MINISTERE DE L'ECOLOGIE, DE L'ENERGIE, DU DEVELOPPEMENT DURABLE ET DE L'AMENAGEMENT DU TERRITOIRE



Petrol Station Accidents
France, 1958 - 2007

ARIA
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CONTENT

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I. ACCIDENT TYPOLOGIES AND PRODUCTS INVOLVED


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Petrol stations are classified facilities presenting the unique characteristic of containing large quantities of hazardous materials while some of their equipment is available for direct use by customers, in accordance with concise information and instructions. The storage, supply and distribution of flammable liquid and gaseous products, combined with the repeated movement of vehicles and the presence of members of the general public, are potential sources of accidental release, fire or explosion, and exposure to persons of varying degrees of vulnerability.

The sample of 270[1] accidents studied, taken from the ARIA database, is made up of incidents which occurred in France from 17 May 1958[2] to 14 July 2007. In addition, 19 accidents which occurred in other countries (between June 1970 and January 2005) have also been recorded due to their particular severity or the relevance of the information drawn from them.

A study of these incidents and a list of illustrative cases have allowed them to be characterised and classified according to their consequences in terms of facilities, people and the environment. Probably due to the limited and recent use of LPG in France, there are fewer accidents specifically involving this type of fuel (13 cases out of 270: 5% of release incidents, 5% of fires, and 3% of explosions). As the LPG problem is somewhat different from that of other fuels, these 13 incidents have been analysed separately.

Typologies and products involved in the 270 accidents:

Products involved (some incidents involve more than one / **Typologies (not mutually exclusive)**	Liquid fuels	LPG	Gas cartridges	Other (oils, wastes...)	Unknown	**Total number of accidents**
Releases of hazardous materials	199	12	5	21	3	**237**
Fires	20	3	5	6	27	**60**
Explosions	18	1	4	2	6	**30**
Others (near accidents)	2	1	0	0	4	**7**
Total number of accidents	**202**	**13**	**5**	**21**	**32**	**270**

1 Synopses of the accidents with ARIA numbers appearing in bold in the body of the text are provided at the end of the document. TThe full list of the summaries of 289 accidents used for this study is available in french at www.aria.developpement-durable.gouv.fr, in the "Analysis and Feedback" section.

2 Collection of the data has been organised since 1 April 1992, the date on which the ARIA database was created; however, some prior incidents may also have been recorded depending on the information available.

Apart from cases during general operations or with unspecified specific circumstances, fuel procurement operations by petrol stations and maintenance or renovation work or test periods should be given particular attention. Indeed, these categories respectively represent 17% and 6% of the accidents, whereas the corresponding operations account for lower percentages of time in the service lives of the facilities.

Origins and circumstances of the accidents:

Circumstances / **Origins of the accident**	Maintenance / renovation / test	Petrol station procurement	Fuel distribution to customers	Stopped petrol station	General oprations / unspecified circumstances	**Total number of accidents**	**Percentage among accidents of known origins**
Tanks and connected equipment	10	10	0	0	47	**67**	**30,5 %**
Tankf fill units	0	15	0	0	0	**15**	**7 %**
Pipes	2	2	0	0	32	**36**	**16,5 %**
Fuel pumps and connected equipment	0	1	14	0	17	**32**	**15 %**
Stores / annexes	1	4	0	0	27	**32**	**15 %**
Water treatment equipment	2	0	0	0	4	**6**	**3 %**
Petrol station delivery vehicles	0	5	0	0	0	**5**	**2 %**
Customer Vehicles	0	0	7	0	11	**18**	**8 %**
Petrol station in general	1	0	0	0	5	**6**	**3 %**
Unknown	0	10	1	1	41	**53**	
TOTAL	**16**	**47**	**22**	**1**	**184**	**270**	
Percentage	**6 %**	**17,5 %**	**8 %**	**0,5 %**	**68 %**		

a / Tanks and pipes

Tanks and pipes are the types of equipment most often involved in petrol station accidents (around 60% of the sample analysed). As they are usually underground, they can be difficult to inspect and maintain, and failures are often detected late. There are many instances of leaks in the cases recorded: they are the result of aging and corrosion (ARIA 558, **6222**, 7912), "unsuitable" assemblies (ARIA **7985**), and work operations (ARIA 694, 4111, 4539, **32293**). A significant proportion of the accidents (46 of the cases recorded) occurred during the filling of station storage tanks: equipment failure in the transfer mechanisms between the tank truck and the tank (ARIA 1300, 1382, 3685, 9256, 20239, 21236, 24233, **25794**, 27868), defective joint (ARIA 2932, **3500**, 3537, 6843, 9245, **16225**, 30816), inadvertent movement of the tank truck causing breakage of the hose (ARIA 691, 4789, **15228**, 31149), overfilling due to human error (ARIA 3979, **7764**, 22702) or the failure or absence of a fill limiter (ARIA 622, 1809, **4855**, 7409, 30461).

These accidents illustrate what may appear obvious: operations involving relatively high flow rates require rigorous compliance with procedural instructions. These release incidents primarily result in water and land pollution, as well as fires and explosions (ARIA **20943**).

Fuel seepage sometimes reaches external equipment such as sewer systems, underground railway tunnels or the basements of neighbouring buildings (ARIA 4843, 4844, 4845, **4846**, **26832**).

