

Appendix 1 - FRANCE

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ARIA database

The ARIA database, used by the Ministry of Ecology and Sustainable Development, is essentially a record of the accidental incidents which have or could have been hazards to human health or public safety, agriculture, nature or the environment. For the most part, these incidents result from the activities of factories, workshops, warehouses, work sites, breeding operations, etc. which are classified under the legislation relating to Classified Facilities, as well as from the transport of hazardous materials. The recording and analysis of these accidents and incidents, in France and abroad, have been organised since 1992. This record, which depends largely on public and private sources of information, is not exhaustive. The following list of accidental incidents contains only a selection of illustrative cases. Despite the great care taken in preparing this summary, errors may have been overlooked in the information presented. Should any readers detect an error, they are kindly requested to report it, citing the sources of information, to the following address:

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    **ARIA 343 - 13/06/1988 - 26 - ROMANS-SUR-ISERE**
24.46 - Production and transformation of nuclear materials
 Within a nuclear fuel production plant, a leak ignited with hydrogen (H2) occurred on a semitrailer hooked up to a pressure reducing station while awaiting a transfer. The alert was sounded by personnel of the company cafeteria located nearby. The external rescue crews arriving at the site 15 min later reported a very sizeable gas leak ignited at the rear of the semitrailer, near the vertical bottle storage area. The excess red-white heat at the end of the semitrailer platform raised fears over deterioration of the bottle valves. Moreover, the pressure reducing station to which the semitrailer was connected (the former station was being used as an emergency centre) was the origin of many ignited leaks. Four other semitrailers were positioned at the level of the transfer station hooked up to a second pressure reducing station (new one): 1 was connected and in a wait mode, 1 not connected, and 2 connected and being serviced.
 The first measures undertaken consisted of cooling, by flooding all bottle heads on the leaking semitrailer, and removing the other semitrailers. In addition, the hydrogen production equipment was shut off in order to isolate the distribution network. Two hours later, with the pressure inside bottles on the damaged semitrailers having dropped, rescue personnel could get close enough to close the valves. Lightning would have caused the accident.
 The definitive elimination of the damaged pressure reducing station (emergency centre) would be used to resume distribution network operations as of the next day. All of the semitrailer connection studs could be refurbished in a way that offsets the risk of destruction by heat.

    **ARIA 614 - 10/08/1988 - 59 - SIN-LE-NOBLE**
36.00 - Water extraction, treatment and distribution
 Within a water treatment plant, a thunderstorm caused 2 fuses on a transformer to overheat, leading to a leak of 2 litres of pyranol; 2 employees and 1 fire-fighter were hospitalised for precautionary reasons.

    **ARIA 654 - 23/09/1988 - 13 - ROGNES**
86.90 - Other activities involving human health
 During a thunderstorm, a fire broke out on a transformer struck by lightning. The risk of toxic release related to the pyranol contents was controlled; 87 residents of a retirement home were evacuated and 2 fire-fighters became seriously indisposed.

ARIA 1151 - 21/05/1989 - 33 - PESSAC
46.73 - Wholesale of wood, building materials and sanitation appliances
 Lightning caused a fire inside a wood distribution warehouse.

    **ARIA 1200 - 24/07/1989 - 15 - AURILLAC**
37.00 - Wastewater collection and treatment
 A thunderstorm created disturbances in operations at a wastewater treatment plant. The Cère River was polluted over a 5-km stretch and several thousand dead fish were recovered from the river.

    **ARIA 1760 - 13/03/1990 - 65 - BAZILLAC**
72.19 - Research & development in other physical and natural sciences
 A fire broke out at an industrial laboratory specialised in producing high electrical voltages for simulating the effects of lightning and testing insulation materials and lightning rods. The damage amounted to 4 or 5 million francs (€ 0.6 million).

    **ARIA 1884 - 22/04/1990 - 69 - PIERRE-BENITE**
20.14 - Production of other basic organic chemicals
 Subsequent to an electrical outage caused by lightning, a pressure surge occurred within a Forane production unit and a toxic cloud formed. Water curtains were quickly deployed and slowed dispersion of the cloud while generating a heavy fog. The services of external fire-fighters were not required.

    **ARIA 2715 - 05/07/1991 - 29 -**
21.10 - Production of basic pharmaceuticals
 Subsequent to lightning striking the wastewater pumping station at a specialty chemicals plant, the remote alarm on the retention tank was damaged. The circuit-breaker was also activated: the lift pumps were shut down. This tank overflowed and approx. 150 m³ of untreated cystine effluent (poultry feather extract) poured into the Les Noës stream. Water quality was adversely affected all the way to the confluence with the La Claire River; no significant consequences however could be detected on the local fish population.

ARIA 3661 - 29/05/1992 - 12 - LA LOUBIERE

47.59 - Retailing of furniture, lighting fixtures and other household items within a specialty store

A fire, caused by lightning, broke out inside a hangar used not only as a workshop for a company producing leather living room furniture, but also as a warehouse for a telephone line installation company. The workshop, warehouse and 2 trucks were destroyed.

 **ARIA 3707 - 10/06/1992 - 02 - MARLE**

20.20 - Manufacturing of pesticides and other agrochemical products

 A fire broke out during a thunderstorm in a storage area containing the finished goods from a phytosanitary production plant. The fire was caused by a high-intensity lightning bolt that exceeded the protective capacities of the facility's lightning rod. The POI Internal Response Plan was triggered and 3 large nozzles (diameter: 70) were set up inside the building. Local fire-fighters were notified. The fire was brought under control within 45 min. As a result of this accident, 10 tonnes of products were burned and 400 m² of warehouse space destroyed. The fire extinction water was channelled into the site's retention basins and thus did not create any pollution risk. Property damage totalled 3.5 million francs.

 **ARIA 4507 - 30/05/1993 - 87 - BESSINES-SUR-GARTEMPE**

24.46 - Production and transformation of nuclear materials

 An incident occurred within a uranium ore treatment facility during experimentation conducted on a new fabrication process. Under stormy weather conditions, a malfunction of the lime feed pump, located in the unit assigned to neutralise effluents generated by a uranium oxide dissolution installation, was at the origin of a nitrogen dioxide discharge. 30 fire-fighters were called to the scene. The treatment line was quickly restored and the acid tank drained. The discharge was not radioactive, and the incident had no consequences for the local population.

 **ARIA 4801 - 22/09/1993 - 69 - RILLIEUX-LA-PAPE**

36.00 - Water extraction, treatment and distribution

 Lightning fell on the main transformer (63 kV) of a 300,000 m³/day water supply plant. A fire broke out (with flames reaching 50 m high), fuelled by the 6,000 litres of oil in the transformer. The medium-voltage distribution system was damaged due to a "domino effect" and the 5 lifting pumps were shut down. Neither the hydraulic circuitry nor the extraction fields (114 wells) were affected. The implementation of emergency backup measures enabled maintaining water supply service to the city of Lyon. Fire-fighters had to stay 6 hours on the site to extinguish the blaze. Property damage was valued at 11.5 million francs and necessitated 3 months of repair work.

 **ARIA 4900 - 08/10/1993 - 62 - VENDIN-LE-VIEIL**

35.13 - Electricity distribution

 Lightning destroyed a 150-kV transformer, which was shut down during the accident (circuit-breaker left open) and protected by a spark-gap. Subsequent to the Joule effect due to overvoltage, 38,000 litres of oil contained in the device ignited. The fire was controlled within 2 hours, yet some materials continued to burn for over 36 hours. Electricity supply to the city of Lens was interrupted for a total of 50 min. Following the accident, 45,000 litres of oil/water emulsion were recovered and stored in a tank for subsequent incineration. The soil was polluted over 200 m² area. Borehole samples, conducted in order to evaluate groundwater pollution risks, yielded a 0.003% detection rate of hydrocarbons down to a 3-m soil depth. Damages and operating losses were appraised at 7.8 million francs.

