

Base de données ARIA - Etat au 15/02/2012





Fireworks accident (outside France) Sorted by ARIA number


**(Nota : please note that from the original French version, only the
« interesting summaries » have been translated to english)**


n° de requête : ed_12083


La base de données ARIA, exploitée par le ministère du développement durable, recense essentiellement les événements accidentels qui ont, ou qui auraient pu porter atteinte à la santé ou la sécurité publique, l'agriculture, la nature et l'environnement. Pour l'essentiel, ces événements résultent de l'activité d'usines, ateliers, dépôts, chantiers, élevages,... classés au titre de la législation relative aux Installations Classées, ainsi que du transport de matières dangereuses. Le recensement et l'analyse de ces accidents et incidents, français ou étrangers sont organisés depuis 1992. Ce recensement qui dépend largement des sources d'informations publiques et privées, n'est pas exhaustif. La liste des événements accidentels présentés ci-après ne constitue qu'une sélection de cas illustratifs. Malgré tout le soin apporté à la réalisation de cette synthèse, il est possible que quelques inexactitudes persistent dans les éléments présentés. Merci au lecteur de bien vouloir signaler toute anomalie éventuelle avec mention des sources d'information à l'adresse suivante :


BARPI - DREAL RHONE ALPES 69509 CEDEX 03 / Mel : srt.barpi@developpement-durable.gouv.fr


    **ARIA 72 - 22/09/1989 - ITALIE - TERRALBA**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 An explosion occurred inside the central laboratory of a fireworks production unit during a powder handling operation. Following this site's 3rd pyrotechnic accident within a span of 2 months (accounting for 14 deaths), measures were being implemented to limit the number of employees exposed. This accident's toll: 8 dead and 1 injured. The buildings were destroyed. The explosion could be heard more than 10 km away.


 **ARIA 97 - 17/07/1989 - ITALIE - SAN VITO**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 A very violent explosion erupted during a fireworks manufacturing process. 2 deaths and 3 injuries were reported. Local authorities, mistaking the blast for an earthquake, activated a general population evacuation plan. 6 explosion-proof buildings were reported destroyed, with missiles being projected several hundreds of metres. No damage was observed outside the facility, which had deliberately been located on a very isolated site.






 **ARIA 99 - 21/08/1989 - ITALIE - SANT'EUFEMIA D'ASPRONTE**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 An explosion occurred during fireworks production, most likely due to operator error; 4 dead and 1 injured were reported.






 **ARIA 115 - 29/06/1990 - JAPON - TOYOHASHI / AICHI-KEN**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 An explosion ripped through the finishing workshop as part of a fireworks manufacturing process. The circumstances remained unclear. All employees directly involved in the accident were killed on the spot: 5 deaths and 5 injured was the final toll.






 **ARIA 116 - 06/09/1990 - JAPON - KITA-HATA-MURA / SAGA**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 An explosion happened during preparation of an explosive powder (both the circumstances and causes were unknown). The 2 employees involved in the accident were both killed on the spot.






 **ARIA 3098 - 14/02/1991 - PAYS-BAS - CULEMBORG**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 Around 11:50 am, two major explosions shook a fireworks production facility. Onsite storage had been authorised for some 10 tonnes of fireworks classified for transport in Division 1.3 or 1.4, in two buildings located 20 m apart, one of which was a former bunker. The other newly finished building recently brought online was entirely destroyed; a 10 m x 5 m crater 2 m deep marked its spot. The bunker caught fire and small fireworks explosions continued all day long. The closest buildings, located on the other side of the dyke, were heavily damaged: collapsed roofs, cracked walls, broken windows, etc. Damage could be observed up to 900 m away, and glass panes were shattered all the way to the city of Culemborg at a distance of 5 km. Considerable debris and strewn objects (bricks, concrete pieces weighing up to 20 kg, metal girders between 2 and 3 m long) were found within a 650-m radius. The force of the explosion was evaluated at 2 tonnes of TNT equivalent. One employee and one visitor to the plant were killed, 6 others injured. Total damages were estimated at Euros25 million. Cleaning inside the storage units was ongoing at the time of the explosion. Could a fire have broken out prior to the explosions? The origin of this incident has remained unknown (a cigarette? static electricity? product instability? presence of powder on the ground reacting during the cleaning work?). Subsequent to this accident, the following recommendation was issued by Dutch authorities: "Classification procedures are needed for fireworks, not only specific to their transport conditions but also distinct procedures relative to manufacturing, assembly and storage. The simple application of classification results for transport conditions to other operations, as currently practiced, must be rejected."