Typologies and origins of the 202 accidents involving liquid fuel:

Origins / Typologies (not mutually exclusive)	Fixed facilities						Customer vehicles and delivery trucks0	Others / Unknown	**Total number of accidents**
	Tanks	Pipes	Fuel pumps	Tank fill units	Effluent treatment	Stores			
Release of hazardous materials	62	33	27	14	4	7	8	44	**199**
Fires	1	1	5	2	0	4	4	3	**20**
Explosions	6	3	1	1	0	5	0	2	**18**
Others (near accidents)	0	0	2	0	0	0	0	0	**2**
Total number of accidents	**62**	**33**	**29**	**14**	**4**	**7**	**9**	**44**	**202**

Tanks, pipes and distribution areas are involved the most frequently.
Of the 147 petrol and diesel fuel release incidents on fixed facilities, 13 were ignited (fires and / or explosions).

The property by which fuel vaporizes is an additional source of accidents, due to the formation of toxic, flammable or explosive atmospheres. In Givors in 1991, an explosion is caused by the ignition of explosive vapours in an underground tank of premium grade petrol escaping through the manhole seal (ARIA 2990).

In Marsannay-la-Côte in 2005, an explosion occurs when hydrocarbon vapours that accumulated in the space between the tanks and the concrete slab (created as a result of multiple modifications of a petrol station) is ignited by an electrical source; the concrete slab is blown into the air, then falls and shatters into pieces (ARIA 31234). Fuel saturating the ground soaks down and seeps into another medium, where it creates an explosive atmosphere that could be ignited (ARIA 4846, 23952, 29652). In Paris in 1958, an explosion destroys a garage equipped with fuel distribution pumps, killing 17 people, when the garage owner activates an electrical switch that ignites fuel vapours emitted via a leak caused by severing an obsolete pipe that had been left in place after undeclared expansion work (ARIA **31803**).

Given these circumstances, construction work and periodic maintenance operations must be conducted methodically and with rigour. They are sometimes at the origin of ignition of these explosive atmospheres: 3 of the 8 fatal accidents recorded at petrol stations in France occurred during construction work (ARIA **179**, **11931**, **27182**).

In Annecy, a worker dies following an explosion in the manhole of a fuel tank, while he was welding disused tanks, without a fire permit or safety plan: the tank capacities had not been rendered inert or filled with foam as specified by procedure (ARIA **11931**). In Montluçon, improper distancing of vents in the compartments of a fuel tank (the 4 vents were interconnected) allowed fuel vapours to spread from a compartment being filled to another compartment on which maintenance was being done; the vapours exploded, killing one worker (ARIA **27182**). During repair work on a pipe connected to an underground petrol tank, a spark from an electrical tool ignites fuel vapours escaping via the leak: the explosion seriously injures two workers (ARIA 11703). In Grenoble, an employee is intoxicated by emissions while cleaning an empty petrol tank, probably due to a defect in his respiratory mask; a second employee who comes to his assistance is also intoxicated (ARIA 1997).

Abroad

In the United States in 2000, the presence of a cigarette or use of a mobile phone in the immediate vicinity of the facilities may be the cause of a flash that severely burned a man who had been filling his car's petrol tank (ARIA 18686).


ARIA 33414


ARIA 33414

b / Fuel distribution areas

Twenty percent of the 270 accidents in the sample studied occurred in fuel distribution areas. These are generally open access areas, and the equipment they contain is used by the public, who are not always aware of the potential risks it presents.

Misuse of pumps, nozzles that are torn off or improperly attached (ARIA 1647, 8223, 12776, 14914, **16757**, 21534, 31769), loss of control of a vehicle that hits petrol station equipment (ARIA 927, **5492**, **6963**, **19293**, **24329**, 32621), leakage or explosion of hazardous materials transported by customers (ARIA **1155**, 7388, **16826**, 21825), vehicle or fuel can fires (ARIA 2754, 15663, 17990, 18989, 19073, 21603, **23752**, 32627, 32844), or malicious acts (ARIA 3302, 10101, 23756, **33414**) are all causes of accidents, sometimes with serious human consequences.

In Portes-Lès-Valence (ARIA **6963**) and Les-Chères (ARIA **24329**), 2 people die when their vehicles run into petrol station pumps and catch on fire. In Blanzy, a car fire spreads to 3 fuel distribution pumps and the front of the garage (ARIA 32844). In driving over the pump hose, a heavy goods vehicle causes overpressure in the relief valve, leading to the leakage of 200 litres of petrol onto the road (ARIA 18939).

In addition, due to their high rate of use and handling by the public, fuel distributors require special consideration in the design phase and particularly rigorous maintenance.

Multiple accessory defects or failures are at the origin of accidental release: nozzle loosening (ARIA 4189, 11534, 11692, **20822**), breakage in the distribution hose (ARIA 10810), leakage at the distributor feed unit (ARIA 7986), joint defect (ARIA 12287) or weld breakage (ARIA **20580**), porosity of pump parts (ARIA 4853), failure of: the shut-off switch (ARIA 12266), the emergency shut-off after an impact (ARIA **19293**), the suction mechanism (ARIA 11548) or a pump flange (ARIA 12572), and pipe corrosion (ARIA 6153). These leaks are sometimes the initiating factor in more serious accidents, due to the flammability and volatility of the fuels (ARIA 4189).

Abroad

In Peru in 2002, a bus runs into the petrol pumps at a service station, causing an explosion and fire. Casualties are high: 35 people are killed and 20 more injured (ARIA 22033).


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ARIA 24999

Accidents involving the use of LPG are characterised by faster kinetics and greatly intensified effects: any LPG leak, whether on a vehicle or a petrol station facility, drastically increases the risk of explosion and fire (ARIA 15710, **23804**, 24700, 30608, 32112, 32995).

