i'Tec_E11
September 2019

Keywords: Fire, Explosion

Summary of studies and analysis of accidents by fire and explosion in the bulk food sector

2011 saw the publication of a preliminary assessment of good professional practice in the field of accidentology detailing occurrences of fire and explosion in France for the period 1982-2011. This good professional practice is also outlined in special report N° 70 "Guide to developing a hazard study".
This technical datasheet provides the latest, up-to-date review of this data, drawing primarily on the BARPI (French Bureau for Analysis of Industrial Risks and Pollutions) database; https://www.aria.developpement-durable.gouv.fr/le-barpi/), and supplements the data collated from the 2011 study. It focuses exclusively on accidents that occurred within France.
The data was processed during the first half of 2019; the data for 2018 is not included as we lack a full dataset for this period

1. General data

This section presents an overview of industrial accidents caused by:

- fire
- explosion
- fire followed by explosion
- explosion followed by fire

These data present a synopsis of the industrial sectors affected by such phenomena, and their development within France over the period 1982 to 2017.

1.1. Sector-specific data

Figure 1 illustrates the distribution of the occurrence of fires and explosions by business sector. BARPI defines a business sector based on its NAF code.

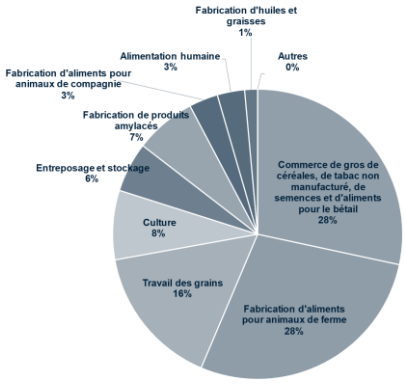

Figure 1 : distribution by NAF code

557 accidents were recorded in ten or so industrial sectors over the period under study. Three sectors stand out, representing **72%** of recorded accidents:

- **28%** in the wholesale trade sector involving grains, unmanufactured tobacco, seeds and livestock feeds (158 accidents),
- **28%** in the livestock feed manufacturing sector (156 accidents),
- **16%** in the grain processing sector (88 accidents).

The data on these three sectors is detailed below.

1.2. Developments in the field of accident studies and analysis

The BARPI database is used to study trends in the occurrence of fire and explosion phenomena by business sector. This trend is illustrated here for the bulk food sector (comprising the three sectors listed above) (Figure 2 - 401 accidents recorded over 35 years), specifically, livestock feed manufacture (Figure 3 - 156 accidents recorded over 35 years).

90% of the 401 accidents recorded in the bulk food sector exclusively involved fires. We find a similar ratio (88%) in the animal feed sector alone.
Figure 2 illustrates that these phenomena are increasing year-on-year. Over the last 4 years, the BARPI database has recorded an average of 20 accidents per year.
Conversely, Figure 3 illustrates that since 1997 this average has remained fairly constant (6 per year) in the livestock feed manufacture sector. Prior to 1997, the year of the Blaye accident, it is probable that not all events were systematically recorded, and that it was this incident that impelled the DREAL to supplement this database.

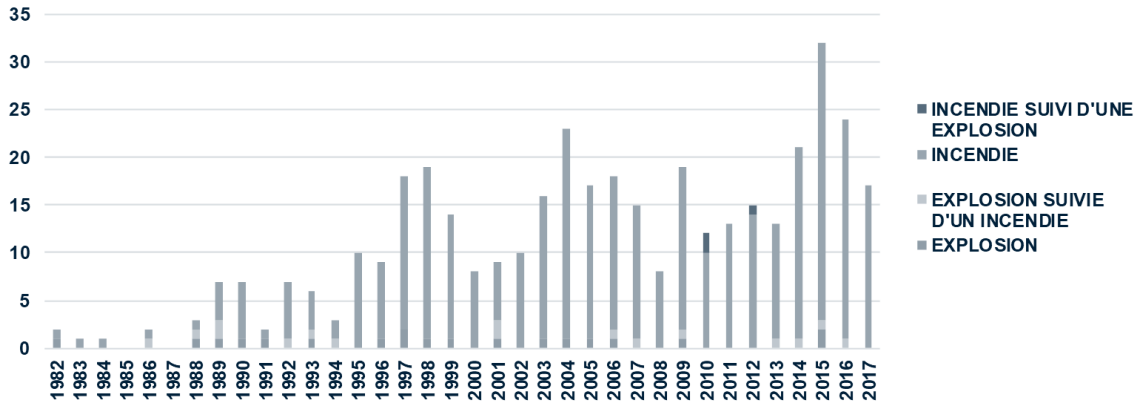

Figure 2 : Accident trend analysis in the bulk food sector for the period 1982 to 2017