 **ARIA 4922 - 16/10/1991 - ALLEMAGNE - GÖLLHEIM**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 Around 9 pm, an explosion involving 29 kg of explosives and 1,720 kg of fireworks stars struck in the storage area of a pyrotechnic facility. The storage depot, built with 40-cm thick reinforced concrete walls covered by earth, was entirely blown apart. Damage both inside and outside the plant were estimated respectively at Euros2 million and Euros770,000. The explosion caused no casualties; the cause remained unknown. Subsequent to this accident, it was decided to limit the quantities of products stored in the depots to 2,000 kg as well as to isolate the units with sand walls.






     **ARIA 8364 - 26/01/1995 - ITALIE - ANGRÌ**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 At a fireworks plant, five individuals were assembling fireworks for the pyrotechnic show as part of a city celebration.
 At 9:55 am, a very violent blast occurred, followed by two others and then an intense fire, fanned by strong winds.
 Emergency response teams arrived on the scene and successfully evacuated a seriously injured employee, transporting him to hospital. The company director, his son and 2 employees died during the explosion. Fire-fighters, assisted by local law enforcement officers and volunteer fire-fighters, extinguished the blaze by the beginning of the afternoon.
 The plant was destroyed. Two hypotheses were forwarded to explain the cause of this explosion: a short-circuit, or a burning cigarette ash carried by the wind.

     **ARIA 11819 - 05/11/1997 - ETATS-UNIS - LOS ANGELES**
 32.40 - *Fabrication de jeux et jouets*
 32.40 - Manufacturing of games and toys
 In a toy factory, a series of violent explosions, accompanied by a flash, occurred subsequent to a malfunction of the machine used to package detonators in retractable plastic film. Four employees were killed by the shockwave and flying debris, while another 25 were injured. Two women had to be hospitalised due to their wounds and burns (one had burns covering 30% to 50% of her body). The automatic extinction system (sprinklers) combined with fire-fighter intervention brought the incident under control. The factory's windows were shattered and debris was ejected into the street.






     **ARIA 14502 - 11/12/1998 - ETATS-UNIS - HILLSDALE**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 A violent explosion destroyed a workshop for producing fireworks shells. The blast could be heard 30 km away and witnesses stated that a huge black mushroom cloud was visible in the sky. 7 employees were killed and another 13 injured by the explosion. Even after an investigation, the causes remained unknown. A second explosion occurred just 3 months later, this time killing 5 employees (ARIA 16261).






     **ARIA 14565 - 17/11/1998 - ROYAUME-UNI - UFFCULME**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 A fire and series of explosions erupted in one of the country's largest fireworks plants. Nearby houses and local businesses, including a flour mill, had to be evacuated. Several small explosions were spaced over a 15-minute interval, followed by a violent blast causing an abundance of sheet metal projections in the vicinity (container pieces strewn 150 m around). Window panes were shattered up to 10 miles (16 km) away. A total of 8,200 kg of fireworks had reacted, for a TNT equivalent estimated at 200-250 kg, given both of the craters found at the site of one of the eight 6.1-m metal containers placed inside the building (made of a concrete slab and brick walls). Despite intervention difficulties (relative to access and a thick black smoke), 35 fire-fighters were on the scene battling the blaze and several hours later had control over the incident. They found the 13 workers, who were all safe and sound, despite the intensity of the explosions and fire.
 An investigation conducted by Britain's Safety Authorities (HSE Office) revealed that the company's safety management system was deficient: lack of employee protection, inability to communicate information to the proper authorities regarding explosives-related risks, inappropriate use of buildings (including storage errors, most notably exceeding the quantity authorised inside a building), and the dismantling of fireworks (which was the operation responsible for the accident: a firework returned from a show was poorly disassembled, triggering its ignition). In noncompliance with the guideline that stipulated using a sharp knife and wood cutting board in a dedicated spot, the technician cut the fuses connected to the shells with a pair of scissors inside the storage container itself. The case was to be judged by Exeter Crown Court (date unassigned / sentence not known).