LPG distribution requires more sophisticated technology for pressurized transfer of the product, which is sometimes at the origin of accidents (ARIA 19010, **23804**, **27779**). In Laguenne, due to a hook-up problem, the LPG pump nozzle gets stuck in the tank of a car causing a potential risk of explosion (ARIA 24295). While fuelling up with LPG, a camper van explodes when a leak in a hose between the cap and the tank ignites (ARIA 19010). In Valleiry, a flash due to loss of tightness between the manual valve and the solenoid valve of a LPG pump severely burns the owner of the vehicle being filled (ARIA **27779**).

Abroad

In Ankara, Turkey in 2003, a leak on a defective joint during an LPG delivery is at the origin of 3 successive explosions, including the BLEVE of the tank truck, followed by a raging fire. Three people died and 189 others were injured (ARIA 24999).

In the Netherlands, in 1978, a slow leak on the transfer lines between a storage tank and an LPG tank truck during delivery ignites on a hot point in the truck's engine, causing the BLEVE of the tank truck (ARIA 10026).

Typologies and origines of the 13 accidents involving LPG :

Origins / Typologies (not mutually exclusive)	Fixed facilities			Véhicles running on LPG	**Total number of accidents**
	Tanks	Fuel pumps	Pipes		
Release of hazardous materials	1	2*	6	4*	**12***
Fires	0	1*	0	3*	**3***
Explosions	0	0	0	1	**1**
Other (near accidents)	0	1	0	0	**1**
Total number of accidents	**1**	**3**	**6**	**4**	**13***

Of the 9 cases of LPG release on fixed facilities, only one was ignited.
Independently of fixed facilities, 3 accidents involve the ignition of LPG on vehicles.
* Accident ARIA 27779 involves an ignited leak on the auxiliary LPG tank of a camper van and then on a LPG distributor with no established connection between the two incidents.


ARIA 24999

Although not in direct contact with fuel storage and distribution activities, auxiliary facilities at petrol stations, which are sometimes open to the public (shop, repair shop, car wash, storage facility, etc.), are also exposed to fires, explosions and other accidents.

First, the proximity of the fuels is a potential source of flammable vapours that can spread through service shafts (ARIA 14616), disused pipes, or any other duct (ARIA 29652). Indeed, 4 explosions occurred in cashier booths following the ignition of fuel vapours by electrical devices (ARIA 4203, **4981**, 12091, 33470). In Aubigny-Sur-Nère, two members of the public died in an explosion in a car wash due to the spread of vapours via disused pipes from the neighbouring petrol station (ARIA **28734**).

Other accidents are directly caused by the auxiliary activities at service stations (sales, car repair, etc.).

Fires (24 of the cases studied) affect stores of combustible materials such as tires (ARIA, 25588, 27945), oil, waste (ARIA 27945), etc. Also of note are an explosion initiated by an employee in a spray booth (ARIA **16274**) and a fire in a garage when a flash occurred near hot drain oil (ARIA 13090). These accidents can affect other service station equipment, e.g. causing the outage of the leak detectors on jacketed tanks (ARIA **19208**). The presence of gas cartridges for sale can be an aggravating factor in the event of an explosion (ARIA 17447, 19342, 21909, 22045, **33414**). Cases of release of hazardous materials or pollutants have also been recorded: drain oil (ARIA 4407, 5597, 24810, **26832**, 30360), lube oil additive (ARIA **24462**), freon from a cold room (ARIA 28462), car wash effluents (ARIA 25144), etc. Hydrocarbon settlers-separator failure or misuse result in the contamination of surface water or water purification systems (ARIA 2133, **3718**, 9180, 10101, **11814**, 19630). Stores and storage areas are sometimes the target of malicious acts (ARIA 12160, **19208**) with potentially serious consequences (ARIA **33414**).

Abroad

In Italy in 1997, a valve failure in the car wash area at a service station causes wash water to run into the drinking water pipes, rendering the tap water unfit for consumption for several days (ARIA 11993).


ARIA 31234

Consequences of the incidents

		Number of accidents
Human consequences	Fatal	8
	Causing serious injury	16
Environmental consequences		157
Material damage	Internal	74
	External	19

8 accidents resulted in 27 deaths (ARIA **179, 5492, 6963, 11931, 24329, 27182, 28734, 31803**). The environmental consequences most often consist in land pollution and contamination of ground water (30 of the cases studied) or surface water (71 of the cases studied).

The accidents recorded may have had social or environmental impact and incidence: damage to homes and facilities, work stoppage, evacuations, fuel seepage into water purification systems, etc.

The recent accident in Sotteville-Lès-Rouen (ARIA 33414) was a reminder, if any was needed, of the risks inherent to petrol stations located in urban areas. Although service stations are seen as ordinary, experience shows that they are the site of accidents resulting in the loss of human lives (27 people died as a result of 8 accidents), serious injury (50 people suffered injuries in 16 accidents), pollution, and damage to neighbouring constructions. While it is true that petrol station equipment is not exempt from external aggression, customer negligence or malicious acts, implementing the following organisational and technical measures would have reduced the frequency or severity of many of the incidents described above:

• Setting up leak detection systems using both equipment (limiters, jacketed tanks with leak detectors, etc.) and organisational methods (tracking consumption and delivered quantities, supervising tank fill operations, maintenance, etc.).

• Setting up adapted confinement systems in case of release (retention, sealed areas, storm drainage system isolation valves, hydrocarbon detection, etc.).

• Managing tank fill operations through procedures and operator awareness efforts.

• Regular and rigorous inspection and maintenance of facilities and their safety devices.