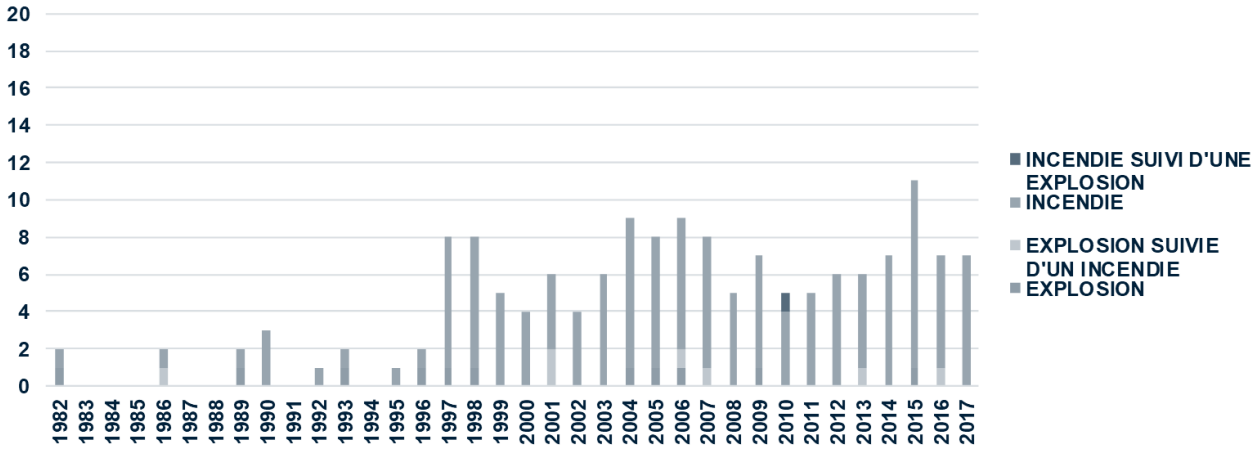

Figure 3 : Accident trend analysis in the livestock feed manufacture sector for the period 1982 to 2017

2. Equipment involved and related causes

Following a cross-sectoral representation of fire and explosion phenomena and the related trend over time, this section focuses on the equipment involved in one or other of these phenomena and their triggers.

2.1. Triggers

As with the accident trend analysis, the triggers for these events are represented graphically for the bulk food (Figure 4) and livestock feed manufacture (Figure 5) sectors.

The main triggers in the bulk food sector (Figure 4) are:

- **44%** silos
- **11%** dryers
- **10%** unknown origin
- **8%** coolers

Elevators, other handling equipment and grinders each represent **5%** of accidents.

The main triggers in the livestock feed manufacture (Figure 5) sector are:

- **38%** silos
- **19%** coolers
- **8%** unknown origin
- **8%** dryers

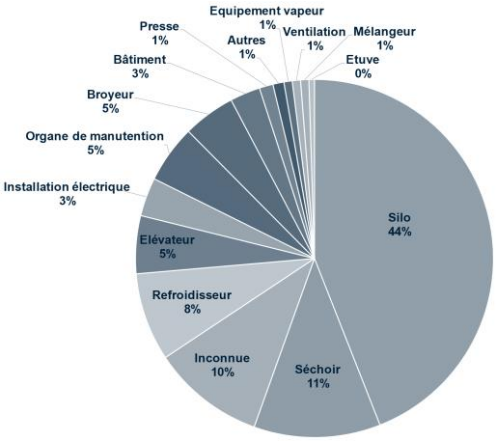

Figure 4 : Trigger equipment in the bulk food sector (401 accidents)

Elevators (**3%**), other conveyor equipment (**4%**) and grinders (**6%**) are rarely involved in such accidents

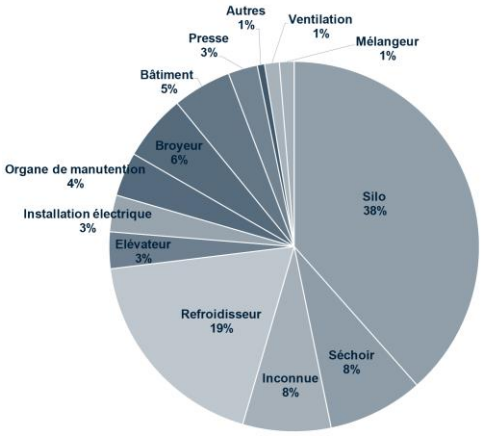

Figure 5 : Trigger equipment in the livestock feed manufacturing sector (156 accidents)

2.2. Causes

Where the cause has been identified, accidents have been processed based on phenomena typology. Nevertheless, the number of accidents considered (231 since 1982) is less significant as the data collected by the BARPI did not allow a clear identification of the cause triggering these phenomena in such cases.

Erreur ! Source du renvoi introuvable. illustrates the causes of fire and fire followed by explosion for 206 accidents out of 231. Note that fire followed by explosion only represents 3 accidents out of the 206 accidents that were studied.

Figure 6 shows the causes of explosion and explosion followed by fire for 25 accidents only. Note that explosion followed by fire accounts for 12 accidents out of the 25 accidents studied, i.e. nearly 50% of the total.

These data concern all bulk food sectors. Given the paucity of the data (particularly concerning explosions) and in the interest of increased representativeness, it has been decided to avoid limiting the study solely to the livestock feed

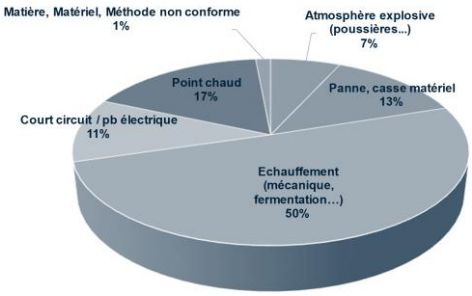

Figure 6 : Causes of explosion and explosion followed by fire (25 accidents)

Figure 6 demonstrates that the explosions were caused by:

- **38%** hot spot work,
- **12%** electrical issues,
- **12%** equipment breakage and/or failure,
- **8%** overheating,
- **8%** use of a nonconform material, method or equipment.

3. Conclusion

The livestock feed manufacturing sector is vulnerable to fire and explosion. Since 1997, these phenomena have been recorded at an average rate of 6 per year. The Fire/Explosion ratio is in the region of 90%/10%. The primary causes of fire are not the same as the primary causes of explosion. 48% of fires are generally caused by mechanically induced overheating while 38% of explosions occur during hot spot jobs.