     **ARIA 17730 - 13/05/2000 - PAYS-BAS - ENSCHEDE**
 20.51 - *Fabrication de produits explosifs*
 20.51 - Manufacturing of explosive products
 On a Saturday shortly before 3 pm, a fire broke out in the C2 workshop (used for manufacturing fireworks) at a fireworks depot. Local fire-fighters were notified. Rockets spread the fire to containers located just opposite the blaze.
 At 3:08 pm, fire-fighters arriving on the scene requested reinforcements due to the multiple fire sources detected. Fireworks were flying all around the workshop. Many onlookers from the adjacent street approached the scene in order to witness the spectacle and had to be moved further away by emergency responders. A very intense deflagration accompanied by a fireball 85 m in diameter then rocked the zone. Fire-fighters were forced to retreat to seek shelter. The succession of explosions and associated shockwaves destroyed doors on the various storage depots: the central bunker violently burst, generating a 135-m diameter fireball along with a tremendous plume of smoke. The fire spread to a brewery adjoining the warehouse and nearby homes. A supermarket was razed, with a 3 to 4-ha zone resembling a bombarded landscape, and the site of the warehouse was replaced by a crater 13 m in diameter and 1.3 m deep. The force of the main explosion was evaluated at between 4 and 5 tonnes of TNT equivalent. The smoke column was visible 40 km away; glass panes and store windows were blown out over a radius in the hundreds of metres. In all, 22 deaths were reported, including 4 fire-fighters, with 974 people hurt, 50 of whom suffered serious injuries. Over 2,000 local residents had to be evacuated, 500 houses were destroyed or heavily damaged. Hundreds of rescue workers were needed to extract the injured. A health monitoring effort was required in the area for several years hence.
 An investigation was conducted, but the cause of the accident could not be determined (malicious act? handling error? short-circuit? self-ignition?). Neither the structures nor containers appeared to offer sufficient protections relative to the fire and explosion risk; moreover, they were not or inadequately equipped with fire detection and extinction resources. Their layout did not respect regulatory distances. The risk classifications among stored products had most likely been underestimated or the products poorly classified (fireworks imported from China). Subsequent to this accident, public authorities modified the regulations on fireworks and a national database of fireworks storage was launched. Mandated safety distances were revised: 800 m for all installations using fireworks professionally, and 30 m for novices.






     **ARIA 17742 - 15/05/2000 - ESPAGNE - RAFELCOFER**

20.51 - *Fabrication de produits explosifs*






     20.51 - Manufacturing of explosive products

     An explosion occurred in a fireworks production facility. Followed by smaller blasts, this event caused a fire to break out inside the plant and then spread to a neighbouring forest before control could be restored by fire-fighting crews.






     The human toll was great: 7 killed and another 7 injured, including 2 critically. The victims were mainly employees, but clients were also present onsite at the time of the explosion. The causes of this accident remained unknown. The explosion was heard over a 24-km radius. It appears that the accident was triggered inside a workshop producing the Roman candle fireworks display. The majority of depots exploded, generating a mushroom smoke cloud visible 5 km around. The authorities subsequently concluded that the facility had been compliant with operating rules. Inspections followed, and a series of recommendations were issued.

     **ARIA 18408 - 01/08/2000 - JAPON - TAKETOYO**

20.51 - *Fabrication de produits explosifs*

     20.51 - Manufacturing of explosive products

     Around 10 pm, a violent explosion and fire ripped through a building used to temporarily store smokeless gunpowder.


     This building was entirely destroyed and 13 craters were visible on the ground where it stood; 29 other buildings on the site were also completely destroyed, plus another 39 partially destroyed, and 252 structures sustained damage (for 60 of them, damage was limited to broken windows). Outside the facility, a total of 888 buildings were damaged: 12 collapsed, 26 partially gutted and 440 with lighter damage. A total of 410 dwellings were damaged, 364 of which by broken window panes, and 79 injuries were reported.

The powder had been stored for several years inside this "temporary" depot under highly unsatisfactory conditions: direct exposure to sunrays, inadequate temperature and humidity controls, etc. Lacking stability, the powder self-ignited; the 7.7 tonnes, which were exposed to high temperatures (in excess of the critical height for explosion threshold?), exploded.









The day before, 36 kg of powder had entered storage and another 31 kg left; no abnormal phenomenon had been observed.






The company spent Euros22.6 million in compensation for external damage (with purchase of the cereal crop as a means of preventing eventual contamination), plus another Euros5.3 million to rebuild the installations. Operating losses due to the plant closing amounted to Euros7.5 million.

