

Appendix 2_foreign accidents

Request No.: ed_10930

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:

BARPI - 2, rue Antoine Charial 69462 LYON CEDEX 03 / E-mail: sei.barpi@industrie.gouv.fr

 **ARIA 1001 - 12/08/1989 - CHINA - QINGDAO**
46.71 - Wholesale of fuel and related products



 Lightning struck a tanker in an oil depot and triggered a fire that consumed over 40,000 tonnes of crude oil. A significant amount of resources were used to stop the fire including 100 fire engines and several helicopters. 19 people died and 74 (mostly fire-fighters) people were reported to have sustained injuries.

 **ARIA 1587 - 21/06/1990 - RUSSIA - KARKATEEVY**
46.71 - Wholesale of fuel and related products



 A fire, undoubtedly triggered by lightning, destroyed a 5,000 tonne oil tank. The fire, kindled by violent winds, spread to three other tanks that exploded. Nine hectares of the surrounding land was burnt. A train carrying 60 tonnes of carbon dioxide snow was urgently sent to the disaster area.

 **ARIA 3140 - 21/08/1991 - AUSTRALIA - MELBOURNE**
YY.YY - Unspecified activity



 Fire broke out in a storage site containing 47 tanks including 26 that contained liquid chemicals (benzene, phenol, MEK, acrylonitrile, methyl methacrylate, etc.). 27 tanks were either destroyed or seriously damaged. Toxic fumes (benzene, HCN, etc.) was released outside the site. Fire-fighting started 6 min after the outbreak of fire and continued until about 4.00 pm the following day. 450 m³ of AFFF fire-fighting foams were used. Thousands of people within a radius of 2 km were evacuated. Lightning may have triggered the accident. Losses resulting from stoppage of work were estimated at 40 M\$ (200 MF) and material damage at 11 M\$. People on site or in its vicinity were required to wear a breathing apparatus.

 **ARIA 5655 - 24/07/1994 - UNITED KINGDOM - PEMBROKE**
19.20 - Crude oil refining



 During a violent storm, two low-intensity explosions involving two homes took place in a crude oil refinery in the morning. Special teams were in place for rescue operations and put activity back on track in the morning after the fires were extinguished. At 1.30 pm, there was a violent explosion in the catalytic cracker section of the refinery. The noise was heard 15 km away. The impact uprooted an administrative building situated 200 m away from its foundations and a fireball was observed. 26 employees were hurt, 130 firemen were involved in rescue operations and three fire areas were maintained for 48 hours to ensure the safety of facilities. The 1st phase was linked to the rupture of a picking on a flare network capacity. An IT breakdown (lightning) during the re-start phase could have been the reason behind the main explosion. Losses were as high as 395 MF including 160 MF for internal material damage and 170 MF for operational losses.

ARIA 5729 - 02/08/1994 - GERMANY - CITY NOT SPECIFIED
01.46 - Pig farming
 A series of fires triggered by lightning resulted in the death of hundreds of pigs in several farms in Bavaria.

 **ARIA 6220 - 08/10/1994 - UNITED STATES - PORTLAND**
49.50 - Pipeline transport



 Lightning interrupted the power supply to IT equipment of the piping and control system of a pumping station with a crude oil pipeline. The computer issued faulty orders resulting in the closure of a main valve of a pipeline at 6 km from the sea. The increase in pressure caused the pipeline to rupture causing 340 m³ of crude oil to spill. A small portion of oil spill spread to the Corpus Christi Bay through the local water network. Several specialised companies were involved in hydrocarbon pumping operations (95 m³ recovered after one week) and cleaning the contaminated land.

 **ARIA 6541 - 30/06/1987 - UNITED STATES - CITY NOT SPECIFIED**
35.30 - Production and distribution of steam and conditioned air



 In an urban boiler room, lightning struck a natural gas boiler rupturing the valve at the gas inlet of the boiler. There was no explosion but a small fire outbreak that lasted till the line was isolated. The building was evacuated and the traffic stopped in the neighbouring roads.

 **ARIA 8183 - 24/10/1995 - INDONESIA - CILACAP**
19.20 - Crude oil refining



 Lightning struck the automatic gauging device of a 38,800 m³ fixed-roof tank being filled with kerosene at 43.5°C (temperature higher than the flash point). The poor equipotentiality of the device resulted in sparks that triggered a fire. The gaseous cloud over the tank exploded destroying the roof. The burning liquid spread the fire to six other tanks in the dike. The residents and staff members were evacuated. No victims were reported. Nearly 600 homes were damaged and some hundred water bodies were polluted. The fire was extinguished after three days. The damages are assessed at 560 MF.