ARIA 5060 - 02/07/1993 - 94 - CRETEIL

38.22 - Treatment and elimination of hazardous wastes

A thunderstorm caused a combustion gas discharge fan to shut down at a facility designed to treat hospital and urban wastes. These combustion gases were released without filtration once the safety alarm had been triggered. A black-coloured smoke was emitted. The discharge fan was repaired after a few days of down time.

 **ARIA 5675 - 29/07/1994 - 38 - ROISSARD**

94.99 - Activities sponsored by associations ("not classified elsewhere")

 In a holiday camp, lightning struck the lightning rod and caused an electric arc between the lightning rod and the underground gas supply pipes feeding the kitchens from a propane cistern, resulting in ignition of the gas. One individual onsite reacted quickly and put out the fire using an extinguisher. However, the faulty trigger-regulator on the cistern did not shut off the supply line despite the pressure drop due to the leak, and the gas continued to spew. The manual valve on the cistern had seized and could only be operated later on by a fire-fighter on the scene. 124 children and camp counsellors had to be evacuated during the emergency intervention. The regulator was changed the very same night by the gas distribution company, which owned the cistern. The underground pipe was made of copper and ran at a distance of just 20 cm from the lightning rod (while good engineering practice dictates a distance of 1 m). The building was scheduled for demolition in August of 1994 and the entire gas installation was due to be replaced.

 **ARIA 5678 - 28/07/1994 - 76 - CIDEVILLE**

49.50 - Pipeline transport

 A 1.20 m deep underground gas pipeline (external diameter = 457.2 mm; MS pressure = 67.7 bar; steel X60; thickness = 5.2 mm) with polyethylene lining was punctured by lightning and ignited in the open field, at 200 m from residential dwellings. Flames 10 m high could be observed, cornfields burned over a 30-m radius. The impact occurred at the level of a 1.50 m wooden post planted into the soil (depth: 0.5 m) and used as a landmark for the structure; it created 2 craters 110 mm apart. On one of them, the pipe lining disappeared altogether and the pipe wall was perforated, while on the other, the lining was locally absent and 2 perforations could be observed. The accident was noticed by a train conductor (in witnessing a brushfire), who promptly sounded the alert. After 70 min, the gas leak was detected and the site operator notified. The next step consisted of depressurising the pipe segment and flaring the gas, following modification of the zone's supply configuration. The fire was extinguished 7 hours following detection. The damaged zone was replaced (through installation of a jointing band). The supply network was re-established 7 hours later.

ARIA 5870 - 07/09/1994 - 07 - PEAUGRES

01.50 - Combined farming and cattle breeding activities

A fire caused by lightning destroyed a 250-m² farm building along with the equipment housed inside.

ARIA 5871 - 08/09/1994 - 07 - SAINT-ALBAN-D'AY

01.50 - Combined farming and cattle breeding activities

Lightning caused a fire to break out on a 500-m² farm.

ARIA 5874 - 08/09/1994 - 38 - ROUSSILLON

20.14 - Production of other basic organic chemicals

Several non-continuous emissions of nitrous vapours occurred within a chemical plant, subsequent to power outages caused by thunderstorms.

 **ARIA 6109 - 05/08/1994 - 85 - LA GAUBRETIERE**

31.09 - Manufacturing of other furniture

 Lightning fell on the aluminium building of a furniture factory and caused a fire to break out. After piercing the roof, the lightning propagated to the electrical circuits of the company's 12 varnishing booths. Three of them went up in flames.

 The powder-based fire safety system activated and was able to contain the fire outbreak until fire-fighters arrived on the scene. Thanks to the presence of a fire wall, the blaze could be controlled within 2 hours. The 1,200 m² of roofing were all damaged as were 420 m² of factory premises. The three booths and a varnishing line were shut down. Property damage and production losses amounted to 4.9 million francs.

 **ARIA 6139 - 24/03/1986 - 63 - ISSOIRE**

24.42 - Aluminium metallurgy

 An explosion took place within a foundry, on a casting machine supplied by natural gas. Lightning created an electric arc at the level of the casting workshop and caused liquid aluminium to spray. The fog that formed and then rose once in contact with air was responsible for the explosion. The descent device cable broke and let the entire mechanism fall into the shaft. A second, less violent explosion then occurred, with a flare shot off following the gas pipe rupture. Rescue teams arrived quickly on the scene (6 min. after the alarm was sounded). The human toll: 4 dead and 25 injured. Wind gusts tore off the sheet metal roofing as well as the lobby siding. Parts weighing several tens of kilograms were found at distances of up to 400 and 500 m.

 

 **ARIA 6277 - 05/11/1994 - 13 - BERRE-L'ETANG**

19.20 - Oil/petroleum refining

 The floating roof of a 15,000-m³ storage tank containing platformate (a close derivative of gasoline) collapses for an undetermined reason. The sinking was detected on November 5 at 9:40 pm. Despite spreading foam for fire prevention purposes, lightning caused the inflammation of the platformate product on November 7 around 9:45 pm during a violent thunderstorm, once the foam layer had been diluted due to heavy rainfall. The fire was contained in 40 min via the facility's internal response measures. The volume of hydrocarbons destroyed during the fire was estimated at 400 m³, and another 25,000 litres of emulsifiers were lost. Property damage was appraised at 2.2 million francs.

 

ARIA 7168 - 14/07/1995 - 15 - SAINT-GERONS

01.50 - Combined farming and cattle breeding activities

A fire broke out on a farm, in two 800-m² buildings housing beef cattle, hay and agricultural machinery. The machinery and 60 tonnes of hay were destroyed. Lightning was the cause of this loss.

ARIA 7295 - 06/08/1995 - 50 - MARIGNY

28.29 - Manufacturing of miscellaneous general-purpose machines

Subsequent to a lightning strike, a fire on the premises of a company manufacturing extinguishers destroyed 200 m² of workshop space. The presence of a breeze-block wall enabled salvaging the adjacent premises, warehouse and painting booth.

 **ARIA 7348 - 22/08/1995 - 42 - VIOLAY**

61.10 - Wired telecommunications

 A transformer containing pyranol exploded following a lightning strike. The entire volume of pyranol (30 litres) spread into the retention tank. The product would ultimately be destroyed by a specialised firm called to the site.

 

 **ARIA 7508 - 02/05/1988 - 01 - BALAN**

49.50 - Pipeline transport

 At dawn, lightning struck an insulating joint located on an aboveground power supply line for a pressure sensor at a distance of 1.75 m from a transport pipeline pressurised at 80 bar. The subsequent ethylene leak then ignited. The personnel reacted by cutting the gas intake and cooling the adjacent metal structures. The fire could be contained within 90 min. The site operator made plans to implement a lightning protection plan.

 

 **ARIA 7545 - 05/10/1995 - 26 - MERCUROL**

49.50 - Pipeline transport

 A lightning strike punctured a 6-mm² hole on a gas pipeline crossing an orchard and supplying gas to the town of Tain L'Hermitage, and then ignited the leaking gas. This 100-mm diameter pipe, 3.6 mm thick and 10 km long, which was transporting natural gas under 58 bar of pressure, runs underground at a depth of 1.2 m. The lightning arrester and electrical cabinet of the closest pipeline station sustained damage. Temporary repairs (i.e. installation of a coupling sleeve) were completed 8 hours later.

 

 **ARIA 7663 - 28/10/1995 - 79 - SAINT-VARENT**

 *01.47 - Poultry farming*

 Lightning fell on a 84 m long hangar covering a floor area of 1,100 m². The building was destroyed in less than 2 min and 8,400 turkeys were charred to death. The commercial loss was estimated at 130,000 francs (i.e. 10 tonnes of poultry meat) and property damage in the neighbourhood of 700,000 francs.