• Setting up work procedures to reduce personal risks (fire permits, explosivity measurements, fire fighting facilities, etc.).

• Installing adapted equipment, particularly in explosive atmosphere areas.

• Informing and educating staff about existing risks.

• Ensuring on-site security (direct or camera surveillance of sensitive points, systems to limit malicious acts, etc.).

• For a site in an urban area, taking accident risks into account, particularly the intensity and possible effects on people liable to be exposed in the surrounding area (e.g. complying with regulatory minimum distances between facilities, and fencing).

• Conducting investigations with regard to polluted land to limit the risk of ground water pollution and identifying scenarios liable to result in gas accumulation in confined areas (network).

SELECTION OF FRENCH ACCIDENTS MENTIONED IN THE TEXT

ACCIDENTS

ARIA 179 - 08/08/1989 - 53 - LAVAL
50.5Z – Fuel retailer
An explosion occurs on an underground fuel tank while workers are degassing and cleaning it. The accident leaves two dead and one burn victim. The tank is destroyed.

ARIA 1155 - 24/04/1989 - 51 - REIMS
50.5Z - Fuel retailer
An explosion occurs on a drum of di-isocyanate (product used in the manufacture of hard plastic) inside a light-duty truck parked at a petrol station.

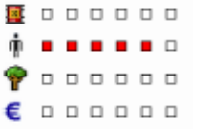
ARIA 3500 - 30/03/1992 - 31 - TOULOUSE
50.5Z - Fuel retailer
A valve bursts due to mishandling while a petrol tank is being filled; 3500 litres of hydrocarbons spill onto the ground and seep into the storm water system. The HERS river is polluted. A safety barrier is set up and traffic is deviated.

ARIA 3718 - 24/06/1992 - 71 - SAINT-AMBREUIL
50.5Z - Fuel retailer
In a petrol station, a crack occurs in a settling tank, and hydrocarbons spill into a stream. Large numbers of fish are collected along the banks.

ARIA 4846 - 06/01/1990 - 75 - PARIS
50.5Z - Fuel retailer
A fire occurs in a subway tunnel (No. 3 line) due to seepage of a petrol/diesel/water mixture along a raceway. Ignition of the fire is probably related to rail cutting and welding work underway on the other side of the tunnel. The petrol station at the origin of this pollution is not in compliance with regulations: it has no leak detection device on the underground tanks, no stop valve and no tightness certificate for the diesel fuel main. The fire damages the cables ensuring the safety of the line, which is stopped for 4 hours.

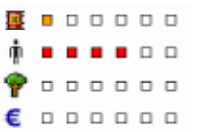
ARIA 4855 - 13/05/1991 - 75 - PARIS
52.2P – Retailer of specialty foods and other products
At a service station, petrol spills through the risers in an underground tank at the end of an transfer operation. The accident occurs during a test performed to check the effectiveness of the stop valves installed on the tanks. Four previous spills have occurred due to valve blockage by foreign objects (drain plug, bulb, used seal, etc.). Transfer operations are suspended until 11/7/91, at which date the stop valves and vent lines are replaced.

ARIA 4981 - 29/11/1993 - 85 - LA GUERINIERE
52.1D - Supermarket
An explosion and fire occur at a supermarket service station while a petrol truck is unloading. The station cashier initiates the explosion when she actuates an electrical switch in her booth. The flammable cloud escapes through a dipstick hole which was left open. The accumulated gases penetrated via an unsealed electrical cable sleeve arriving directly inside the booth. Two people are injured in the fire: the cashier, burned on the hands and face, and a customer near the booth. The installation is recent (1987 / 1990) but does not comply with regulations: there is no trap screw on the gauge, gas storage facility improperly situated...



ARIA 5492 - 29/03/1984 - 42 - SAINT-ETIENNE
50.5Z - Fuel retailer
The braking system fails on a heavy truck on RN 82, going into the city of Saint-Etienne. The truck veers out of control, hitting several vehicles, knocking down a pedestrian and literally crushing a car with a young woman at the wheel. The brakeless truck finally comes to a stop when it crashes into a petrol station; the truck driver manages to avoid hitting the fuel pumps. The female car driver is killed instantly, and the wounded pedestrian dies of injuries sustained in the accident.

ARIA 6222 - 04/10/1982 - 69 - TAPONAS
50.5Z - Fuel retailer
A leak due to electrolytic corrosion occurs on a fuel distribution line in a petrol station; 24,650 litres of petrol seep into the ditch. The station is not equipped with a dike to retain hydrocarbons contained in the runoff water. Pollution is detected in the ground water. Two piezometers are installed in order to monitor the hydrocarbon content in the ground water.



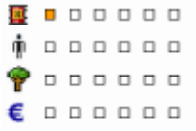
ARIA 6963 - 09/05/1995 - 26 - PORTES-LES-VALENCE
50.5Z - Fuel retailer
A fire occurs in a petrol station along the A7 motorway when a car runs into 2 fuel pumps, tearing them out of the ground. The elderly driver, who had probably suffered a medical incident, dies in the fire which immediately erupts in his car. The station attendant activates the emergency shut-off for the station's fuel pumps, and all the vehicles under the same overhang are evacuated. The pumps are equipped with anti-break valves and no explosion occurs. A specialised external company collects the extinction products (powder and foam) and cleans the waste water collection system (oil separators and pipes).