The operator had not identified the explosion risk. The training of technicians and managers was strengthened, as was the safety monitoring and management system (through the implementation of backup controls); in addition, stability tests on the explosives were conducted. The products were stored to avoid direct exposure to sunlight or to excessive humidity and temperature. Along these lines, temperature and humidity recorders were installed. Technicians were reminded that the temporary storage depot had been designed to warehouse semi-finished products for short periods (with regular monitoring). An automatic fire extinction system was introduced in all temporary storage units. As a final modification, the size of containers and the quantities of powder stored per container were reduced.

     **ARIA 22018 - 06/03/2002 - AUSTRALIE - CARMEL**






20.51 - *Fabrication de produits explosifs*

        At 8:45 am, a series of fires and 3 explosions broke out at a 10-ha fireworks storage site. A technician withdrew a series of electric detonators on fireworks ground packs, then a second technician sorted these detonators by colour for the purpose of reusing them during a subsequent fireworks display. As part of this manipulation, he placed a round of fireworks on a wooden bench, which triggered a reaction (due perhaps to the presence of a pyrotechnic compound between the paper and the carton packaging following removal of the fusehead?): a firework was launched and caused ignition of 25 other charges contained in the pack, and then at greater frequency the reaction of fireworks present in the shop area. The two technicians onsite left the premises, found shelter and notified the emergency services.

     The flashes of flames reached a first container, at a distance of 16 m, which exploded and in turn caused 3 other containers to ignite, 2 of which triggered the detonation 10 minutes later.









The level of property damage was significant: the site was totally destroyed, including: 3 storage magazines, 4 steel freight containers, 2 workstations, 1 caravan, and several vehicles. Two dwellings located 300 m away were heavily damaged as well, and 38 other houses sustained minor damage. Metal debris from the mass explosion of 2 containers was strewn over a 400-m radius, with some pieces recovered up to 530 m from the blast site. The flashes of flames and projection of debris also started several brush fires. Despite the violence of these fires and explosions, no injuries were reported.









The investigation underscored the importance of better identifying the explosion risk inherent in certain fireworks under given conditions (e.g. confinement), in addition to: respecting safety distances between magazine storage sites, evaluating "relay effect" risks, adopting good storage practices (e.g. removal of all unnecessary combustibles) and, lastly, separating assembly zones from storage facilities. Moreover, Australian regulations concerning fireworks were reinforced.









     **ARIA 23996 - 04/02/2003 - PAKISTAN - SAMBRIAL**

52.22 - *Services auxiliaires des transports par eau*









52.22 - Ancillary water transport services











        Stored in a freight transfer zone at the port, two 40' containers (each approx. 12 m) carrying fireworks and explosives detonated. 18 people were killed, including 3 children on their way home from school; another 40 some people were injured, almost all of whom employees at the freight transfer centre or other schoolchildren. The majority of victims were hospitalised in critical condition. The windows on tens of buildings were shattered to pieces. Flames originating from the containers rose to heights of 100 m, according to witnesses. The outside walls of a dozen homes, a private school as well as several other containers were severely damaged. Explosion debris was strewn throughout the transfer zone, extending to neighbouring parcels and the railroad. The population was noticed reacting in panic when the explosions struck the port zone. Subsequent to this accident, all shopping centres, shops and banks were temporarily closed, in a sign of mourning. According to the investigation's initial findings, the freight shipped from China had been listed as plastic toys. Cargo unloading was underway at the time of the blast, and the containers had just been transferred dockside under the supervision of a customer service inspector, who also perished in the accident. The cause was not known, but the country's senior authorities requested conducting a high-priority investigation.

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        **ARIA 24429 - 11/04/2003 - JAPON - KAGOSHIMA**

20.51 - Fabrication de produits explosifs

        20.51 - Manufacturing of explosive products









          At 1:27 pm, a series of explosions followed by a fire broke out in a fireworks production plant located 5 km from the city centre, in a sparsely populated zone. The emergency services, called at 1:30 pm, arrived on the scene at 1:40; the fire was brought under control around 2 pm with 15 fire-fighting vehicles called into duty. Three ambulances transported 4 passers-by injured by the explosion (blast, debris). Among the 28 employees working at the facility at the time of the accident, 9 were killed and 2 injured.

Damage was considerable: 6 of the 25 buildings at this 20,000-m2 plant were destroyed during the incident, broken glass could be found on buildings adjacent to the site, including a vocational high school 300 m away; 8 cars were damaged 50 m from the plant.