ARIA 7664 - 29/10/1995 - 79 - SAINT-AUBIN-DU-PLAIN

01.50 - Combined farming and cattle breeding activities

A lightning-induced fire destroyed a 500-m² hangar housing farm machinery. Fire-fighters spent 6 hours battling the blaze and were able to avoid its spread to a poultry breeding farm and gas cistern.

 **ARIA 8885 - 18/05/1996 - 76 - LILLEBONNE**

 *20.14 - Production of other basic organic chemicals*

 During a violent thunderstorm at the time of a shift change, an explosion occurred in a glyoxal synthesis unit. Two other explosions followed and the ensuing fire destroyed the entire unit. A 50-m³ tank was projected some 200 m. The Internal Response Plan (POI) was activated and 60 fire-fighters were called onsite and applied large quantities of water. The extinction water partially overflowed into the river. Radioactive sources were affected during the incident, although all radioactivity controls remained negative. NO_x was released, yet no injuries were reported. The cost of the accident amounted to 170 million francs. Plant production was halted for 2 weeks. An expert appraisal revealed a flaw in the emergency electrical supply.



 **ARIA 8909 - 18/05/1996 - 47 - ANDIRAN**

 *10.61 - Grain handling*

 Lightning gutted the tank of a transformer containing 315 kg of askarel (PCB) inside a grain mill. A specialised firm recovered the product within a retention tank.



ARIA 9664 - 02/08/1996 - 33 - LE HAILLAN

30.30 - Aeronautic and spatial construction

Lightning fell onto a lightning rod designed to protect a building used for assembling launchers and space vehicles. The equipment sustained damage as did the fire prevention system, causing halon to leak. The thrusters were protected and the workshop area evacuated and ventilated. All contract personnel exposed to the halon gas were examined and no adverse reaction was detected. The resumption of plant activities was conditional upon complete restoration of the protection systems. The inerting system was affected by reverse lightning currents, which created a signal similar to the activation signal (i.e. resultant from activation of 2 fire detectors). In the future, the electrical circuits will be protected by lightning arresters.

ARIA 9996 - 22/04/1996 - 78 - MANTES-LA-JOLIE

20.30 - Production of paints, varnishes, inks and mastics

A violent fire sparked by lightning broke out in a specialised facility producing paints for the automobile industry. A workshop encompassing a floor area of 300 m² and containing stocks of paint, solvents, varnishes and resins was destroyed. Fanned by a strong gusty wind, the fire spread to the premises of a neighbouring company.

 **ARIA 10074 - 17/11/1996 - 13 - FOS-SUR-MER**

 *20.14 - Production of other basic organic chemicals*

 At 3:45 am at a chemical site, an isobutane leak occurred on the flange of a temperature sensor, positioned at the apex of a small-diameter absorption column. A fire sparked by the lightning bolt broke out. The cone formed reached a length of several metres. The plant was shut down and the Internal Response Plan (POI) was activated. Despite considerably cooling the affected zone (1,500 m³/hour of water), the fire continued to be fuelled for another five and a half hours by the pressurised gas; it was eventually extinguished at 9:45 am. Column depressurisation was completed at 3:40 am and the emergency notification was lifted at 2:50. Activation of the response plan enabled eliminating the explosion risk for the overheated capacitances containing gas. The accessory equipment was not damaged, and the incident resulted in no victims or environmental damage.



ARIA 10169 - 11/06/1997 - 93 - BOBIGNY

38.31 - Dismantling of discarded material

In a facility engaged in recovering recyclable metal material, a fire broke out on a 20-m³ heap of steel turnings and filings. Welding activities at the time of gusty wind conditions would have caused this loss. Since the accident occurred during stormy weather and in the presence of extremely violent lightning flashes, the site operator has planned for the possibility of a lightning strike (a phenomenon deemed to be quite rare). The inflammation of such normally-incombustible waste is perhaps linked to the presence of soluble oil traces. Since no flammable material had been stored nearby, the fire was quickly contained by fire-fighters; however, a tourist coach parked in the vicinity was destroyed.

 **ARIA 11239 - 07/06/1997 - 78 - LA CELLE-SAINT-CLOUD**

 *49.20 - Rail freight transport*

 Lightning hit a voltage regulation station housing 19 condensers, each of which was containing 5 litres of PCB. Neighbouring residents heard an explosion, perceived smoke and alerted the local fire department. A strong odour could be noticed at the site, 5 condensers were deformed and 2 other ripped apart. Pieces of porcelain and mica were projected outside of the station enclosure, 10 litres of PCB spilled onto the slab flooring of the station, which had been covered in order to limit any dispersion of the pollution. The condensers were emptied and soil analyses undertaken. All structural components (whether earthen or concrete) with a PCB content in excess of 50 ppm were excavated, placed into barrels and removed from the site. The removal of elements containing between 10 and 50 ppm of PCB was then performed as part of a follow-up step.



ARIA 11262 - 01/01/1988 - 84 - L'ISLE-SUR-LA-SORGUE

20.51 - *Manufacturing of explosive products*

Within a chemical plant during a thunderstorm, plant personnel started up a nitration process following a power outage. A nearby lightning strike and a fireball could be observed; flames tens of cm high were visible on the lid of the nitration device. The fire was extinguished in 10 sec by drainage of the nitration line (automatic blow-down). The lightning did not fall onto the adjacent lightning rod but instead on the roof of the reactor building, thereby deteriorating the heat insulation and cables located adjacent to the device. Inspections indicated the compliance of the electrical installation. The incident was caused by an indirect effect of the lightning. A lightning risk evaluation was commissioned. The exact date of the accident remains unknown.

  **ARIA 11562 - 04/08/1997 - 31 - TOULOUSE**

20.15 - *Production of nitrogenous compounds and fertilisers*

 In a fertiliser plant, an ammonia synthesis unit stopped following the malfunction of an alternator (due to a thunderstorm). The safety features were operating normally, yet the synthesis gas (N₂ / H₂) emitted into the atmosphere ignited in the chimney (sparked by lightning?). Alerted by the noise and after noticing the flames raging for 15 min, neighbours contacted the fire department. During this time, the facility operator cut the natural gas intake that supplied the unit and secured the installations. Fire-fighter presence was not required at the site. An investigation was undertaken to identify the causes of alternator malfunction.

  **ARIA 12150 - 11/06/1997 - 49 - CHOLET**

93.19 - *Other sports-related activities*

 A PCB transformer exploded during a thunderstorm. An subcontractor removed the transformer and excavated the polluted soils.





  **ARIA 12220 - 26/08/1972 - 44 - DONGES**

50.20 - *Maritime and coastal freight transport*

 Lightning caused the explosion on an oil tanker during ballasting manoeuvres after unloading a crude oil shipment. The port was closed to all navigation. A pollution spill covered a 15-kilometre stretch upstream and downstream. A second explosion also occurred destroying the remaining dock facilities. Two operators, the lorry driver and 3 sailors were all killed. The fire assault continued into the next day and extended until September 2, 1972 in cooling the sheet metal. The pollution was neutralised with 38,800 litres of *Cirexit* and 96 tonnes of water-repellent *Nautex*, while the banks were cleaned using 2,300 litres of *Polycien*. On the boat, the 3,100 tonnes of product remaining had to be pumped by tanker trucks. A 590-m breakwater had been installed, yet proved ineffectual due to the tidal currents.

ARIA 12937 - 27/05/1998 - 07 - VIVIERS

01.50 - *Combined farming and cattle breeding activities*

A fire started by lightning devastated a farm.

 **ARIA 12948 - 27/05/1998 - 30 - NIMES**

46.69 - *Wholesale of other machinery and equipment*

 A fire erupted around 6:45 pm in a 4,200-m², non-compartmentalised electrical equipment warehouse that had not been fitted with smoke vents. The five employees still on the premises, unable to see through the heavy smoke, had to crawl out to safety. A torrential downpour then dissipated the irritating smoke. Fire-fighters had to wear a respiratory apparatus to provide assistance. Considerable resources were mobilised in order to contain this outbreak.