ARIA 7764 - 18/09/1995 - 51 - REIMS
50.5Z - Fuel retailer
At a petrol station, in the manager's absence and due to a programming error, a delivery driver transfers 7000 litres of diesel fuel into a tank which can only contain 3000 litres of fuel. The stop valve is defective and the deliveryman does not realise his oversight until the pit containing the tank overflows. Over 3000 litres of diesel are pumped outside the tank, and several tens of litres spill out of the pit.

ARIA 7985 - 04/01/1996 - 49 - ANGERS
52.1F - Hypermarket
To avoid inventory shortage at a petrol station, a 100-m³ tank is added to two existing tanks. During a maintenance visit, a private company notices that a tube leading from the tank to a manhole had not been plugged. Over the course of a month, tens of litres of fuel spilled into the sand around the tank. Cleanup work is begun and lasts until the month of June.

ARIA 11814 - 17/09/1997 - 09 - PAMIERS
50.5Z - Fuel retailer
Oil pollution occurs in the canal of Pamiers following a cleaning operation on the oil mains and separators at a petrol station. The authorities require the petrol station operator to review the cleaning procedures and their frequency, and to provide an exact effluent map (storm water, waste water, wash area, pumping area).

ARIA 11931 - 18/11/1997 - 74 - ANNECY
50.5Z - Fuel retailer
During welding work at a petrol station, an explosion occurs in the manhole of a fuel tank. The operation in question involved welding plugs onto the bodies of tanks which had just been retired and replaced by new, jacketed tanks. The two workers completing the job were employees of an external company; one is killed and the other injured. According to witness accounts and information in the report, no fire permit had been issued and no safety plan had been established. The tanks should have been shrouded and filled with foam, but apparently the work was performed prior to this operation. In a second instance procedure, the Annecy criminal court sentences the person in charge of the outsourcer company, this company's works foreman and the maintenance manager of the petrol station's operating company to respective suspended prison terms of 18 months, 6 months and 8 months.



ARIA 15228 - 16/02/1999 - 58 - CLAMECY
52.1D - Supermarket
A petrol leak occurs while a tank is being filled at a supermarket service station. To reduce the fill time, the deliveryman moves his truck in order to hook up to another tank 10 metres away, but he misjudges the distance (night time, bad weather) and this places severe stress on the tube, causing sudden rupture of the tank valve. He activates the shut-off valve, but 1000 litres of fuel spread to the low points, manholes and pipes in the shop parking lot. Firemen set up a safety barrier and place absorbent products throughout the affected area. A specialised company cleans the site the following day. No pollution is found. The operation carried out after closing the shop kept the accident from becoming more serious. The administration finds that the station's facilities are not in compliance with regulations (transfer area, spill prevention). A safety instruction must be established.

ARIA 16225 - 25/06/1999 - 78 - BUC
52.1D - Supermarket
A leak occurs at a service station while a tank truck driver is transferring petrol (premium unleaded). The driver fails to properly secure the hose to the transfer valve, and the hose detaches as soon as the valve is opened. 300 litres spill onto the ground in the transfer area, onto the road and into the gutter. A safety barrier is set up. Explosivity measurements are taken in the storm water system up to the flow equalization basin located 2 km away. Sand is thrown onto the spills. At around 10:00am, the safety barrier is removed after the risk of explosion is found to have diminished.

ARIA 16274 - 20/11/1985 - 60 - COMPIEGNE
50.2Z – Vehicle maintenance and repair
At a garage equipped with a petrol station, an explosion occurs when a worker lights a cigarette while cleaning the paint spray booth. A fire ensues; the worker suffers minor burns.

ARIA 16757 - 13/11/1999 - 69 - MEYZIEU
50.5Z - Fuel retailer
At a petrol station, a customer who is very irritated at having had to pre-pay after 8pm forgets to remove the fuel pump nozzle from the tank of his vehicle. He climbs back into his car and starts the engine. The pump is torn off.

ARIA 16826 - 02/12/1999 - 83 - VIDAUBAN
50.5Z - Fuel retailer
The driver of a truck carrying 13,000 litres of sulphuric acid stops at a petrol station and notices leakage from a seal; 1000 litres of acid spill onto the ground before firemen are able to empty the tank.

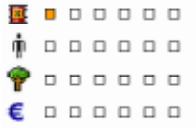
ARIA 19208 - 21/09/2000 - 94 - ALFORTVILLE
50.5Z - Fuel retailer
A fire breaks out in the shop of a petrol station, leaving the station partially destroyed. Equipment such as the storage facilities, pipes, and gas pump meters are untouched, but the electrical cabinet located inside the shop and the leak detectors on the tank jackets are destroyed. Repair work is carried out. Initial findings indicate that the fire was not of electrical origin, but seems to have been the result of a malicious act. In this light, the facility's administrative situation is rectified.

ARIA 19293 - 23/11/2000 - 67 - ECKARTSWILLER
50.5Z - Fuel retailer
A car damages a petrol pump due to misuse of the emergency brake. The impact is not very forceful, and does not trigger the safety valve located at the base of the pump. A leak appears in the O-ring in the bent tube joining the underground pipes to the pump with a nominal flow-rate of 8 to 10 m³/hour. Approximately 4300 litres of premium unleaded petrol spill onto the ground. A station employee actuates the emergency shut-off, to no effect, and opens the device housing in order to reach the foot valve. As the pump still does not stop (another leak?), he finally shuts off the power at the electrical switchboard. A relay failure seems to have impaired proper operation of the emergency shut-off. Rescue workers cover the affected sheaths and pipes with foam. A specialised company collects the petrol and other fluids from inside the spill wall and the pumping area (8 tonnes of material). The prefect issues an emergency order.