According to the investigation, which was complicated by the loss of buildings and the deaths of employees during the accident, the initial explosion would have taken place in the manufacturing workshop, during loading or bundling of fireworks (initiation due to impact, friction or static electricity). This explosive force would then have been transmitted to the storage depots a few metres away (i.e. domino effect).











The plant had been authorised to store up to 9 tonnes of black powder. Large quantities of explosives illegally stored onsite, specifically in the depot reserved for non-explosive raw materials, in intermediate storage or in the mixing workshop, exacerbated the consequences of this accident.

A prior inspection had not revealed any special problems with this site. The government reinforced its supervisory system involving the various assigned authorities.

        **ARIA 28480 - 03/11/2004 - DANEMARK - KOLDING**

20.51 - Fabrication de produits explosifs

        20.51 - Manufacturing of explosive products

          Around 2 pm, inside a company storing fireworks (net weight: 300 tonnes / gross weight: 2,000 tonnes), a fire broke out during an unloading operation on a 40-foot container subsequent to the mishandling of a box filled with fireworks rockets. The fire quickly spread within the container and to fireworks stored on pallets placed outside.









The company activated its internal emergency plan and evacuated facility personnel. A 1-km safety perimeter was established around the site; local residents were also evacuated. Residents beyond this perimeter were asked to remain indoors.

Despite a few intervention difficulties (caused by smoke, noise, water supply interruptions, a defective nearby hydrant), fire-fighters were able to cool the closed fireworks containers stored adjacent to the ignited containers. An explosion occurred at 3:25 pm, killing one of the fire-fighters and injuring 7 others. Three additional explosions occurred at 5:45 pm.









The nearly nonstop explosions of fireworks lit the sky until the evening. The fire, which had been releasing a thick smoke, was only contained 2 days later. In all, this intervention mobilised 400 fire-fighters, with support provided by police officers and army pyrotechnics specialists. 63 people were examined at the hospital for smoke inhalation or hearing difficulties. A total of 450 homes, 11 businesses, fire-fighting vehicles and police cars were destroyed or damaged by the blast from these explosions or the various projectiles spraying a 1-km radius. Offsite property damage was estimated at Euros100 million.











The violent explosions of fireworks were surprising in that the containers were only filled with fireworks imported from China and therefore theoretically classified as 1.3G (i.e. without any risk of explosion).

Danish authorities decided to move the storage units containing pyrotechnic substances to rural zones. The country's legislation on the manufacturing and sale of fireworks was revised to impose restrictions on purchases and use by the general public, along with limitations on the use of certain types of rockets by consumers.

        **ARIA 32509 - 03/12/2006 - ROYAUME-UNI - LEWES**

20.51 - Fabrication de produits explosifs

        20.51 - Manufacturing of explosive products









          In a fireworks storage facility belonging to one of Britain's largest importers, an employee was waterproofing (operation taking place outside the facility building) fireworks scheduled to be used that same evening. Electric igniters were located nearby. Around 2 pm, the technician moved these igniters, causing them and the fireworks to

ignite. The ensuing fire spread to a utility van parked with its doors open and loaded with 150-mm fireworks shells and maroon/salutes displays in a transport box. The van explosion and associated ignited projections further spread the fire throughout the entire site, and then to a 6.1-m long metal container.









A 200-m safety perimeter was established since the presence of gas cylinders was suspected. Local residents were evacuated to a school outside the impacted zone. The B2192 highway was closed to traffic; 12 ambulances, 10 fire-fighting vehicles and a helicopter were deployed at the site. The container exploded violently around 3 pm, while fire-fighters were trying to cool it down, killing 2 crew members and injuring 9 fire-fighters, as well as one police officer and two members of the general public. The explosion could be heard all the way to Uckfield, 19 km away. The fireworks continued to fly around for 5 hours from the time the call was placed to emergency services; wood debris and ignited projections fell back to the ground, hitting houses in the neighbourhood.











The site was completely destroyed (buildings, vehicles, owner's home). The windows and roof tiles on houses within a 240-m radius were broken. The container was pulverised into fragments 1 to 4 m² in size, some of which were found up to 350 m from the point of explosion; a 10-m³ crater was formed at the spot where the container once stood. The force of the explosion was estimated at 200-250 kg of TNT equivalent.

The investigation revealed that fireworks had been illegally stored in the site's non-pyrotechnic buildings and moreover that several fireworks presented a risk of massive explosion, with the site not being authorised to store such fireworks. The container that exploded had not been authorised to store fireworks and had no label affixed indicating the type of products contained therein; emergency responders therefore were not properly informed of the potential hazard.