The fire was able to penetrate the palletised storage areas by means of a succession of intense flames. The heat flow was responsible for burning some of the softwoods several metres from the building facade even though the trees were soaked by the rain. The emergency intervention lasted 3 and a half hours, and one fire-fighter was slightly intoxicated by fumes. The damage amounted to 13 million francs for the building, which needed to be rebuilt, and 17 million francs for the lost merchandise. This disaster would have been caused by lightning (362 local impacts over a 12-hour period).

 **ARIA 14352 - 14/11/1998 - 45 - BONNEE**

47.11 - *Non-specialised retail outlet serving primarily as a food store*

 A fire destroyed a 2,000-m² supermarket at a peak shopping time. The smoke intoxicated some fifteen people. As a result of the explosion risks due to the presence of 2 propane tanks, residents in nearby homes were evacuated and traffic was detoured. Lightning was the cause of this incident.





ARIA 14741 - 08/07/1970 - 76 - LE HAVRE

YY.YY - *Unspecified activity*

Lightning sparked a fire on a 80,000-tonne oil tank. Fire-fighters had to isolate the tank.

ARIA 14941 - 13/05/1986 - 32 - MARCIAC

31.09 - *Manufacturing of other furniture*

A fire started by lightning destroyed a furniture factory.

ARIA 15215 - 14/08/1983 - 13 - CHATEAUNEUF-LES-MARTIGUES

19.20 - *Oil/petroleum refining*

Struck by lightning, a tank with a floating roof caught fire at a refinery site.

ARIA 15238 - 01/08/1986 - 87 - SAILLAT-SUR-VIENNE

17.12 - Paper and cardboard production

A fire sparked by lightning destroyed 3,000 tonnes of recycled paper within a paper warehouse.

ARIA 15689 - 25/06/1999 - 17 - LA ROCHELLE

16.10 - Wood sawing and planing operations

At a sawmill, a lightning-induced fire broke out in a sawdust silo and spread to the sawing / planing building via the sawdust removal ducts. The metal frame building, made of reinforced laminated timber and wood cladding, was destroyed. The remainder of the business, notably the wood treatment installation, did not sustain any damage. Six employees had to be made redundant. The sawmill had not implemented any protection measures against lightning, in disrespect of the conditions stipulated in its business operations permit.

ARIA 15749 - 01/07/1987 - 38 - LE PONT-DE-CLAIX

20.14 - Production of other basic organic chemicals

In a chemical plant producing chlorine, an electrolysis room had to shut down operations subsequent to a micro electrical power outage during a thunderstorm. An inappropriate manipulation caused a rise of pressurised gaseous chlorine into an unpressurised column located upstream of a compressor that was still running. The column head was lifted and 6 kg of chlorine were released into the atmosphere.

ARIA 15833 - 20/08/2002 - 39 - ARBOIS

20.30 - Production of paints, varnishes, inks and mastics

A fire broke out at night in a 50-m² storage building located inside a varnish plant whose installations were shut down. This space, which was physically removed from the other onsite installations, housed 5 tonnes of nitrocellulose in combinations of 20-kg cardboard boxes / sealed bags or 200-litre barrels / sealed bags. The fire destroyed the stock and damaged the building. The heat flow was responsible for destroying a medium-voltage electrical line in alignment with the storage area and damaged the separating fence. The extinction water flowed into a creek, yet no traces of soot could be detected. Given the inactive state of the storage room along with the evidence of lightning having struck the electrical line, the hypothesis of a lightning bolt was preferred. One individual was slightly hurt. The site operator was requested afterwards to establish a report. The operating loss related to the disappearance of the nitrocellulose inventory was valued at 15,000 euros.

ARIA 15849 - 13/07/1999 - 69 - BIBOST

01.50 - Combined farming and cattle breeding activities

Lightning would have most likely caused the outbreak of fire within the outbuildings of a farm; the blaze went on to engulf 500 m². No victims were reported. Fire-fighters quickly controlled the blaze.

ARIA 15934 - 27/06/1999 - 43 - SAUGUES

01.46 - Pig farming

In a pig house during passage of a thunderstorm, an electrical outage caused the ventilation to stop and a malfunction in the building's automatic airlock opening: 234 pigs suffocated to death.

ARIA 16089 - 06/07/1999 - 69 - GENAS

47.3 - Retail sales of fuels at a specialised outlet

Lightning struck a petrol filling station. The computer network controlling pump operations was damaged and then restored the next day.

ARIA 16283 - 06/08/1985 - 59 - BOURBOURG

20.14 - Production of other basic organic chemicals

An explosion due to lightning occurred on 3 tanks each containing several hundred hectolitres of sugar beet alcohol and burned the warehouse.

ARIA 16412 - 25/09/1999 - 42 - SAINT-JULIEN-D'ODDES

01.50 - Combined farming and breeding activities

Lightning sparked a fire on a farm.

ARIA 17923 - 10/06/2000 - 68 - SAINT-AMARIN

13.20 - Weaving

A fire broke out on the roof of the production building of a textile factory during a violent thunderstorm. The foreman and crew working onsite quickly notified emergency services. No one was injured, around ten looms and 8 m² of roofing were damaged; factory production was interrupted for 3 days. Lightning could have been at the origin of this incident.

ARIA 18325 - 24/07/2000 - 10 - ARCIS-SUR-AUBE

10.81 - Sugar production

In a distillery, a 5,000-m³ tank containing 1,000 m³ of ethanol at 96% concentration exploded when lightning struck and then ignited. The raised roof fell into the reservoir, which remained intact. However, the tank foot valve cracked upon impact. An emulsifier delivered 2 hours later enabled preventing the fire from spreading to the 1,000-m² retention basin. The blaze was extinguished in 3 hours and the fire-fighters for over 5 hours cooled 3 adjacent 2,500

m³-tanks exposed to the intense heat. Their structural condition would be controlled prior to resuming facility operations. During the emergency response, 23,000 litres of emulsifiers stored onsite and a total of 7,000 m³ of water (including cooling water) were used. An Internal Response Plan drill conducted 2 months earlier and based on a comparable scenario involving one of these tanks served to facilitate the actual intervention. The loss was valued at 30 million francs (including 2.5 million of alcohol destroyed and 3 million of emulsifier). The extinction water (1,500 m³) collected in the retention basins would be diluted in a lagoon. An outside organisation was called

to verify the electrical installations of the storage zone. Both the flame arrestors on the vents and the breathing valves on the tanks, which had been recommended 18 months prior at the time of a lightning risk evaluation study, had not been installed. The operator was issued a formal warning to install these devices within one month. Groundwater quality was monitored on a daily basis for 7 days, then weekly for another 3 weeks: no groundwater impact was to be found.

ARIA 18331 - 24/07/2000 - 24 - EXCIDEUIL

16.23 - *Production of structural frames and other joinery elements*
Lightning caused a fire within a woodworking/furniture-making shop.

  □ □ □ □ □ **ARIA 18563 - 03/06/2000 - 73 - SAINT-MARCEL**

20.13 - *Production of other basic inorganic chemicals*
On a site that produces sodium and chlorine, several chlorine discharges happened during the power build-up in a new electrolysis room. During the thunderstorm activity on June 3, the activation of compressors for several-hour stretches caused the shutdown of both the overriding power rectifiers and the electrolysis rooms. 20- and 18-kg bursts of Cl₂ during two of these shutdowns were perceived in a neighbouring village (through odours). These malfunctions resulted from continuing to run (for some unexplained reason) a power rectifier during the period of compressor shutdown. The lack of procedural compliance and design flaws were recorded: compressors with an electrical starter whose frequency-based control serves to increase sensitivity to micro outages and voltage variations, valves open in the safe position, risk of losing a liquid trap. The trap was eliminated, a power inverter installed, automated mechanisms modified and the compressors regulated based on speed, etc.