 **ARIA 8390 - 22/08/1995 - ALBANIA - KUCOVE**
YY.YY - Unspecified activity



 Lightning struck a tank containing crude oil and caused a major fire. The following day, while the fire seemed under control, a second tank containing 1,000 tonnes of crude oil exploded. The accident resulted in the formation of dense black clouds that could be seen 25 km away. A safety was demarcated on the second day within a radius of 1 km.

Number of incidents recorded: 50

Three tanks are reported to have been destroyed and 1,650 tonnes of crude oil wasted. One person died and four people sustained injuries. The fire-fighters brought the fire under control in 36 hours.

ARIA 8466 - 05/06/1994 - CANADA - IMPERIAL

01.11 - Cereal (except rice), pulses and oilseed farming

A fire possibly caused by lightning broke out in a wheat silo. Five hours later, the fire was brought under control by the fire-fighters. The 2300 m³ was full to 60% of its capacity. The total losses were known only after investigation. The contents of the silo were transferred. A nearby facility used to store agrochemicals remained intact.

 **ARIA 8523 - 14/09/1994 - ITALY - BOSSICO**
49.50 - Pipeline transport
 Lightning struck a gas pipe carrying methane that ignited.



 **ARIA 8543 - 01/11/1995 - UNITED STATES - BAYTOWN**
01.50 - Farming and breeding activities
 Lightning struck the roof of a fixed gas oil tank around midnight causing it to puncture in two areas. This resulted in a fire leading to the evacuation of two schools.



 **ARIA 8552 - 08/03/1995 - BAHAMAS - GRAND BAHAMA**
19.20 - Crude oil refining
 Lightning struck a tank containing 65,000 m³ of gas oil causing a fire accompanied by dense fumes. The port authorities and the refinery staff were warned. The residents were evacuated. The fire was brought under control on 10 March at 6.00 pm. Material damage was estimated at 35 MF. Environmental damage, as well as the number of missing persons is not known.



ARIA 9045 - 07/06/1989 - GERMANY - OBERHAUSEN

20.13 Production of other basic inorganic chemicals

Lightning struck the neighbouring area of a chemical plant. The currents induced in the control circuit caused the nitric acid production unit to stop. During the attempts to re-start the unit, nitrous gases emanating from the compressor were released into the atmosphere.

 **ARIA 9824 - 09/08/1996 - GREECE - ISTHMIA**
19.20 - Crude oil refining
 In an oil terminal, a violent storm caused the supply pipe of a tanker to rupture during a filling operation. A significant quantity of crude oil spilled onto the sea. A specialised team of the refinery intervened immediately and set up floating booms. During this operation, an employee in one of the rescue boats was seriously injured by lightning. The oil spill resulted in severe damage to aquatic fauna (fishes and crustacean farms) and polluted several beaches. Cleaning operations that followed lasted several days. Three days after the incident, the ship owner was ordered to pay 70 million Drachmas (300,000 \$).



ARIA 9865 - 20/07/1996 - CANADA - SARNIA

20.13 - Production of other basic inorganic chemicals

A tank containing 8,200 m³ of petrol additive caught fire about 1.00 am. It took 7 hours for the fire-fighters to put out the flames that rose as high as 30 m. The teams worked the entire weekend to drain the tank whose roof had been ripped off and the upper part severely damaged. The adjacent tanks were sprayed with fire-fighting foam throughout the rescue operations. Violent winds obstructed the work of the firemen. Three hundred people were evacuated. Lightning is responsible for the fire.

 **ARIA 10166 - 23/07/1980 - UNITED STATES - SEADRIFT**
YY.YY - Unspecified activity
 A reactor containing ethylene oxide exploded (CVCD = Confined Vapour Cloud Detonation). Lightning was responsible for the accident. This resulted in significant material damage that totalled to 14,986 M\$.



 **ARIA 11233 - 04/06/1996 - UNITED STATES - TEXAS CITY**
19.20 - Crude oil refining
 During a thunderstorm, a fire destroyed a MTBE tank in a refinery. The fire-fighters managed to prevent the fire from spreading to the adjacent tanks.











ARIA 11236 - 01/06/1996 - UNITED STATES - WOOLBRIDGE

46.12 – Intermediary in fuel, metal, mineral and chemicals trade

A violent fire destroyed a petrol tank. Lightning is suspected to be the cause. No casualties have been reported.