        **ARIA 35519 - 14/02/2008 - CHINE - SANSHUI**

52.10 - Entreposage et stockage

        52.10 - Warehousing and storage






          Around 3 am (local time), a fire broke out in a pre-loading port storage unit containing fireworks. Explosions were also noticed. The storage facility, which accounted for 60% to 70% of China's fireworks exports, was composed of about 20 buildings over a 70-ha zone designated for storing large quantities of packages on several floors (between 15,000

and 300,000 boxes according to sources). The fire gradually spread to all of the zone's buildings through ignited fireworks falling back to the ground. These ignited fireworks also triggered fire outbreaks within the vicinity; 18,200 poultry and 9 hectares of cereal farmland and forests were burnt to ashes. The fire was only brought under control after more than 30 hours by some 100 fire-fighters.





The fire did not cause any casualties; just 2 individuals were injured by walking on broken glass. According to (contradictory) sources, a blast effect (measuring 1.1 on the Richter scale) would have damaged other storage buildings as well as 4,000 dwellings in neighbouring villages, while destroying windows within a 1 to 2-km radius.





Initial investigation findings suggested that the buildings had not been designed to store the kinds of fireworks found onsite (illegal storage of fireworks classified in risk division 1.3 contained in buildings designed for division 1.4).

The company acted by compensating residents at an amount equal to 3 million yuan (equivalent to Euros320,000).

     **ARIA 36593 - 21/03/2006 - YEMEN - NC**






50.20 - *Transports maritimes et côtiers de fret*

    The M/V Hyundai Fortune is a container ship severely damaged in an accidental fire. It was built in September 1996 in South Korea and sailed under the flag of Panama ; its cargo capacity is 5,551 twenty-foot equivalent units (TEU).

    The vessel was on its way from ports in China and Singapore through the Gulf of Aden about 60 miles south of the coast of Yemen. It was sailing west towards the Suez Canal on the way to ports in Europe. Around 12h35 UTC, a huge explosion of unknown origin occurred below deck, sending 60 to 90 containers into the ocean. The explosion caused a massive blaze that spread through the stern of the ship. Secondary explosions followed as 7 containers full of fireworks also ignited above deck on the stern. A large chunk of the hull had been blown out below deck and above the waterline.





After efforts to contain the fire failed, all 27 crew members abandoned ship and were rescued by a Dutch destroyer. On March 23, firefighting tugs began to arrive on the scene; the Hyundai Fortune continued to burn for several days. The combined cost of the ship and lost cargo is now estimated at over 300 million US dollars.





Two hypothesis are to mention : a violent chemical reaction of calcium hypochlorite exposed to moisture or heat or the fire/explosion of volatile cargo such as fireworks.

     **ARIA 36670 - 22/03/1989 - ROYAUME-UNI - PETERBOROUGH**

49.41 - *Transports routiers de fret*






49.41 - Road freight transport

    At 9:45 am, a vehicle transporting nearly 800 kg of explosives exploded while making a U-turn on a company's premises within an industrial park where it had taken a wrong turn.





    The lorry, specially equipped to transport up to 5 tonnes of explosives, had already made 2 deliveries (at 7:15 and 8 am) and was headed towards a fireworks production plant. Upon arriving at the industrial park, the driver realised that he had taken the wrong road; he drove over a speed bump and entered the parking lot of a company within the park in order to make a U-turn. The watchman at this company's site and two drivers on hand detected smoke and then flames coming from the lorry's load. They stopped the vehicle, alerted local fire-fighters and oversaw the site's evacuation. These measures however proved insufficient and bystanders witnessed the incident escalate from the site entrance and neighbouring buildings.

12 minutes later, the lorry's cargo detonated, causing the death of a fire-fighter, who happened to be 15 m away. More than 100 people were injured, 87 of whom required hospitalisation, 2 in critical condition. The damage to buildings and cars in the vicinity was considerable, and broken windows were recorded up to 1.2 km away. A crater 3.5 m in radius and 46 cm deep marked where the lorry had stopped.

The vehicle's crossing of the speed bump caused a package to fall carrying comb-type starters for fireworks, leading to their ignition followed by spreading of the fire to the other loading items (detonators + civilian explosives), until the ultimate explosion. The packaging was noncompliant with standards and hazardous: an excessive number of fireworks per box, presence of a composition and rust in metal boxes, etc. The operator was fined 250,000 pounds for breaking British law (as per the Health and Safety at Work Act, 1974).