 □ □ □ □ □ **ARIA 19539 - 04/07/2000 - 76 - GRAND-COURONNE**

52.29 - *Other ancillary transport services*
A 5-second electrical outage was caused by a lightning strike on a 225-kV power supply cable. This event damaged one of the machines, which had to be shut down for two and a half days. The loss was estimated at between 4 and 5 million francs.

ARIA 19716 - 19/08/2000 - 37 - AVOINE

24.46 - *Production and transformation of nuclear materials*
The system used to relay monitoring information on a nuclear site was rendered inoperable by lightning during the night-time shift. Some units, such as the treatment of irradiated materials, were not beneficiaries, as activities that are executed with a permanent human presence, as opposed to the majority of other nuclear installations. Outside of working hours, relevant information such as alarm triggers are relayed to the site's main supervisory station. On a Saturday towards the beginning of the evening, lightning knocked out the transmission system for around ten hours. Consequently, the line of defence, which relies upon human intervention in case of an operating anomaly, disappeared. Site security was merely dependent on the technical and operational devices in place, yet the exhaustiveness and efficiency of such devices were never completely assured. Once the information relay was discovered to be inoperable, the on-call personnel set up a human monitoring routine until the defective system could be restored and recalibrated. Analogous failures were identified on other site retransmission systems. Given the momentary degradation in the level of security for the particular installations, this incident was classified as a Level 1 on the INES (International Nuclear Event Scale).

ARIA 20354 - 25/01/2001 - 79 - NIORT

38.31 - *Dismantling of discarded material*
A fire broke out at night on vehicle bodies within a company specialised in recovering and recycling metal waste. Major emergency resources had to be deployed for the 4 hours it took to contain the blaze. The operator himself used a grapple to remove the vehicles stored on a 300-m² site up to 5 m high. The amount of property damage remained limited. A violent thunderstorm would have triggered the event.

ARIA 20662 - 04/07/2001 - 21 - TERNANT

01.50 - *Combined farming and breeding activities*
A fire due to lightning broke out on a farm. The owners began dousing the blaze with extinguishers before fire-fighters arrived on the scene.

  □ □ □ □ □ **ARIA 20835 - 28/07/2001 - 38 - CROLLES**

26.11 - *Manufacturing of electronic components*
In a microelectronics plant, a fire broke out inside a workshop (circuit etching), originating at one of the gas treatment devices fitted onto the production machines. This device is responsible for incinerating process gases (with high C₂F₆ content) through the use of methane, as well as for water cooling before inflow onto the site's general gas treatment installation (including washers). In equipping each of the 19 machines, the device features an array of safety controls: water flow rate and pressure to ensure site security, incineration temperature, methane and fluorine detection individually controlled by methane supply cut-off, water level. The likely chronology is as follows: violent thunderstorms caused the destruction of water supply pump controls as well as the network pressure drops. The alarms that sounded did not shut down the gas abatement device, as system design indicates. On-call personnel were mobilised. An alarm on the CH₄ detection sounded without triggering closure of the supply valve. The personnel were then evacuated and the Internal Response Plan implemented. 3 sprinklers heads were activated above a single machine. The fire department was called. Reliance on the emergency water network and after a general gas supply shutoff, the fire was brought under control. Effluents were drained in the direction of the site treatment plant. The emergency water supply procedure was scheduled for review.

ARIA 20844 - 29/07/2001 - 17 - ARTHENAC

11.01 - *Production of distilled alcoholic beverages*
In just one hour, a fire destroyed a 2-storey, 800-m² building housing a distillery containing 50 hl of pure alcohol. The emergency intervention of some forty fire-fighters using major quantities of emulsifier still did not enable saving the production line, the storage of bottles ready for shipping or the distillery offices. A thunderstorm passing 90 minutes earlier would have caused an electrical overvoltage with power outage; even though power was restored when the operator activated the circuit-breaker, a smouldering fire was still created that eventually lead to the full-scale blaze.

ARIA 20960 - 17/08/2001 - 54 - NANCY

46.69 - Wholesale of other machinery and equipment

During a thunderstorm (direct lightning strike? or overvoltage causing an electrical short circuit?), a fire broke out in the warehouse of a wholesaler of rubber parts. 20 employees had to be made redundant.

ARIA 21493 - 27/07/2001 - 17 - PUYRAVAULT

01.50 - Combined farming and breeding activities

Lightning caused the onset of fire in a wheat silo. Fire-fighters controlled the blaze and, throughout most of the night, emptied the 400 tonnes of wheat from the affected cell.

ARIA 22776 - 30/07/2002 - 26 - HOSTUN

01.47 - Poultry farming

Some 4,400 chickens were charred to death in the fire that engulfed a 400-m² hen house. Lightning might be the cause of this fire given that several major thunderstorms passed through during the night.

ARIA 22796 - 30/07/2002 - 79 - DOUX

49.41 - Road freight transport

A fire broke out on a stock of pallets and cardboard packaging within a 12,000-m² industrial building (which was 75% destroyed). Six of the 57 employees had to be laid off. The cause could be attributed to lightning.

 **ARIA 23150 - 03/09/2002 - 2B - BRANDO**

37.00 - Wastewater collection and treatment

 On a wastewater network, a discharge pump was damaged by lightning during a thunderstorm. The buffer tank used to store wastewater reached its maximum level, and then the effluents to be treated spilled into the river that empties into the Mediterranean Sea. The remote monitoring system in place did not operate properly due to a malfunction in the telephone network that occurred the very same day. The nauseating odour stirred reaction among the neighbours, who alerted the Mayor's Office. As a precautionary measure, swimming in the sea was prohibited while awaiting the results of seawater analyses performed in order to detect any eventual trace of pollution.

 **ARIA 23626 - 05/12/2002 - 64 - BAYONNE**

35.22 - Distribution of gaseous fuels by pipeline

 Around 4 am, a fire sparked by lightning broke out first on the electrical catenary cables, and then spread to a pressurised gas pipeline located near the railroad tracks. The pipe burst and the gas ignited to form an immense flare. Traffic on both the high-speed and regional trains was interrupted. The fire was contained by 10:15 am and traffic was authorised at slower speeds as of 11:00 am.

 **ARIA 24526 - 05/05/2003 - 27 - CARSIX**

47.52 - Retail sales of hardware items, paints and glass at a specialised outlet

 Around midnight, a fire broke out in a 3,000-m² home improvement store. The blaze spread to the warehouse that was storing 2,000 litres of alcohol, bottles of inflammable gases and a wide array of chemical products. Traffic on the national highway had to be detoured. The emergency response conditions proved rather complicated for the 80 fire-fighters called to the scene. Given the quantity of inflammable substances, fire-fighters were required to cut through the metal shutters protecting the store entrances in order to install a sufficient number of nozzles. A sizeable volume of extinction water spilled into a retention basin, which in turn overflowed. The polluted water then spread into the natural environment before penetrating the joint municipal water supply catchment. The population was requested not to drink tap water. Two fire-fighters were slightly hurt during the response. The sales area was destroyed, but the inside warehouse could be salvaged. The monetary amount of damage was appraised at the value of the stock (4 million euros), and 65 employees were made redundant. Lightning could have caused this loss.

ARIA 24825 - 15/06/2003 - 01 - SAINT-JUST

22.29 - Manufacturing of other plastic articles

A fire destroyed a 500-m² building at a plastics transformation plant. Lightning struck the building following a weather warning that predicted violent thunderstorms to hit the region, accompanied by major electrical activity. The fire was extinguished after a 2-hour battle, and 11 employees had to be laid off.