ARIA 20580 - 21/05/2001 - 69 - COMMUNAY
50.5Z - Fuel retailer
At a service station along the motorway, the operators detect a leak after comparing the volume stored to that distributed. The amount leaked is estimated at 6500 litres of diesel, yet no visible trace of this leak is found on the ground or in the station's outfalls. The leak seems to be due to a broken weld on an elbow in the feed manifold at the base of the gas pump meter. The station shuts down all operation, including the pumps that transfer fuel from the storage tanks to the pumping facilities. The manifolds are also immobilized. An emergency order from the prefect, upon recommendation by the inspectors of classified facilities, requires the station operator to demarcate the polluted area, to estimate the extent of soil and ground water pollution using piezometers, and to determine the exact causes of the accident, within 7 days. The absence of any danger is to be demonstrated before the facilities may resume operation. The ground is permeable in this location and the risks of pollution are high.

ARIA 20822 - 12/06/2001 - 94 - CRETEIL
52.1F - Hypermarket
At a petrol station in mid-afternoon, a fuel nozzle separates from the pump hose while a customer is pumping fuel. The customer does think to immediately return the nozzle to the pump in order to stop the flow of fuel, and petrol spills onto the ground. An attendant comes to his assistance and places the nozzle back in the pump. Sixty litres of petrol have spilled onto the ground and into the pipes connected to the fuel tank. When the station managers arrive, the safety of the station is ensured. Absorbent product is placed on the ground and a private company is brought in to clean up the product. After this incident, it is decided that users must be reminded of how to stop the pumps (by returning the nozzle to its hook on the pump) and that the condition of the hoses must be visually checked every morning. All the hoses are checked by the maintenance company. The oil pipes and separator are cleaned as well.

ARIA 20943 - 02/08/2001 - 67 - BENFELD
52.1D - Supermarket
At a petrol station, an incipient fire starts in the transfer tube of a tank truck during an initial tank filling operation. The station operator attempts to stop the leak flowing toward the sewer, then calls the firemen who put out the fire in the transfer pit. The truck driver is treated at the hospital for minor injuries on his hands and arms. The customers and staff of the supermarket are evacuated. A safety barrier is set up. There is major property damage: damage to the truck tank, and destroyed transfer stations. According to local authorities, no pollution is found. The inspectorate recommends various measures to the prefect: an emergency action plan requiring a new declaration as a condition for resuming operations, and requiring an accident report and analysis of the installation by a super expert. The exact causes are not determined, but the accident appears to be due to the discharge of fuel from the tank truck to the transfer pit, followed by ignition of these fuel vapours.



ARIA 23752 - 28/10/2002 - 94 - CRETEIL
50.5Z - Fuel retailer
At a service station, a vehicle bursts into flame in front of the shop, near the butane bottles and fuel pumps, just after the driver finishes filling his petrol tank. He was leaving the pumping area when the car burst into flame. The occupants of the vehicle, 2 elderly people, exit the vehicle and the manager quickly puts out the fire with an extinguisher. The vehicle is removed and fire fighters finish extinguishing the fire. The station facilities can continue normal operations the same day. Apparently, the vehicle – loaned to the 2 people by a garage – had a gas leak when it arrived at the station.

ARIA 23804 - 03/01/2003 - 22 - PLURIEN
50.5Z - Fuel retailer
A liquefied gas leak occurs at a petrol station on Friday at 5:30pm; the contents of a tank truck, i.e. some 9000 litres spill onto the ground when a pipe bursts. The explosivity measurements taken show 100% LEL in some places. A residence adjacent to the station is evacuated (2 renters) and a safety barrier is set up around this residence and the station. The next morning, the owner opens the station against the recommendations of the emergency responders. The town hall issues an order to close the station, which is delivered by the police force (gendarmerie). The next day at noon, a patrol reads values of between 1 and 2% LEL at the external opening, but still 100% at the openings near the filling area. That evening, the measurements do not show significant levels. The ground is to be analysed before the operator reopens the station in order to ensure that no product remains in the ground.

ARIA 23952 - 22/01/2003 - 93 - LA COURNEUVE
50.5Z - Fuel retailer
While workers are injecting concrete to reinforce a sewer on behalf of the equipment service, an explosion and fire occur when they perforate the side wall. Two workers are severely burned and curls of black smoke escape through the sewer outlets over a 1.5 km stretch of the pipeline. The area within a radius of 200 metres is demarcated as a danger zone, and traffic is stopped in both directions on the RN2 national road. Some of the offices and restaurants located in the accident zone are evacuated. The emergency response mobilises more than 80 fire fighters and 20 specialised machines for 7 hours; the damaged sewer is inundated with foam. The causes and circumstances of the accident remain undetermined. Explosivity measurements are taken throughout the night and a fire fighting plan is kept in effect in case the fire reignites. The accident appears to have been caused by a pocket of pollution with a high concentration of flammable liquids, following the discharge of hydrocarbons into the sewer when its wall was perforated; a petrol station that has long been out of service is located nearby. A criminal investigation is conducted with the help of the central forensic laboratory. Given that the water trap passed through the water table, the water is pumped out the next day in order to locate the leak and attempt to stop it. Four days later, the water trap is once again filled with foam after explosivity measurements again show dangerous concentrations of fuel vapours. On 5 February, a specialised company brings in divers to detect and stop the fuel leaks. The accepted hypothesis is that when the petrol station was in service, there was a constant leak which stagnated as it reached the first impermeable layers. On 20 March, a series of bore holes are drilled in the ground at the old petrol station in order to locate any traces of hydrocarbons. The 5 sample borings reveal the presence of petrol and diesel in the first layers of the water table. A very large quantity of water – some discharged by the emergency responders but mostly seepage water – is polluted by the hydrocarbons present, though at a low concentration. The polluted water is pumped out and discharged into a neighbouring water trap.