     **ARIA 37473 - 16/06/1992 - JAPON - MORIYA**

20.51 - *Fabrication de produits explosifs*

    Several explosions occurred at a fireworks manufacturing factory, causing the death of 3 employees and injuring 58 persons. Two workers were carrying out shell-production work at a charging and forming workshop. Other workers might have been working at a general materials warehouse. Since the workers concerned died, the facts cannot be confirmed. According to a nearby employee, white smoke filled in and around the general warehouse just before the first explosion. A large amount of stored fireworks kept in the general warehouse and the raw materials warehouse exploded one after another.

The area in 2 km radius around the factory was damaged. Fifteen factory buildings burned. Outside the factory, 16 private houses burned, 7 buildings collapsed and 50 partially. A total of 558 buildings were partially destroyed, including window glass damage. 18 vehicles burned out and 20 were partially damaged. The telephone cable was damaged by fire, cutting off 234 telephone lines.





The cause of ignition has not been determined. Large quantities of fireworks / explosives in the warehouses (which were not explosives magazines, that is where the storage of explosive substance was prohibited) might have been ignited by impact or friction on opening or closing the shutter of the warehouse. Ignition could also have occurred by temperature rise from reaction heat or static electricity.

Explosives and raw materials were managed improperly (safety management system, checks, safety education...). The fireworks manufacturing company went bankrupt after this accident.

     **ARIA 38295 - 04/07/2009 - ETATS-UNIS - OCRACOKE**





20.51 - *Fabrication de produits explosifs*





20.51 - Manufacturing of explosive products





    On Ocracoke Island, a lorry transporting fireworks exploded around 9 am on a parking lot for an unknown reason, while 5 employees were unloading contents in preparation for the Independence Day (July 4th) festivities and fireworks show (a planned 40-minute session, i.e. featuring several hundred kg of active material). The explosion,





heard several kilometres around, killed 1 employee on the spot and 3 others subsequent to their injuries. The 5th employee was severely burned and could not recall any warning signs prior to the blast.





This explosion also caused a grass fire, which was extinguished by fire-fighters, two of whom had to be hospitalised for smoke intoxication. An investigation was conducted in order to determine the cause.





 **ARIA 38722 - 17/10/2009 - ALLEMAGNE - NC**
 20.51 - Fabrication de produits explosifs
 20.51 - Manufacturing of explosives
 An explosion in a black powder production plant seriously burned an employee and caused property damage.







 **ARIA 38814 - 16/08/2010 - CHINE - YICHUN**
 20.51 - Fabrication de produits explosifs
 20.51 - Manufacturing of explosives
 An explosion, of a 1 to 5-tonne TNT equivalent, followed by fire occurred at 9:40 am in a fireworks production plant.
 The human toll was 20 deaths, 153 injured requiring hospitalisation and 4 disappeared. The blast blew out windows within a 1-km radius and the shock wave was felt 5 km away. The authorities evacuated 2,000 residents, while 550 fire-fighters and soldiers were mobilised. The Deputy Head of the arrondissement jurisdiction and the local Workplace Safety Office Director were relieved of their duties. The police arrested a Safety Office inspector for professional misconduct along with the plant's director and deputy director. An investigation was carried out. According to initial findings, the plant had been illegally producing fireworks following revocation of its production permit. In June, the site had been ordered by the court to suspend production and upgrade safety standards. Torrential downpours would have flooded one of the site's storage facilities, with the explosion occurring as employees were removing fireworks from the building.


 **ARIA 39223 - 04/05/2010 - PORTUGAL - CANIDELO**
 20.51 - Fabrication de produits explosifs
 20.51 - Manufacturing of explosives
 In a fireworks production plant, an employee was sieving powder (perhaps black powder?) when an explosion occurred at 1:10 pm. The employee was killed on the spot, while 2 residents of the district where the plant was located were injured (including 1 child). The quantity of powder in the workshop at the time was estimated at 100 kg.
 The building was completely destroyed, and damage extended to some 40 homes in the immediate vicinity (shattered windows); emergency services evacuated neighbours as well as a nearby school. The site operator was not insured for any eventual damage external to the site; he refused to compensate neighbours on the grounds that they shouldn't have built their homes so close to the plant. He claimed to benefit from a 322-metre "perimeter of protection" (easements?) that the authorities had failed to apply. Moreover, the operator had been storing 820 kg of explosives onsite, even though these storage areas were rated not to exceed 300 kg.


