HAZARDOUS WASTE INCINERATOR FURNACE WALL FIRE

01/10/2021

Saint-Vulbas (Ain)

France

Fire
Scaling
Extinguishment
Training

THE FACILITIES

The site:

The site involved is a hazardous industrial waste thermal treatment centre. It is classified Seveso Upper Tier and covered by the IED directive. It is located on an industrial estate. The site is surrounded to the north by a B road, to the south and west by railway lines, and to the east by another industrial facility. Its surface area is approximately ten hectares.

It features two major business lines, i.e.:

- thermal treatment of hazardous waste using three furnaces located on site (organohalogenated waste, PCB waste, special gas waste, reactive waste, toxic waste, odorous waste, etc.);
- businesses treating electrical equipment contaminated by PCBs (decontamination and refurbishment of transformers polluted with PCBs).

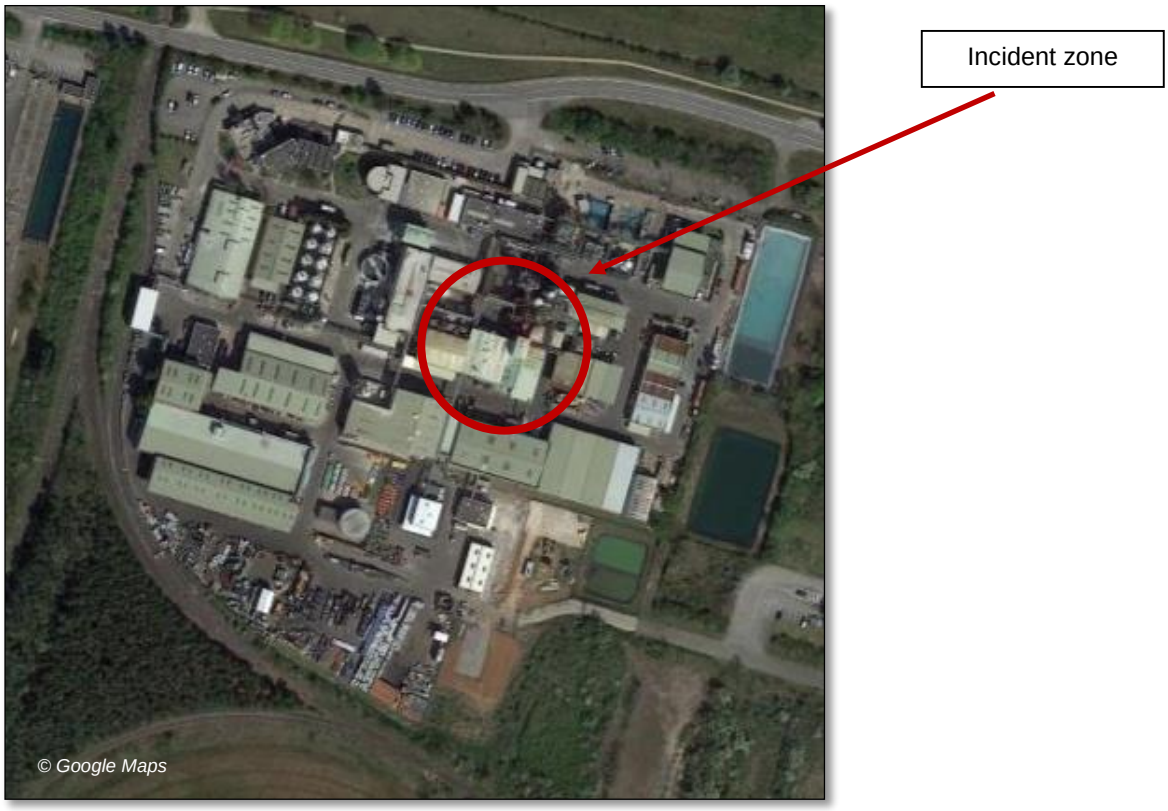
The site treats practically all types of gaseous, liquid, semi-liquid, or solid waste, including organohalogenated waste, compatible with the facilities' functioning. In general, the waste treated is mainly:

- hydrocarbons, oil residues, and distillation residues;
- organic solvents and products;
- oils contaminated with PCB/PCT;
- paint and paint sludge;
- industrial sludge and wastewater;
- pharmaceutical products;
- used consumer or cleaning products;
- specifically for the static furnace: brominated brines;
- specifically for the copper furnace: contaminated metal drums and windings from decontamination of transformers.

The unit

The incident occurred on the rotary furnace's after-burner wall. This is authorised to treat 35,000t/year of hazardous waste: solid, semi-liquid, liquid, gaseous, high calorific value (HCV), low calorific value (LCV), and oil waste

The afterburner can be fuelled with high calorific value liquid waste or otherwise by fuel oil burners raising combustion gases to a temperature of 1,100°C (regulatory obligation for incineration of halogenated hazardous waste).



THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident:

On the evening of Friday 1st October 2021, a fire broke out on the rotary furnace after-burner wall.

The chronology of the event is described below.

At 21.50, shortly before the 22.00 shift change, the direct tank containing high calorific value (HCV) waste connected to the B2 burner located on the east side of the rotary furnace was exhausted. As this B2 burner was no longer fuelled, the afterburn temperature began to fall.

At 21.54, to compensate for the temperature decrease and in accordance with the operating procedures, the console operator opened the solenoid valve from the control room to inject fuel oil into the afterburner via the B3 burner. Fuel oil is fed progressively into this burner (opening at 60% then 75% to maintain temperature). The fuel oil flow rate was estimated at more than 750l/hr but could not be accurately assessed because the flow meter was over range.

At 21.55, the console operator observed the shutdown of the waste feed and secured the facility. As a matter of fact, the after-burning valve opened, and both the rotary furnace exhaust fan and the fans feeding combustion air into the facility shut down. All waste injection was halted. The furnace's rotation was maintained to prevent the shell buckling due to thermal deformation. The facility's emergency shut-down procedure was automatically triggered due to loss of the minimum required after-burning temperature following the loss of the temperature sensors set up on the west after-burner wall.

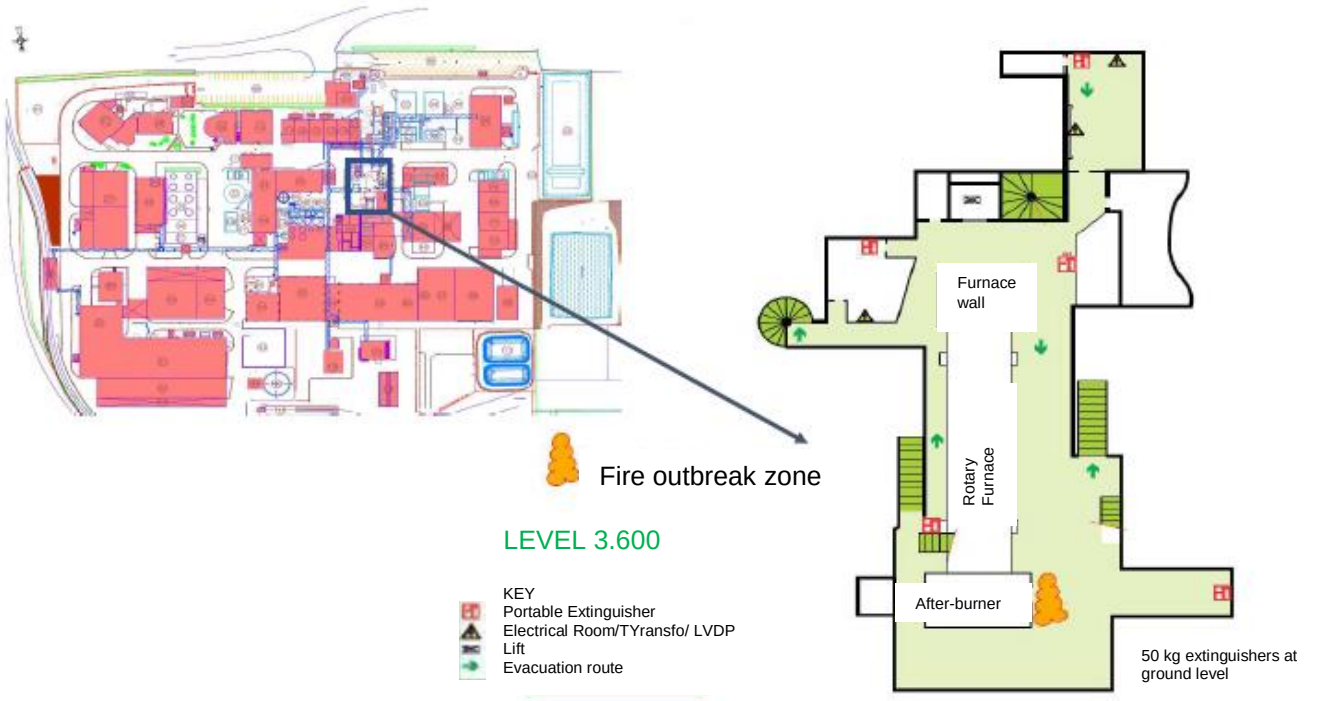
Night shift staff arrived at the control room and reported that flames were visible outside the afterburner on its west wall, on the first floor, accessible via the external stairs.

At the same time, afternoon shift staff also noticed flames on the unit via the operating camera monitoring the B2 burner.

At 22.05, the shift manager called the duty manager. The DM triggered the IOP. The shift manager also called external emergency services given the size of the flames.