ARIA 11565 - 06/08/1997 - UNITED STATES - PILOTTOWN

46.71 - Wholesale of fuel and related products

Lightning triggered a fire in a 20,000 m³ crude oil storage site. Power supply failure due to a tornado hampered the rescue operation of the fire-fighters. Port traffic virtually remained undisturbed. Rivers were not polluted.

ARIA 11590 - 15/07/1997 - UNITED STATES - DEER PARK

20.14 - Production of other basic inorganic chemicals

In a chemical plant, lightning struck a tank emptied of its contents (petrol additive) for maintenance purposes and triggered a fire. Significant quantities of smoke were emitted and the neighbouring main road was closed. Foam and water were used to put out the flames.

ARIA 11599 - 12/01/1997 - UNITED STATES - WILMINGTON

19.20 - Crude oil refining

A fire broke out in a refinery. The city fire-fighters intervened as the water pumping system in the refinery failed. The flames died out themselves in 5 hours due to the closure of the product supply inlet and decompression. Lightning may have been the cause of the accident.









ARIA 11614 - 12/05/1997 - UNITED STATES - CORPUS CHRISTI

19.20 - Crude oil refining

A fire possibly triggered by lightning broke out in the depropanizer tank of an alkylation unit in a refinery. The fire was brought under control in 1 hour. No person is reported to have sustained injuries. Residents were asked to stay indoors. The refinery was shut down temporarily.

ARIA 11967 - 02/09/1997 - UNITED STATES - BAYTOWN

24.46 – Production and transformation of nuclear matter

Lightning ignited the crude oil floating on the water surface near a refinery. The fire that followed burnt down the refinery and the fire hall.









ARIA 12218 - 19/04/1979 - UNITED STATES - PORT NECHES

50.20 – Sea transport and freight coasters

An explosion occurred in a 125,000 tonne oil tanker that had unloaded 50% of its cargo before being struck by lightning. The pier was damaged and two tankers exploded one after the other.









ARIA 12219 - 01/09/1979 - UNITED STATES - DEER PARK

50.20 - Sea transport and freight coasters

During a thunderstorm, lightning struck an oil tanker that had unloaded 40% of its cargo. The vessel exploded and the resulting debris pierced an ethanol tank on board that caught fire. 1,550 m³ of crude oil was spilt in the navigation canal that ignited. The damage is evaluated at 97 million dollars.









ARIA 12221 - 26/04/1995 - THAILAND - BANGKOK

19.20 - Crude oil refining

A tank containing 90,000 m³ of crude oil that was struck by lightning exploded. The fire lasted several days. The damages were assessed at 75 MF.









ARIA 12223 - 24/09/1977 - UNITED STATES - ROMEOVILLE

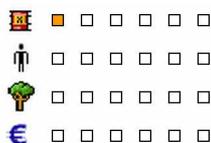
19.20 - Crude oil refining

In an oil depot, lightning struck a 58 m X 16 m fixed roof tank no. 413 that was almost fully filled with gas oil. The roof of the tank exploded and the projected fragments helped the fire spread to a petrol tank no. 115 with a 33 m diameter. The rescue team cooled the neighbouring butane-butene tank and tank no. 312. The latter caught fire at around 4.00 am. In the morning, the fire-fighters fought the flames on the surface of the tank no. 115 with foam: the fire was brought under control at around 1.00 pm. The following morning at around 2.25 am, the firemen injected foam into the base of the tank no. 413, the rate of injection had to be reduced due to the cavitation in either of the pumps but the fire was brought under control in about 15 min and nearly extinguished in 1h30. A few fragments of the roof that had fallen inside the tank formed a few fiery pockets. The tank ignited again due to the lack of foam compound. The second round of attack with foam injections at the foot of the tank and spraying on the surface fire started around 6.00 pm. The fire was put out at 10.30 pm.

ARIA 12225 - 11/07/1988 - UNITED STATES - BORGER

YY.YY - *Unspecified activity*

During a violent storm, the roof of a tank struck by lightning caught fire and the petrol spilled over to the floor.



ARIA 12229 - 04/04/1991 - UNITED STATES - PASADENA

YY.YY - *Unspecified activity*

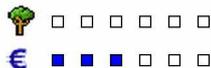
A fire broke out on the joint of a hydrocarbon tank roof that was struck by lightning. The fire was brought under control in one hour and the joint replaced.