 **ARIA 39295 - 13/05/2010 - CHINE - ANPING**
 49.41 - Transports routiers de fret
 49.41 - Road freight transport
 A lorry transporting black powder caught on fire and then exploded, killing 5 and injuring 2 others. A spark caused by an electrical cable might have served as the powder ignition source.



 **ARIA 40136 - 08/04/2011 - ETATS-UNIS - WAIPAHU**
 39.00 - Dépollution et autres services de gestion des déchets
 39.00 - Pollution clean-up and other waste management services
 At 9 am, an explosion followed by fire inside a storage bunker of a company certified for the disposal of explosives and fireworks killed 5 employees. Fire-fighters had the fire extinguished after several hours of intervention. The explosion destroyed a vehicle parked in front of the facility and weakened the building's structural frame, which was buried in a hillside. The bunker was still hot 2 days after the detonation. A mine removal team didn't find 2 of the victims' bodies until the next day. A specialised team removed the residual explosives between 18th and 21st April. The police, fire-fighters, the US Bureau of Alcohol, Tobacco, Firearms and Explosives, the US Chemical Safety Board and both the federal and local labour inspection offices all collaborated to conduct the investigation. The exact type of explosive involved (fireworks?) and the specific operation ongoing at the time of the accident remained unknown.



 **ARIA 40926 - 12/09/2011 - ITALIE - ARPINO**
 20.51 - Fabrication de produits explosifs
 20.51 - Manufacturing of explosives
 A series of 4 explosions followed by a violent fire occurred at 2:45 pm inside a pyrotechnics plant. The 70-year-old owner, his 2 sons managing the plant and 3 employees were killed. Flames ravaged 2 of the site's 3 buildings, then spread to the neighbouring forest and threatened a few nearby dwellings, which had to be evacuated. First responders set up a safety perimeter. Due to the considerable explosion risks, fire-fighters, who had been dispatched from several stations, battled the blaze remotely; 2 helicopters, 5 ambulances and 2 medical service vehicles removed the victims. The locality's mayor visited the site. The prosecutor and environmental police undertook an investigation. The initial explosion took place during the manual production of fireworks (an error was committed during the mixing of powder? or static electricity to blame?). The plant had been laid out with separate work zones (workshop / laboratory / press, etc.) and featured ATEX-certified equipment for explosive atmospheres, along with a monitoring system and sufficient water resources to battle fires.



 **ARIA 41406 - 19/08/1989 - ESPAGNE - SAN JUAN DE ALICANTE**
 93.29 - Autres activités récréatives et de loisirs
 93.29 - Other recreation and leisure activities
 Two men on their way to a wedding on behalf of a fireworks supplier parked their car loaded with fireworks on the lot of a supermarket to phone ahead and ask for directions. Around 8:30 pm, the vehicle exploded. The human toll was heavy: 10 dead (including the 2 men leaving the vehicle) and 29 injured, some of whom very seriously (deafness, blindness); 34 cars, the supermarket and a phone booth were all damaged. All of the city's fire-fighting crew, backed up by rescuers with a



humanitarian organisation and civilian safety personnel, arrived onsite accompanied by 20 ambulances.

The hypothesis of a Basque separatist attack was favoured at first, as an anonymous call shortly before the accident warned of the presence of car bombs in the region. The police investigation would demonstrate that the cause was accidental. According to a reconstitution of the event, the car was carrying 60 kg of fireworks for an active mass equal to 25 kg of explosives. The car belonged to the driver's father, who was an independent fireworks supplier.

The investigators identified 4 possible causes of explosion (or a combination thereof):

- influence of temperature in the boot of the car, where the fireworks had spent several hours (at the time of the accident, the outdoor temperature was 29°C);
- possibility of an electrical short-circuit inside the vehicle;
- possibility of sparks, friction or an impact caused by the tools present in the boot;
- presence of traces of a pyrotechnic compound or other substances incompatible with the fireworks in the boot, with such a compound originating from previous loads transported in the same vehicle.

The ruling pronounced on 7th July, 1994 acquitted the 2 managers of a fireworks plant on the grounds of no proof that they were responsible for manufacturing and selling the fireworks involved in the explosion. A police officer assigned to inspect pyrotechnic plants at the time of the accident was also discharged.