The teams on site, i.e., afternoon shift operators and night shift operators, used mobile extinguishers on the incipient fire. These six operators used four 50kg powder extinguishers and nine 9kg powder extinguishers. N.B.: the 50kg powder extinguishers were located on the ground floor and were carried by two operators up

to the first floor. Five 9kg powder extinguishers (out of the nine used) were located near the zone where the fire broke out on the first floor.



Location of extinguishers on +3600 gangway of rotary furnace and its after-burner

© Operator RM

At around 22.10, managers arrived on site to set up the crisis unit.

At 22.16, the departmental fire service (42 firefighters) arrived on site along with the duty manager. The teams visited the site and observed that the fire had been extinguished. Three police officers also arrived.

As the fire had been extinguished, the operator decided not to trigger the automated call system used to inform and alert neighbouring businesses on the industrial estate. They considered it was unnecessary to inform their neighbours. This complied with the rules in force given that the SRP (Specific Reporting Plan) was not triggered.

The next day, at 01.38, the site manager sent an email reporting the event that had just occurred to the manager of the industrial estate, municipal representatives, and the classified facility inspector tasked with monitoring this site. The event was not reported to the departmental prefecture.

The zone was taped off to prevent access. The facilities were accessible again from the morning of the next day but one.

The consequences:

The fire was extinguished using powder extinguishers. This meant that the operator did not have to manage any water used on the fire.

Smoke was also generated by the fire for the duration of the event, i.e., from 21.55 to 22.10. The product initially involved in the incident was furnace fuel oil. The operator estimated that approximately 350 litres were involved. As the flow meter was over range at the time of the incident, the quantity could not be accurately determined. Furthermore, electrotechnical devices and related electrical cables located near the furnace were also burned during the incident.

The low quantity of substances burned, and the type of substances involved did not have any off-site impact due to the fire's combustion smoke.

However, the fire caused the incineration furnace to be secured. The consequences of this were as follows:

- the shutdown of the afterburner resulting in the combustion gases from the rotary furnace not undergoing thermal treatment;
- the afterburner "cowl" was opened from 21.55 to 23.05 i.e., for 1h10. During this period, the combustion gases from the furnace were not treated (by-passing of the smoke treatment system);
- shutdown of the venting in the rotary furnace, which may have favoured incomplete combustion.

The flow of smoke generated by combustion of waste located in the furnace was evacuated by natural convection via the afterburner and the AB valve. Due to the shutdown of both venting and combustion air, the volume of smoke reduced rapidly.

Initially, the results of the samples taken by the external emergency services just after the event demonstrated no impact on SO_2, HCl, and HCN parameters.

Subsequently, a soil sampling campaign at existing monitoring points was organised thirteen days after the event. Fourteen samples were taken at seven monitoring points (including one control point). The results of this campaign demonstrated that the event did not have a significant impact on soil quality whether in terms of organic parameters (such as dioxins and furans, dioxin-type PCBs, indicator PCBs) or metals. As a matter of fact, the concentrations measured in soils for:

- dioxins and furans, dioxin-type PCBs and indicator PCBs matched regular values, similar to figures from previous campaigns and featuring no anomalies;
- mercury and hexavalent chromium were below quantification limits;
- lithium, arsenic, and cadmium parameters matched regular values, similar to figures from previous campaigns and featuring no anomalies;
- lead and Br parameters matched regular values, similar to figures from previous campaigns. However, one single anomaly was observed at the control point but was therefore not related to the site's business.

As for the waste left in the furnace at the time of the event, due to the decrease in internal temperature, part of the solid waste was evacuated via the furnace's liquid seal, and the rest solidified and formed a crust. The operator estimated that less than $2m^3$ of waste were involved.

Property damage to the facilities was observed, including damage to both the burners and the injection lines on the after-burner structure.

The after-burner structure underwent an expert assessment by an inspection firm, demonstrating that (a) it was not damaged by the outbreak of fire, and (b) the stability of the installation's metal weight-bearing structure was unaffected.

The incident caused the facility to be shut down for 17 days and 20 employees are placed on technical unemployment. Deliveries were suspended and traffic was diverted to authorised facilities.

The zone affected by the fire was cleaned and residues and washing water were treated on site.

The financial losses due to this event were estimated to total €900k: €100k for inspection, repair, and modification of the facilities, and €800k in operating losses due to the shutdown of the facility.

European industrial accident scale:

By applying the rating rules applicable to the 18 parameters of the scale officially adopted in February 1994 by the Member States' Competent Authority Committee for implementing the "SEVESO" Directive and in light of available information, this accident can be characterised by the four following indexes:

- □ □ □ □ □ □ Dangerous materials released
- □ □ □ □ □ □ Human and social consequences
- □ □ □ □ □ □ Environmental consequences
- ■ ■ □ □ □ □ Economic consequences

The parameters composing these indices and their rating methodology are available here.