ARIA 12230 - 03/04/1991 - NIGERIA - ESCRAVOS

19.20 - *Crude oil refining*

A 65,000 m³ crude oil tank struck by lightning caught fire. Half of its contents were recovered but the tank had to be built again. The damage is evaluated at 25 MF.



ARIA 12231 - 01/06/1991 - UNITED STATES - TAMPA

YY.YY - *Unspecified activity*

A fire broke out at the joint of a petrol tank that was struck by fire.



ARIA 12233 - 08/01/1993 - BRAZIL - PAULINIA

YY.YY - *Unspecified activity*

A 12,000 m³ gas oil tank was struck by lightning while being filled and subsequently exploded. The fire was brought under control after 12 hours of fire-fighting. The neighbouring tanks were saved.



ARIA 12234 - 15/01/1993 - BRAZIL - CAMPINAS

YY.YY - *Unspecified activity*

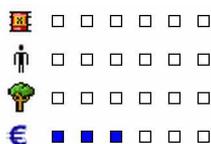
During a violent thunderstorm, a 7,500 m³ gas oil tank caught fire and exploded.



ARIA 13049 - 10/05/1998 - EGYPT - RAS GHARIB

19.20 - *Crude oil refining*

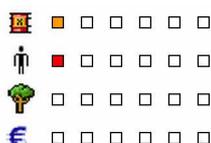
During a thunderstorm, lightning struck one of the 15 2,000 tonne oil tanks in a depot and triggered a fire. The fire spread to two other tanks. The fire-fighters used helicopters to bring the fire under control.



ARIA 13342 - 07/09/1994 - GERMANY - BAD BREISIG

20.60 - *Artificial or synthetic fibre production*

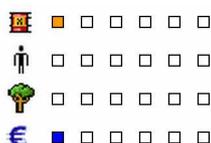
In a polyurethane production site, a foam block ignited on the conveyor belt on its way to the curing site. Since the fire was a threat to a depot, the fire-fighters and the staff evacuated the raw materials to another plant of the firm. The fire spread to the depot despite all efforts deployed by the fire-fighters. The highway near the plant was closed for 2 hours. The storage depot, two warehouses and 20 tonnes of polyurethane derived products were destroyed. Material damage amounted to 4.5 M DM. An industrial cleaning company pumped out the water used on fire coming from the foam facility. An electrostatic charge from lightning is believed to have triggered the accident.



ARIA 13942 - 14/08/1998 - UNITED STATES - PERRY

49.50 - *Pipeline transport*

In a natural gas compression facility, lightning possibly triggered a fire that resulted in several explosions. A fireball over 100 m high was formed. Five people including several firemen sustained injuries and about half a dozen houses were damaged. Residents within a radius of 3.5 km were evacuated. The three gas lines supplying the entire Florida had to be cut, causing activities of several companies to plummet.



ARIA 14442 - 27/06/1994 - GERMANY - GERNSHEIN HESSEN

19.20 - *Crude oil refining*

Lightning caused a tank containing 354 tonnes of methanol to explode and triggered a fire. The fire-fighters brought the fire under control and the mixture of the water used for fire and methanol was treated. No victims were reported. The damage is estimated at 1 million DM.

  **ARIA 19156 - 05/11/2000 - UNITED STATES - SONORA**
 20.1 – Production of basic chemicals, nitrogenous products and fertilizers, basic plastic materials and synthetic rubber







Lightning struck an electric transformer in a chemical plant. An adjacent warehouse containing methanol, solvents and other dangerous substances was on fire. Witnesses described the explosions heard just after the initial impact. A black smoke that could be seen several kilometres away was emitted from the fire. The resident population was evacuated within a radius of 800 m (200 persons), and housed in centres. Most of them were then allowed to return to their homes the same evening. Residents in the high risk zones were allowed to return home only the following evening. Fire-fighters from three fire stations fought the fire 3 hours to bring it under control. The warehouse was destroyed. The rescue teams were backed by a team specialised in dangerous products. Six people sustained injuries including four fire-fighters. Three of the injured were discharged from the hospital the same day while one remained hospitalised even after 24 hours.

ARIA 19807 - 01/03/2000 - JORDAN - ZARQA

19.20 - Crude oil refining

Lightning struck two tanks containing 33,000 tonnes of crude oil in a refinery and triggered a fire. There was no major damage and the refinery continued functioning normally: fuel treatment units were not deployed and since the fire was promptly brought under control.