ARIA 25147 - 02/06/2003 - 69 - GENAY

20.16 - Production of basic plastic materials

Around 5:45 pm, a thunderstorm caused both immediate and deferred damage inside a plastics plant. Operators reported a momentary loss of electrical power, followed by down telephone lines running through the switchboard, along with the destruction of 3 parking surveillance cameras. Later on about 4:45 am, an alarm indicated a lack of water serving the workshops at 1.5 bar. A single reactor at the time was performing polymerisation; the system shut down the monomer and catalyst injections, and the temperature that was stable at first then started to slowly decrease. A still that had been operating in a workshop on a cooling tower circuit was able to finish its distillation process. All the devices were thus turned off. According to analysis, the lack of water was caused by shutting down the water tower supply pumps during the thunderstorm; the system to alert the operating company of a low water level malfunctioned due to a lack of electrical power and the fact that the industrial zone consumed the total volume available from the water tower between 5:45 pm and 4:45 am. Restoring the zone's water network occurred gradually and water pressure was reset around 9 am. The incident, which exerted no impact on the environment, did however place the company in a position of highly-compromised safety. The inspection required the operator to conduct a safety analysis of all facility operations. This analysis and the associated conditions were then expected to be integrated into the study of site hazards.

  **ARIA 25440 - 28/08/2003 - 42 - SAINT-VINCENT-DE-BOISSET**

 *13.30 - Textile dry filling*
 An 800-m² building containing fabric samples and rolls was destroyed by an accidental fire, which broke out around noon within a former farm building adjacent to a large manor house where two fabric retailers set up their businesses.
 The staff present in the offices noted the lightning, with two explosions having been heard before the outbreak of fire. The thick column of black smoke was visible up to several kilometres away. The adjacent road was partially cut during the period of emergency intervention. The gas supply line had to be shut down by the gas response crews. The building was sprayed for more than 2 hours using several nozzles. Despite these efforts, the fire quickly spread via the roof, fanned by the inflammable nature of the products stored inside the building. The fire was finally contained around 2:30 pm. Fire-fighters succeeded in saving the offices and another building that housed an embroidery workshop, but 2/3 of the main building and nearly all of the stock were destroyed. Surveillance continued until the following day in order to prevent any new ignition. The property damage was severe, but salvaging the offices was expected to enable both companies to stay in business without having to lay off employees.

ARIA 25463 - 30/08/2003 - 29 - PLOUIGNEAU

01.46 - Pig farming
 8,000 pigs were charred to death in a fire at a 15,000-m² pig house and another 3,000 had to be slaughtered. Lightning was implicated as the cause. For the next two days, farm employees and many others showed up spontaneously to assist the farmer in removing and loading onto trucks the 500 tonnes of charred animal for transport to the knackery. Given the presence of asbestos and risk of building collapse, the 200 people mobilised onsite were equipped with protective gear.

ARIA 25617 - 22/09/2003 - 30 - SAINT-GILLES

20.14 - Production of other basic organic chemicals
 Within a ethylic alcohol (fermentation) production unit, lightning struck onto a 1,000-m³ alcohol storage tank that was nearly empty; the tank was ripped apart and ignited. Fire-fighters and unit personnel were able to contain the outbreak. The alcohol and extinction foam were confined to the retention basin. A surveillance operation remained in effect in order to avoid any repeat ignition of the alcohol. Once the surveillance had been completed, the emergency response centre retracted the Prevention Plan (PPI).

  **ARIA 26503 - 26/10/1967 - UNKNOWN -**

19.20 - Oil/petroleum refining
 A fire broke out at a refinery within a hydro-treatment unit. The fire was caused by the bursting of a furnace tube during a poorly-timed load shedding operation. The event occurred after a thunderstorm (¾ hours later), which in particular led to voltage drops at the level of this unit and was followed by two outages. The unit was starting back up when the accident took place. The thunderstorm also produced other effects throughout the site: disturbances to the plant supply network, utility shutdown, near flooding of the electrical substation. No one was injured due to the accident.

ARIA 26535 - 16/06/1986 - UNKNOWN -

19.20 - Oil/petroleum refining
 At a refinery during a thunderstorm, lightning fell on a vacuum distillation unit, at the level of the unit's vents and the gasoline stabilisation vents. The investigation performed indicated that a leak had already existed around the valves. The steam injection step attempted near the vents in order to extinguish the flame had not worked since the line was clogged.

ARIA 26577 - 26/02/1969 - UNKNOWN -

19.20 - Oil/petroleum refining
 At a refinery, an incident occurred on a predistillation column (diameter: 4.5 m; height: 35 m) within an atmospheric distillation unit. During a violent thunderstorm, a valve opened and spewed crude oil to the exterior, with fallout covering an area of approx. 800 m². Given the ambient temperature (0°C), the sewer network was obstructed by hailstones. The pressure inside the tower had been raised to 9 bar, yet neither the level sensor nor the corresponding alarm was working properly. The cause of the accident could be attributed to lightning. No other consequences were mentioned in the accident report.

  **ARIA 26579 - 26/05/1977 - UNKNOWN -**

19.20 - Oil/petroleum refining
 An explosion took place on the furnace of a refinery's atmospheric distillation unit. A violent thunderstorm was responsible for generating various incidents in this unit, as a result of power outages. The furnace was thus turned off and then back on about 4 hours later. Approximately 45 min after start-up, the boilers were activated due to the lack of fuel and experienced a pressure loss on the steam network. An air pressure drop followed at the level of the system instrumentation, with the collapse of the gas fuel network, along with a pressure drop at the level of the pilots, including those of the specific furnace which were extinguished. The explosion actually happened inside the furnace by means of self-ignition of the accumulated gases. The origin of this accident stems from the poor meteorological conditions: an unfortunate lightning/thunderstorm combination.

  **ARIA 27506 - 27/06/2004 - 70 - LOEUILLEY**

20.30 - Production of paints, varnishes, inks and mastics
 In a paint and varnish plant, a fire broke out in a room containing 1.7 tonnes of nitrocellulose and 20 tonnes inert products. The single-storey building, with a 250-m² footprint and 10 m high, featured wood frame construction with a tiled roof and burned immediately. Local fire-fighters, assisted by plant personnel, offered initial rescue and relief services. The adjoining building containing solvent-based resins was protected from the flames by fire-fighters, with the proximity of the Vingeanne River providing sufficient water supply resources to extinguish the fire of the plant building and to cool the wall of the abutting building. The adjacent road was closed to traffic in order to avoid the consequences from smoke should the road become engulfed. Since ignition of the nitrocellulose was immediate, the smoke rose vertically and then dispersed into the atmosphere. Once the fire had been extinguished, the burnt building continued to be monitored. On June 11, just a few weeks earlier, a fire had already occurred at the plant when lightning fell on the roof. A repeat fire on this structural frame is entirely possible; a legal expert was appointed. Following this accident, it was decided to stop storing nitrocellulose products prior to building reconstruction. The daily volume requirements were thus to be stored at a neighbouring facility. Moreover, this operation was slated for an in-depth lightning assessment. The authorities recorded the facts of this case, and the operator agreed to commission this study and was obligated to submit an accident report as well.

ARIA 27885 - 07/09/2004 - 31 - SAINT-ALBAN

YY.YY - Unspecified activity

A lightning-induced fire broke out on an external storage of paper bundles. The blaze then spread to a 150-m² industrial building.

ARIA 28591 - 21/07/2004 - 81 - SAINT-SULPICE

18.12 - Other printing shop (labour)

During a thunderstorm, lightning severely damaged the automated atmospheric discharge scrubber at a printing shop. A lightning bolt entered the workshops, yet without any generating other consequences. A prefectural order was signed the next day, following consultation with the Departmental Hygiene Council (CDH), to impose halting production until the completion of repair work. The operator used this occasion to reinforce lightning protection measures of all shop installations.