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THIS ACCIDENT

The operator identified the origin of the fire. A splash of fuel oil caught fire on the external wall of the afterburner. It was hot (estimated temperature: approx. 80°C).
However, as the hose was destroyed by the fire, the operator was not able to precisely determine the cause of the splash. Several hypotheses are possible: hose disconnected, leaky seal, or leaky fuel oil hose.

ACTIONS TAKEN

Following the event, the operator modified its IOP to include reporting to the departmental prefecture in accordance with the terms and conditions set out by the local crisis management bureau. “Immediate” reporting to the classified facility inspectorate was also amended with the addition of an emergency telephone number instead of a single email address to contact a specific person. The report forms were therefore updated and integrated into copies of the IOP available on site. Furthermore, all duty staff attended training to learn about these amended documents.

The operator also made technical modifications to their facility. They moved the combustible fluid pipe / valve / flow meter groups away from the after-burner wall.

LESSONS LEARNT

This event highlights several points about fire risk management.

Firstly, it underlines the importance for operators of possessing up-to-date response plans covering all these points. In this case, the fault concerned the terms and conditions for immediate transfer of the report to the competent authorities. The relevance of the different points of these plans must therefore be checked regularly and be backed up, in case of amendment, with relevant staff training.

Next, this event highlights the importance of the design of facilities particularly in terms of the choice of fuel feed hoses suitable for potentially high temperature conditions. This event also underlines the importance of properly positioning all monitoring equipment (such as sensors), and control and supervision equipment (such as valves or flow meters) at the facility to keep the best possible control over the facility in case of incident or accident.

Finally, this event demonstrates the importance of the first measures taken after a fire breaks out. In this event, they allowed the incident to be contained very quickly.

As a matter of fact, emergency services were called immediately by the operator after the occurrence of the fire. Even though they did not ultimately have to take any further action because the fire was already under control when they arrived, external emergency services must be called as quickly as possible to take account of response time (i.e., time between reporting the incident to the emergency services and the first vehicle arriving on site). The operator must not in fact wait to know whether they are able to contain the fire on their own before alerting the emergency services.

Furthermore, the Internal Operating Plan (IOP) was triggered just after the discovery of the incident despite it occurring in the evening at the start of the weekend, at shift change time. This plan is a crisis management tool. Its aim is to contain and bring incidents under control to minimise their effects and limit damage caused to public health, the environment, and property, and also take necessary measures to protect public health and the environment against the effects of major accidents.

In addition, the incident was quickly extinguished. This is the most important lesson learnt from this event because this promptness prevented the fire from spreading to other facilities on the site and becoming a conflagration. Two key factors meant the extent of the incident could be limited like this.

Firstly, during the event, sufficient staff trained to handle extinguishing equipment were on site. Accordingly, six operators responded during the extinguishment, including two first responders (FR) and four secondary responders (SR).

FRs are trained annually to handle extinguishers in real-life conditions on a gas or fuel oil fire simulator for operating staff.

SRs attend ten in-house annual training courses. The themes covered on these courses are: responding to chemical leaks (including manoeuvres using a protective suit), fire manoeuvres (on-site fixed and mobile facilities), drills wearing SCBA (Self-Contained Breathing Apparatus), and search and rescue in a contaminated environment. This training is backed up with two annual days of training at a fire and chemical risks training centre located in a neighbouring department. Two (gas-fuelled) “real fire” drills are organised along with chemical accident scenarios.

Accordingly, correct staff training mean that operators are able - when necessary - to handle an incident calmly and respond promptly and effectively. This fire demonstrates this was the case as the fire was extinguished in under 15 minutes using extinguishers (including several 50kg extinguishers carried up to the first floor by operators).

Furthermore, the site had extinguishing equipment not only suited to the type of fire encountered, but also positioned appropriately and in sufficient quantity. This equipment was set up by one of the operator’s sub-contractors based on the instructions of rule APSAD R4 “Portable and mobile extinguishers”. This technical standard defines a methodology to analyse risks, determine the type and number of extinguishers, and establish setup and maintenance principles.

Setting up mobile portable extinguishers is a means of enabling a first firefighting response, pending use of more powerful equipment often set up by external emergency services. This equipment must be used by any operator who notices a fire breaking out. A fast response is essential because this equipment is generally only effective on an incipient fire due to the quantity of extinguishing agent, limiting utilisation time.

This fire therefore provides feedback positive on the setup of first measures in case of fire. In addition to a fast and appropriate response from operators, please note the operator's correct preparation for this risk, whether setting up first response equipment and maintaining it in good working order, or staff training and procedures to be followed in case of incident. Anticipating and taking this risk into account in the site's operating procedures therefore meant the fire could be brought under control using on-site equipment without any off-site impact.