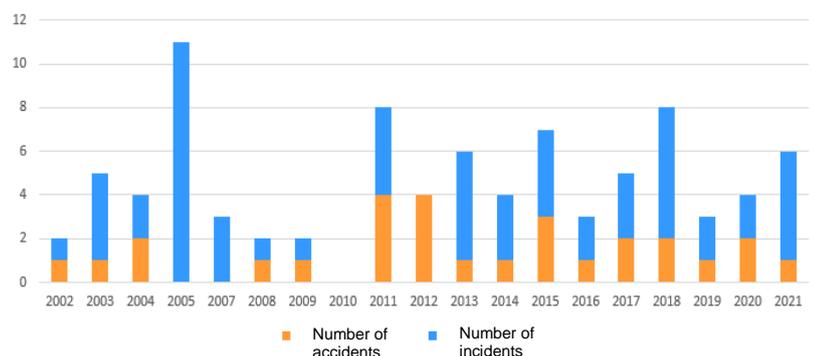
To address issues of both energy efficiency and global warming due to CO<sub>2</sub> emissions, some industrial operators are switching to biomass boilers for their heat production, using wood as fuel. This type of fuel is a low-carbon energy source and offers the opportunity to recover energy from various associated products sourced either directly on-site or from partners. These can include products from forestry (thinning, logging residues, farmland upkeep, etc.), sawmills (wood waste), or other sectors (clean recovered wood: boxes, shredded pallets). Though this process appears to be gaining in popularity, with an increasing number of businesses setting off on their energy transition journey, accidents do still happen, and a few cautionary tales may provide useful insight.

Based on information collected in the ARIA database, the number of events does not follow any particular trend. Two-thirds of events were incidents: fires that destroyed the silo, or even the boiler.

Fire can break out in the silo as a result of self-heating due to wood storage conditions or the presence of foreign materials, but also in the boiler or its infeed system. In this case, it is often poorly controlled combustion and/or flashback to the silo via the infeed worm or belt conveyor that causes these incidents, which almost systematically have economic (90%) and sometimes social (layoffs) or human (injuries) consequences.

The woodworking sector is by far the most affected. Other sectors such as furniture-making, specialist construction operations, food industries, generation and distribution of electricity, gas, steam and compressed air, and waste collection and treatment can also be affected, but to a lesser extent.

20-year trend: accidents involving wood silos feeding biomass boilers



### ARIA 58364 – 16/12/2021 – CHARENTE - Incident

#### Wood mulch silo fire

Several fires emitting a **large amount of smoke** were detected in a wood dust and mulch storage silo feeding a boiler at a wooden veneer and panel manufacturing business.

There was a **flashback** along the boiler's infeed worm conveyor, through the discharger that should have acted as a safety device, then along the cross-feeding worm to under the silo worm, where the fire broke out.

### ARIA 58504 – 12/06/2021 – HAUTE-SAÔNE - Incident

#### Fire in a sawdust silo feeding a boiler

A fire broke out in a silo, 60% filled with sawdust and wood dust, feeding the boiler at a wood panel manufacturing plant. It would appear that the fire broke out as a result of the **worm's feed drive overheating**, due to the **presence of a large amount of dust** generated by a leak and a **high external temperature** over the previous few days.



### ARIA 52959 – 28/11/2018 – LOT - Incident

#### Fire in a wood boiler room

The presence of **smoke** was detected in the hood of the silo storing wood chips used as fuel in a municipal boiler room. When the hood was opened, the wood was found to be **smouldering, but there were no flames**. The most probable cause of the outbreak of fire would appear to have been the presence of **undesirable elements** (battery, electrical cable, etc.) mixed in with the wood. It would appear that these undesirable elements were chipped with the wood prior to storage in the silo.

### Fire on the roof of a silo in a sawmill

A pile of wet shredded biomass (sawdust, bark, and chips) burned **on the roof of a silo storing sawdust** used to fuel the boiler at a sawmill. Following **poor combustion** in the boiler, **white-hot particles fell** onto the roof of the silo where sawdust that had fallen from the silo's infeed hopper had built up.



**By analysing events recorded in the ARIA database, a few lessons can be drawn based on feedback:**

#### **Wood silos:** risk of fire and risk of explosion

To prevent dust from catching fire/exploding and stored wood from fermenting/heating:

- ✓ Dust extraction: fines extracted upstream from storage (ARIA 57149), regular, formal, recorded cleaning in and around the silo (ARIA 57015, ARIA 58504), ventilation, visual inspection (ARIA 55850), regular cleaning out of the silo to prevent any build-up of dust in dead spots;
- ✓ Extraction of foreign bodies (ARIA 52959, 49363);
- ✓ Monitoring of temperature and humidity, and control of wood storage time, based on its humidity (ARIA 53196, ARIA 50856, 47530, 47437);
- ✓ Control of stock management to prevent biomass build-up (ARIA 55593, 58655);
- ✓ Fire detection and protection system in the centre of the silo closely linked to the extraction system (ARIA 57149);
- ✓ Wood storage protected by REI 120 firewalls on 3 sides;
- ✓ Water retention and supply systems must be correctly sized taking account of the high level of spraying required, due to the large amount of smoke generated by this type of event.

#### **Boiler infeed systems:** risk of fire

To prevent flashbacks or blowbacks from the boiler to the wood infeed system:

- ✓ Ensuring full, continuous worm feeding (ARIA 58364, 58710);
- ✓ Setting up a physical separation between the furnace and the infeed system located in the silo (ARIA 57149), this can be a dual fire-stop flap featuring position control and an automatic system to prevent simultaneous opening, or a flame-resistant rotary discharger between the worm connected to the pellet infeed valve and the boiler furnace worm feeder to prevent any flashback (ARIA 58364);
- ✓ Fire detection / temperature monitoring;
- ✓ Worm housing bearing heat extraction or detection system (ARIA 57015: set-up of a continuous greasing system);
- ✓ Preventing build-up of wood dust in the infeed system to prevent combustion (ARIA 58504, 57149, 57015);
- ✓ The pellet conveyor can be equipped with a sprinkler system in the event of temperature increase or outbreak of fire (ARIA 55593, 52969);

Feedback shows that special attention must be paid to maintaining and inspecting the worm feeder's shaft and housing to prevent rubbing that can cause heating then combustion.

#### **Boilers:** risk of fire and explosion

- ✓ Preventing build-up of wood dust in the boiler furnace to prevent micro-explosions (ARIA 57149);
- ✓ Preventing combustion residue fallout on the roof (ARIA 14686, 57149, 54240, 52951, 43473): chimney shutter, regular roof cleaning, moving fuel stores further away;
- ✓ Controlling combustion, particularly by adjusting air inlet and combustion chamber gas venting levels (ARIA 57149, 52196, 22980);
- ✓ Keeping the boiler under negative pressure, and measuring temperature and pressure (ARIA 57149);
- ✓ Regularly cleaning and inspecting electrical appliances (ARIA 54240, 47890);
- ✓ Shutting off the electrical room.