ARIA 28786 - 10/10/2004 - 31 - TOULOUSE

46.72 - Wholesale of ores and metals

A fire broke out on a Sunday morning inside a booth in the reception area of a lead foundry; the blaze started at the surface of a 3,000-ton mound of batteries intended to be recycled. Since the company was not open for business on weekends, the guardian of the neighbouring company actually notified the fire department. With no manager onsite, the rescue teams were required to force open the site (which naturally triggered the anti-intrusion alarm, which in turn alerted the operator) and drill through first the upper siding in back of the building, then the partition separating the crushing and receiving zones. Fire-fighters contained the fire, which remained small in magnitude, and did not detect any release of chlorine vapours or any abnormal pH value in the extinction water stored within the site's sedimentation basin. The batteries were controlled (for foreign bodies, water quantities) upon reception and then broken in order to drain them of their acid and unload their contents. According to the operator, the fire only broke out on the surface and would not have been generated by the batteries themselves, but rather by a lightning bolt strike at night. The batteries had been stored for several days prior to the fire. Notified by the operator on the day of the accident, the Hazardous Installations inspector made a site visit on the morning of the next day and requested that the operator submit a detailed report of the accident accompanied by a set of anticipated preventive and corrective actions, the most recent "lightning" study and an evaluation by an independent laboratory of the impact from smoke released into the atmosphere at the time of the incident. Regional authorities with the DRIRE Agency made the following observations: along the site enclosure, equipment lying on the ground blocked the beam of the anti-intrusion cells; battery collectors stored outside the building could have impeded the smooth arrival of rescue teams into the premises; the mound of batteries exceeded in some spots the reception building wall height and were leaning on the building siding, making it weaker; and the retention basin volume associated with the H₂SO₄ tank was insufficient. The operator installed flame and smoke detectors in the reception area that may be activated outside of business hours and relayed to an on-call staff member or a security company.

ARIA 29439 - 10/09/2004 - 17 - LE FOUILLOUX

02.20 - Forestry operations

At night, lightning ignited a 50-m³ stock of wood logs at a woodcutting site. The flames spread to a lorry parked nearby. A driver notified the emergency services.

      **ARIA 30130 - 14/06/2005 - 38 - SERPAIZE**

      52.10 - Warehousing and storage

      During the pumping of a batch of naphtha, a hydrocarbon leak occurred inside the warehouse enclosure on a pipe branch conveying the product to the refinery, located a few kilometres away. This phenomenon was the consequence of a pressure jolt inside the 12" pipe, which caused the safety valve to open along with the partial destruction of a flange joint upstream of the valve. This pressure jolt was related to the disturbance of pipeline operations experienced

      by site personnel subsequent to a violent thunderstorm (lightning) at the beginning of the evening in the region around Chalon-sur-Saône. According to the operator, no significant impact on the environment could be detected, as the level of coordination between the pipeline operator and the warehouse manager was deemed to be effective and the arrival of response teams at the site rapid. The product that had spread was recovered, but a strong odour still created nuisances for the neighbourhood.

      **ARIA 30199 - 24/06/2005 - 57 - SAINT-AVOLD**

      20.16 - Production of basic plastic materials

      An electrical network supply cut-off affected a basic plastics plant around 7:50 pm on a petrochemical platform. The interruption, which lasted a long time for the batch in progress (over 2 min), triggered protective measures for the plant workshops. The Internal Response Plan was activated and the units shut down operations at 8:15. Under these

      circumstances, the workshops sent the current batches to the site's two flares. The combustion of effluents generated heavy smoke that dispersed into the atmosphere under particularly stormy weather conditions. The backup diesel generating sets of the polystyrene workshop that provide a power relay in cases such as this did not engage fast enough to cool the reactors on lines 1 and 2 during the workshop shutdown phase. A reaction acceleration occurred, and the rupture discs of two line 1 reactors and a third on line 2 burst, causing the atmospheric release of 8 tonnes of styrene. Since the weather conditions were unfavourable (i.e. weak wind), the cloud indisposed three residents from the l'Hôpital locality nearby and another two individuals living in Lauterbach (Germany), including a child who had to be hospitalised for 4 days. The sensors positioned near the petrochemical platform recorded, between 7 and 9 pm, high concentrations of dust, SO₂ (585 µg/m³ in a 15-minute span) and orthoxylene (535 µg/m³ in 15 min), most likely corresponding to styrene (i.e. a close chemical structure). The high SO₂ contents may be due not only to the workshops operating on the site, but also to the coking plant. It turns out that a condensate drip pot self-ignited around 4 pm on the coking plant's gas pipeline feeding the neighbouring power plant. The emergency teams had the situation under control very quickly. The electrical supply interruption caused production losses on the order of 0.5 to 2 million euros. In application of the emergency decree signed July 6, 2005, the operator: established a report on the reasons why the electric generating sets malfunctioned, improved the start-up sequence, and more fully developed both the hazard study and the Response Plan. These actions enabled reopening the workshop. The Hazardous Installations Inspectorate proposed a complementary order that extends to the entire chemical platform a control over backup generating set operations and the completion of a study to lay out the points of potential release in the case of an incident, along with the type and quantity of products potentially discharged.

 **ARIA 30325 - 18/07/2005 - 59 - DENAIN**
 20.11 - *Production of industrial gases*
 A fire broke out on a 9-tonne reservoir of ethylene within an industrial gas production plant. Fire-fighters contained the blaze with 2 nozzles and by use of the nitrogen inerting system. Ignition would have been caused by a static electricity overload in conjunction with stormy weather conditions.



ARIA 30838 - 23/07/2005 - 54 - BLENOD-LES-TOUL

YY.YY - *Unspecified activity*

During a thunderstorm, lightning fell around 8 pm on a warehouse containing school furniture. The fire broke out on the equipment and the furniture ready to be assembled and delivered on the eve of the new school year. Even though the property damage was quite considerable, fire-fighters were able to avoid spreading to an adjacent warehouse.

ARIA 30892 - 09/09/2005 - 13 - CHATEAUNEUF-LES-MARTIGUES

19.20 - *Oil/petroleum refining*

A refinery had its electrical supply cut during a violent thunderstorm. The units activated safety measures when the boilers stopped running.

ARIA 30894 - 10/09/2005 - 13 - BERRE-L'ETANG

20.14 - *Production of other basic organic chemicals*

A violent thunderstorm caused several incidents at an industrial site. The general electricity distribution station was struck by lightning that resulted in many electrical disturbances in particular the loss of equipment, the protection of several installations and, consequently, flare releases for a few hours. Just after sundown, two fires broke out, one on a pump packing the other on a heat-insulated line without any consequence whatsoever being recorded. Moreover, the site's treatment plants had to face a sizeable quantity of water inflow, necessitating the installation of floating dams on the nearby pond opposite the plant's outfalls.

 **ARIA 31773 - 18/05/2006 - 84 - SORGUES**
 20.16 - *Production of basic plastic materials*
 Ignition occurred on a reactor containing 900 kg of trimethylpropane on the first floor of one of the chemical plant's buildings. The site was evacuated. Power was cut off and the premises ventilated following the reactor temperature drop. An employee, who sustained second-degree burns to the face and first-degree burns to the arms, was hospitalised and another entered a state of shock. According to company chemists, the accident was due to lightning.



 **ARIA 32016 - 24/07/2006 - 80 - AMIENS**

37.00 - *Wastewater collection and treatment*

 A discharge of black wastewater polluted the Selle River and caused fatalities among the fish population. An alert was sounded during the morning of the following day. The pollution occurred subsequent to the deficiency of a pumping station at the city's purification plant, leading to the direct spill of wastewater (discharged from a dry cleaners) into the natural environment via the overflow chamber. The general station circuit-breaker, turned off at the time, was responsible for the accident. Once it had been turned back, normal operations could be restored. This malfunction would have been due either to vandalism (signs of forced entry into the electrical cabinet) or to the intense heat. Moreover, network remote monitoring was running in a degraded mode: a thunderstorm a few days prior had destroyed the remote transmission equipment at the pumping station, with information on system flaws not being relayed to the monitoring station. These safety devices could not be replaced due to an inventory shortage in the maintenance workshop, and many equipment replacements had to be carried out since the beginning of the month due to the frequent occurrence of thunderstorms.