ARIA 24329 - 24/03/2003 - 69 - LES CHERES
50.5Z - Fuel retailer
A vehicle runs into the fuel pumps at a service station along the A6 motorway, running north-south. The vehicle catches fire. The fire does not reach the fuel stores and pumps. One person dies, trapped in the car. Two people are injured: one person suffers burns on 30% of the body and another quickly loses consciousness. Fuel distribution is suspended.

ARIA 24462 - 18/04/2003 - 51 - REIMS
50.5Z - Fuel retailer
At a service station, a leak occurs in a drum of additive for lubricating oil. This product is hazardous if breathed into the airway; twelve fire fighters intervene on the scene, assisted by a mobile unit for chemical intervention (CMIC).

ARIA 25794 - 23/10/2003 - 80 - AMIENS
52.1D - Supermarket
At around 9:30am, as 5000 litres of diesel fuel are being transferred at a petrol station adjacent to a supermarket and near residences, a leak occurs in the sight glass at one of the tank truck outlets. When the driver sees the product leaking onto the ground, he actuates the outlet gate which stops the leak. Fifty litres of diesel fuel spread over the concrete transfer area, some of the product flows into the storm water manhole and then into the mud and oil separator. The emergency responders place absorbent materials on the product and an external company comes in the afternoon to empty the contents of the mud separator and dispose of the waste. No impact on the environment is mentioned.

ARIA 26832 - 04/07/2003 - 94 - CHOISY-LE-ROI
50.5Z - Fuel retailer
A tank which catches drain oil at a service station overflows, allowing the products to leak into the boiler room of a neighbouring building. A water officer on site notices that the spill is coming through cracks in the wall and flowing into a sump equipped with a drain pump for the building's wastewater. Given that this water is released directly into the storm water and then into the Seine river, the building manager suspends operation of the pump. Two weeks later, specialised companies clean out the oil pit and the boiler room basement. The station operator checks the tank's tightness and conducts an analysis of the ground in which it is buried. The building manager installs a separate drainage system, which will prevent their waterborne sewage system from being released directly into the storm water.

ARIA 27182 - 26/05/2004 - 03 - MONTLUCON
52.1D - Supermarket
At a petrol station under construction at a shopping centre, an explosion occurs in a new storage tank being filled with premium unleaded petrol. The ensuing incipient fire is quickly brought under control by the driver of the tank truck delivering the fuel. One worker is killed while working on the manhole of the tank. The explosion causes no property damage aside from the tank, and no window breakage is reported. Initial findings reveal that construction work was still underway and that two external companies were working on the tank while 2 of its 4 compartments were being filled. The victim was emptying compartment 3 which had been filled with water the previous month. The compartment in which the explosion occurred had never contained fuel, but the vents of the four compartments were interconnected due to improper alignment. The fuel vapours from the compartment being filled migrated toward the empty compartment on which the victim was working. The explosion was probably initiated by operation of the pump immersed in the compartment or an action carried out by the victim. The inspectorate recommends that the prefect issue an order for emergency measures, requiring the facilities to be immediately secured (emptying, degassing, etc.). Prior notice is required as a condition to resuming activities.

ARIA 27779 - 16/08/2004 - 74 - VALLEIRY
50.5Z - Fuel retailer
At a petrol station along the motorway, a flash occurs on 15 August at around 5pm, when a customer begins filling the auxiliary LPG tank onboard his camper van (running on diesel) from Italy. When the incident occurs, the filling has not actually begun, as the tank is beginning to load but no volume has yet been recorded in the cabin. The driver who was performing the operation is brought to hospital with severe burns. The station's electrical safety is ensured by actuating the emergency circuit breaker. A safety barrier is set up. Initial findings show that the fill hole on this auxiliary tank was located under the body of the vehicle and that one had to lower oneself to the ground in order to make the connection. The flash, which came from an air grate in the camping van, caused burns to the driver's upper body. There is little damage to the vehicle: traces between the fill hole and the air grate. The vehicle is removed by its owners and the distribution pump is shut off at the circuit breaker to prevent any electrical hazard. The emergency responders do not detect any anomaly at this stage. That night, at around 12:30am, fire fighters are called to the petrol station after an incipient fire appears at the bottom of the LPG distribution device. They reveal a small leak in this spot on the device (between the manual valve on the line and the solenoid valve) and shut off the gas inlet valve, which stops the leak. As a precautionary measure, the motorway company decides to close the rest area/service station even though the facilities have hardly been affected by the events in question. An inspection by the DRIRE (Regional Research, Industry and Environment Departments) the following day recommends that the station resume operations on certain conditions and with the permission of court-appointed experts: it must purge the connecting lines and conduct a campaign to check the gas levels (with duly documented results), ensure isolation of tank valves in closed position, temporarily perform regular checks to detect any residual leak. According to information available at present, it is not certain whether there is a connection between these two incidents (flash and fire).