  **ARIA 20586 - 06/06/2001 - UNITED STATES - YORKTOWN**

19.20 - Crude oil refining







In a refinery (62,000 barrels/day), an explosion resulting in a fire ball that was seen several kilometres away occurred in a fuel reforming unit (octane index improvement operation). The fire that ensued was brought under control within 3 hours by the fire-fighters. The rescue team's strategy consisted in letting the unit burn while protecting the adjacent storage and other units. Without a link being actually established in the first place by the operators, there was a violent storm in geographical zone of the refinery just before the explosion of the unit.

  **ARIA 20587 - 07/06/2001 - UNITED STATES - NORCO**

19.20 - Crude oil refining







In a refinery, a 43,000 m³ tank containing 24,000 m³ of petrol was struck by lightning and ignited. The refinery was already amidst a crisis when the incident occurred. On the previous day, the site experienced very heavy rains. Under the weight of the rainwater, the floating roof of one of the tanks gave in and was covered with 15 cm of petrol. The staff was draining the tank when the thunderstorm started. Lightning struck the tank and ignited the petrol floating on the surface. The tank was drained and foam was used to cover and extinguish the fire. If this did not work, an alternative strategy that consisted in letting the petrol burn while protecting the neighbouring tanks and especially the two butane tanks was ready to be deployed. The staff not involved in the rescue operations was evacuated from the sight as a precautionary measure. Residents were asked to stay indoors.

  **ARIA 20633 - 22/06/2001 - RUSSIA - NERTCHINSK**

84.22 - Defence







A fire triggering a series of explosions broke out in the arms depot of a military base. Lightning is believed to be the cause of the accident. It might have struck the building housing the shell storage site that subsequently caught fire. Five soldiers are reported missing and one seriously injured. Five other soldiers who were in the basement of the shed were unharmed. During the explosion, the flying splinters were projected several kilometres away. Nearly 3,000 residents were evacuated.

  **ARIA 20819 - 01/01/1999 - TUNISIA - BIZERTE**

19.20 - Crude oil refining







A fire broke out in two floating roof fuel tanks. The joints of the tanks were not leak proof. During a thunderstorm, lightning ignited the fuel vapours that leaked out. The fire was brought under control within 30 to 40 minutes by the fire-fighters of the fire training academy of the S.T.I.R (confederation of Tunisian refinery industries). The tanks were severely damaged and a significant amount of fuel was lost (a few thousand m³).

ARIA 22581 - 28/03/2002 – MOROCCO - MARRAKECH

23.99 - Production of other non-metallic mineral products (not classified elsewhere)

Lightning struck several tanks containing flammable products in a cobalt production plant (1,500 tonnes/year). No victims were reported and the other units of the site continued to operate smoothly despite the material damage observed.

ARIA 23141 - 11/06/1996 - UNITED STATES - BAYWAY

19.20 - Crude oil refining

A fire broke out in the furnace of a hydrodesulfuration unit of a refinery. The impact of lightning is believed to be the cause of the accident. The unit operations were only temporarily stopped.

 **ARIA 23584 - 05/05/2002 - POLAND - TRZEBINIA**

19.20 - Crude oil refining







In a refinery, lightning triggered a fire in a 2,000 oil tank. There was no risk of the fire spreading to other tanks. As a precaution, the residents were evacuated. One fire-fighter was reported to have sustained injuries.

 **ARIA 27990 - 20/06/1987 - UNITED STATES - CITY NOT SPECIFIED**

46.71 - Wholesale of fuel and related products

 In a liquid hydrocarbon storage site, a fire broke out in a floating roof tank 12 m high) containing 9,300 m³ unleaded petrol (filled ¾). Lightning was responsible for this accident. Since the tank had no fire fighting equipment, the safety team used hand line to extinguish the fire from the truss at the top of the tank shell: the fire covered about 20% of the circumference and could not be contained by the fire-fighters on site. The fire spread to entire roof that capsized. The tank was destroyed and the damages were assessed at 10 M\$ US.

 **ARIA 29708 - 14/04/2005 - SPAIN - HUESCA**

10.61 – Cereal processing

 An explosion followed by a fire occurred at around 6.00 pm in a grain storage of a flour factory. 19 people sustained injuries of which 7 were serious. 11 people were hospitalised. The facility where about 20 employees were working was seriously damaged. Glass panes were smashed and vehicles damaged in the vicinity of the plant. According to witnesses, lightning may have been responsible for the accident.

 **ARIA 31285 - 10/11/2004 - PERU - CITY NOT SPECIFIED**

20.51 – Manufacture of explosives

 Lightning caused an explosion in a civil explosive warehouse. Six people dies and 6 others sustained injuries.