 **ARIA 32075 - 19/07/2006 - 16 - COGNAC**

46.34 - *Beverage wholesaling*

 A lightning-induced fire broke out around 8 pm on the roof of a wine cellar housing 5,000 hl of liqueur. The flames spread over 15 m² and threatened other cellars. Emergency teams contained the blaze using 3 nozzles, one of which had to be sprayed from a ladder. The teams set up lighting fixtures, gutted the roof over a 40 m² area, used a thermal camera to aid extinction and monitored the site for the rest of the night. A fire-fighter got hurt during the intervention.



 **ARIA 33011 - 26/05/2007 - 43 - LES VILLETES**

43.11 - *Demolition work*

 In a public works firm, lightning struck a garage and damaged a gas-fired air heater located underneath the roof. The gas supply pipe ignited and fire spread to a wood chipper. A driver notified authorities and an employee closed the supply valve. Fire-fighters arrived on the scene and contained the outbreak in an hour using three foam nozzles; as a preventive measure, the tyre storage was then cooled. No employee layoffs were required.



 **ARIA 33092 - 09/06/2007 - 02 - VERVINS**

46.21 - *Wholesale of cereals, unprocessed tobacco, crop seeds and livestock feed*

 Lightning hit an electrical transformer servicing a silo run by an agricultural cooperative, causing a 357-kg leak of PCB (polychlorobiphenyl). The product then spilled into the transformer retention tank, where it overflowed and spread into the sewer outlet located just a few metres away. The rescue teams proceeded by blocking the sewers and establishing a 100-m safety perimeter, which entailed evacuating 10 neighbours and 4 of the company's maintenance personnel. Five individuals working near the site of the incident, who had walked in the product (one of whom had direct contact on the forearm), were transported to the St Quentin Medical Centre for decontamination. Neighbours were allowed to return to their homes and stayed indoors. In order to avoid contamination via the storm drains, the pipe was to be cleaned by a specialised company.



 **ARIA 33120 - 06/06/2007 - 47 - LE PASSAGE**

 *10.91 - Production of farm animal feed*

 In a plant that produces farm animal feed, a fire broke out around 8:30 on an electrical transformer and spread to the building attic space and into the biofilter suction duct that measures 1.6 m in diameter by 100 m long, igniting the deposits of dust and animal fat remaining inside the duct. Plant personnel were evacuated. All suction operations were halted so as to avoid a "drawing" phenomenon and the valves at the level of the biological filter suction duct were closed to prevent the fire from propagating to other workshops. The emergency crews focused on three strategies: combating the fire, protecting the silos, and surveying inside the silos with the help of a thermal camera. They encountered difficulties in extinguishing the fire inside the duct yet ultimately contained the blaze around 12:30 am. They also put out the residual hot spots, monitored the site for the rest of the night and left the premises at 8:15 the following morning. The extinction water was channelled to the storage lagoon.

 Two fire-fighters were slightly injured and considerable property damage was reported at the level of the biofilter suction duct, cooker driving motors, the transformer room and two control cabinets for the cookers. The accident also gave rise to a loss of local flora in both the peat and heather media of the biofilter, causing its malfunction and hence olfactory nuisances, for which complaints were filed during the ensuing days. Besides the technical consequences valued at 841,400 euros, the operating losses were estimated at another 140,000 euros: 634 tonnes of category 1 and 2 material, plus 379 tonnes of blood that had to be destroyed. These materials were processed by specialised subcontractors.

The fire was due to a condenser that ignited, most likely subsequent to voltage variations induced by the heavy thunderstorms of the previous night. The operator created a new outdoor room for the transformer separate from the workshops, easier to access and set within a more appropriate thermal atmosphere. The operator also installed sectional valves on the suction pipe segments sensitive to devices directing the biofilter suction duct in order to prevent the fire from spreading to the main suction duct, thus avoiding additional damage to the set of environmental treatment tools. Heightened monitoring was also introduced for heating through conducting infrared-based thermographic measurements by a specialised company, in addition to the temperature measurements already performed in-house on the electrical equipment. Lastly, the operator increased the cleaning frequency on ducts used in the milling industry.

ARIA 33277 - 19/07/2007 - 42 - SOUTERNON

01.50 - Combined farming and breeding activities

A fire broke out around 8:20 pm in a farm building. Emergency personnel extinguished the blaze in 2 hours using 3 variable-flow nozzles and then removed the debris. An electrical meter struck by lightning was responsible for producing this incident.

ARIA 33544 - 05/07/2006 - 81 - MAZAMET

13.99 - Production of other textiles ("not classified elsewhere")

In a plant producing felt textiles for the automobile industry, a fire broke out at the level of the transformer room, which contains a 630 kVA transformation unit. The origin of the fire is correlated with the direct or indirect action of lightning on the site or in the vicinity during the day of July 5, 2006. The fire was fanned by the combustion of oil residues contained in the regulatory retention tank (i.e. a volume of less than 1 litre). Control of the dielectric quantity (without PCB) contained in the transformer compartment, undertaken by the subcontractor, indicates that this quantity matches the filling level. An examination of the transformer does not reveal any blisters present in the case of a direct lightning strike; furthermore, the absence of a leak on this transformer offers proof that the integrity of this unit has been preserved. The presence of smoke on the wall and traces in back of the transformer demonstrate that fire had occurred in the tank. This onset of fire could thus be explained by the creation of an electric arc at the level of the tank and the ignition of oil deposits (i.e. a potentially fouled tank). The plant's lightning study underscores that the transformer must be protected by lightning rods, which are indeed very present on the site's supply post, as per the study's set of recommendations. Their state of repair shows no underlying destruction. This study however must be updated every 5 years, and the last study dates back to July 7, 1998. The operator is thus requested to update this study. On the technical side, the lightning study recommends introducing other measurements on the following installations: interconnect the incinerator chimney and structures, remove the former dust cleaning installation, interconnect the dust recovery system with structural masses and the external lampposts with the electrical ground network of the building, equip the protective control and power circuits with a lightning arrester as well as the automatic sprinkler circuits, the suction and the hot air duct, the cooling electrical cabinet, the telephone lines and the secondary power transformer. This study also recommends installing temperature probes on both the cooling fan and charcoal filter box. The operator was required to submit to the Hazardous Installations Inspectorate within one month the verification report demonstrating that these protective measures have indeed been completed. Since it was scheduled that this site would soon be relocated to a neighbouring locality, the Hazardous Installations Inspectorate reminded the operator that all site operations still needed to comply with the general conditions set forth in the environmental code.

 **ARIA 33604 - 09/07/2007 - 59 - MARDYCK**

 *20.14 - Production of other basic organic chemicals*

 In a petrochemical plant, 60 tonnes of unordered ethylene were flared off between 11:15 am and 5:00 pm following the protection of the digester in the steam cracking unit as a result of a lightning strike. Work conducted on one of the plant's boilers did not allow removing the steam from the flaring operation; a cloud of smoke was visible up to several kilometres away.

 The digester converts, using nickel catalysis, hydrogen (H₂) and carbon monoxide (CO) into methane (CH₄) and water (H₂O) at a temperature in the range of 230°C. In this manner, the H₂ devoid of CO is able to convert acetylene into ethylene, which is not the case when polluted by CO. Ethylene, which respects a rather strict specification (5 ppm max of acetylene), is then transformed into polyethylene. On the day of the incident at 11:15 am, the lightning bolt necessitated applying safety precautions to the digester at a high safety temperature; the insufficient H₂ production allowed the acetylene to hydrogenate, resulting in a sizeable output of excess ethylene, which in turn had to be flared off due to the absence of a suitable onsite storage system. By noon, the unit was once again operating, but an underestimation of the time required for installation reloading led to excessive ethylene production and hence its transfer to be flared off until 5 pm.