ARIA 28734 - 10/12/2004 - 18 - AUBIGNY-SUR-NERE
52.1D - Supermarket
In the early afternoon, an explosion at a car wash facility kills 2 people who are washing their car. The emergency responders demarcate a danger zone and the petrol station at a shopping centre 30 metres away is closed temporarily. Initial findings indicate that the explosion occurred inside the equipment room located between the 2 car wash areas, destroying this room and propelling concrete blocks up to 5-6 metres. The room which houses electrically-powered (not gas-powered) equipment is located near 2 underground fuel tanks which supply the pumps at the neighbouring petrol station. Moreover, the car wash facility is built on a site formerly occupied by this petrol station; specifically, a row of fuel pumps used to stand very near to where the car wash facility's equipment room was built. The closest tank lies 2 metres away. At the petrol station, initial findings reveal the absence of seal plugs to block the gauge holes in the underground tanks. In the configuration on this site, these holes open onto a manhole which is also sealed with a plug. Pipes which were no longer in use but which used to supply the petrol station's old row of fuel pumps arrive in this manhole. Given that the fuel tanks had been filled 1 hour before the accident, a possible hypothesis is that fuel vapours had travelled through the non-plugged holes and the manhole, into the obsolete pipes, all the way to the equipment room. They could have accumulated there (small, crowded room) and caused the violent explosion which occurred, on the condition that there is a connection between the obsolete pipes and the equipment room. An investigation is carried out.

ARIA 31803 - 17/05/1958 - 75 - PARIS
50.2Z – Vehicle maintenance and repair
At a 4-storey automotive garage equipped with 2 underground fuel tanks with capacities of 3 and 4 m³ in a lined pit, a strong small of petrol is noticed when the 4 m³ tank is being filled. When he checks the volume, the garageman sees that 1200 litres of petrol are missing from the tank. Fire fighters are called to the scene and set up ventilation equipment to aerate the establishment. At around noon, an explosion occurs when the garageman mechanically actuates an electrical switch at the bottom of the staircase leading to the grease pit. The building collapses and the exterior wall falls into the street onto a group of schoolchildren who had stopped to watch the firemen at work. The accident leaves 17 dead, including 3 firemen and 7 children, as well as 30 people injured outside the establishment. The windows of the 7-storey building adjacent to the garage are destroyed. The occupants of this building and other adjacent residences are evacuated and cannot return for several weeks (exact duration unknown) while debris is being cleared and the safety of the buildings is being ensured. Within the established danger zone, electrical power and gas supply is also shut off for an unknown period of time.
Findings indicate that the deflagration was due to the ignition of petrol vapours which had entered the garage from fuel seepage in the ground; the ignition occurred when the electrical switch produced a break spark. Five years earlier, the fuel pumps had been moved without removing the pipes which were obsolete but still connected to the tanks. During work to expand the garage in the basement, work which was still underway when the accident occurred, one of these pipes was cut, which is what caused the fuel seepage at the origin of the vapours. The investigation also revealed that this expansion work had not been the subject of the regulatory authorization requests.
The garage operator is sentenced to a 6-month suspended prison term and fined 1000 NF (i.e. 1400 euros in 2006). A manager of the company that had moved the fuel pumps is fined 500 NF (i.e. 700 euros in 2006). The damages total 683,000 NF (i.e. 965,000 euros at the 2006 value). After the incident, a proposal is made to change the requirements governing «class 3» garages (subject to a declaration under the legislation on classified facilities), requiring garages to install an explosion-proof electrical system in underground rooms, and prohibiting repair shops involving the use of burners (forges, blow torches, etc.).

ARIA 32293 - 27/09/2006 - 73 - CHAMBERY
52.1D - Supermarket
At around 10:55am at a shopping centre petrol station, a premium unleaded petrol line is torn out during construction work. Approximately 4 m³ of fuel spill onto the ground. A safety barrier is set up at a 100-metre radius, encircling the petrol station as well as an automotive maintenance centre and a fast food restaurant. Some fifty people are evacuated. An explosivity measurement is taken during the emergency response; no risk is detected. The station operator arrives at the scene, and a specialised company cleans the affected area. The emergency responders leave the scene at around 2pm. There are no streams or sewers in the vicinity, but a risk of ground pollution in the upper layers of the water table is suspected.

ARIA 33414 - 14/07/2007 - 76 - SOTTEVILLE-LES-ROUEN
50.5Z - Fuel retailer
A fire of criminal origin (?) erupts at around 2am on a car parked at a petrol station in the town centre. Triggering a domino effect, the fire spreads to a stockpile of used tires 1 metre from the vehicle, followed by the explosion of 16 of 20 bottles of LPG, empty or full, (nominal capacity of 6 to 13.5 kg) contained in a case with wire mesh on 5 sides, standing against a room made of PVC, also 1 metre from the fire. A safety barrier is set up and some sixty residents are evacuated to a meeting hall as a precautionary measure. Fireman employ 5 combination nozzles to fight the fire and to keep the flames away from a second case of gas bottles stored 15 metres from the burned car. The fire is put out at around 6am; the debris is cleared and surveillance of the site is put into effect. One elderly person affected by the smoke is brought to hospital for testing. During the day, measures are taken to ensure the site's safety, i.e. pipes are degassed, and underground fuel tanks (buried under a 25-cm-thick concrete slab) are emptied and then filled with water.
The petrol station service and 3 adjacent apartments, including that of the manager, are destroyed; their occupants are taken in by family. Residence windows have been broken (explosion overpressure or projectile fragments) within a 25-metre radius around the station; hedges are scorched and paint has been burned and chipped due to the heat flow rate up to 25 metres from the station. Metal fragments were propelled a distance of around 200 metres; the station's exterior wall and its partition wall with the adjoining residence seem to have been an effective barrier for projectiles. The police force conducted an investigation in order to determine whether or not the accident was of criminal origin, and if so, to identify the guilty parties.

TECHNOLOGICAL ACCIDENTS ONLINE

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