Accidents with cross-border effects

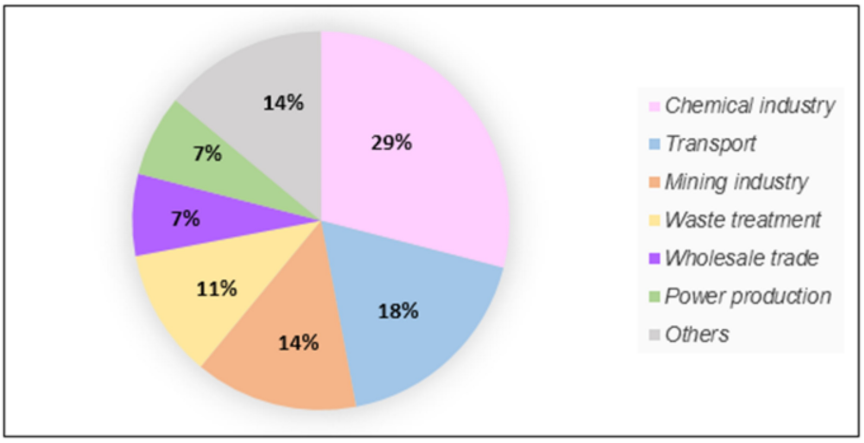
Accidental events whose consequences extend beyond national borders are, by definition, of significant magnitude and constitute for the most part major accidents. Of the 28 events categorised as such in the ARIA database, 23 occurred within the current European Union boundaries.

The Chernobyl disaster, which took place on 26 April 1986, is beyond a doubt the accident that made Europeans fully realise that borders could not protect against technological risks. While it is already difficult to standardise both the knowledge of risks and appropriate prevention practices across all facilities of a given country, achieving these goals at the international level remains an even more challenging task. Yet an analysis of accident studies in this field does prove to be vital.

1. Accident characteristics

1.1. Industrial activities involved

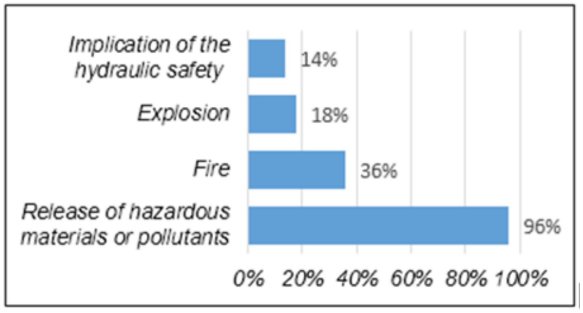
Among the activities involved in accidents with cross-border effects, we find the sectors generating the most widespread consequences. The percentage breakdown by type of activity of these 28 accidents is shown in the following graph.



Sectors of activities involved

1.2 Typology of cross-border accidents

While certain hazardous phenomena, such as explosions, fires or compromised hydraulic safety, are the cause of a number of accidents, it is still the discharge of hazardous substances which typically constitutes the cross-border characteristic of such events. This finding is depicted in the graph below, with percentages indicating the number of accidents in which the given phenomenon is present.



Hazardous phenomena present during accidents

1.3 Accident consequences

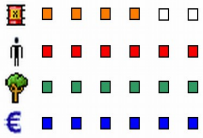
The consequences of these events are highly variable, to a point where providing an average is not representative. The number of accidents by type of consequence is listed in the following table:

Consequences	*Number of accidents*	*% of total*
Loss of life	*4*	*14%*
Serious / minor injuries	*2 / 7*	*7% / 25%*
Redundancy at work	*5*	*18%*
Loss of public services: drinking water or electricity	*8*	*29%*
Population evacuated / safety perimeter	*6 / 10*	*21% / 36%*
Environmental consequences	*27*	*96%*

Besides the lessons learnt from accidents presented in the next section for purposes of illustration, the most significant consequences of accidents with cross-border effects would include:

- ARIA 31005: 13 Nov 2005 in Jilin (China), a series of explosions in a petrochemical plant killed 5 and injured nearly 70 people. 10,000 residents were evacuated. 10 days later, the discharge of 100 tonnes of benzene was announced. Pollution of the river extended into Russia.
- ARIA 31312: 11 Dec 2005 in Buncefield (UK), explosions and a fire occurred in an oil depot, injuring 43 people. 20 tanks of hydrocarbons burned. A tremendous cloud of irritating substances spread all the way to southern England, then on to France and Spain.
- ARIA 32676: 18 Jan 2007 in Lyme Bay (UK), an English container ship ran aground. 200 containers, some of which were discharging hazardous substances and heavy fuel oil spilled. Kilometres of coastline on both the English and Brittany shores were polluted.

2. Accident examples



Pollution of the Rhine River by pesticides

ARIA 5187 - 1 November 1986 - Schweizerhalle - Switzerland

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Fire broke out in a warehouse containing phytosanitary products south of Basel. 80-m high flames were visible 10 km away. Mercaptans in the smoke made the air unbreathable for kilometres around, and the RHINE River was polluted. The retention basin was insufficient: 15,000 m³ of extinction water flowed via the sewer network into the river, which turned a shade of pink (fuchsine);**30 tonnes of highly toxic products (e.g. insecticides, mercury) destroyed all aquatic life over a stretch of more than 250 km.**

The time interval between the fire outbreak and the alert sent to residents of Basel and neighbouring countries caused a major public outcry. The investigation assigned the origin of the fire to an accidental ignition of a pallet of Prussian Blue.

Drinking water catchments were closed for 6 months and all fishing prohibited. Fire damage amounted to €34 million, while liability pay-outs totalled €24 million and site decontamination another €38 million. One year later, the International Commission for the Protection of the RHINE adopted an ambitious plan to restore river quality. The cost of environmental clean-up, decontamination and rehabilitation measures exceeded €40 million.

On 12 November 1986, the Environment Ministries of the adjacent countries met in Zurich to convince the Swiss to pass legislation similar to the **SEVESO Directive** and moreover to finance the river restoration initiative. **The Swiss wound up adopting legislation nearly matching** the SEVESO Directive, thereby raising the level of safety at industrial sites and improving information exchange between adjacent countries in the event of accident. This environmental disaster also gave rise to the 3 January 1992 Water Quality Law officially creating France's SDAGE framework (master planning of water facilities and management).

Explosion of a tank car containing toxic gas

ARIA 20821 - 14 July 2001 - Riverview - United States

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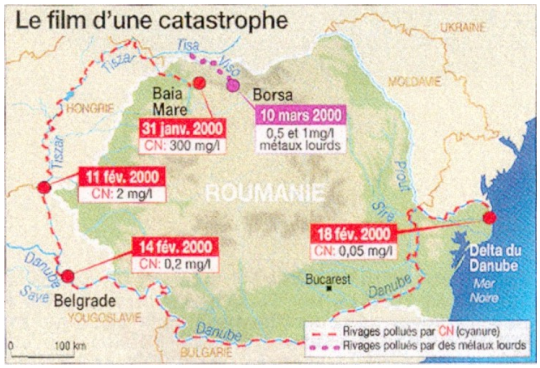
At 3:45 am inside a chemical plant, 2 employees were unloading a tanker car containing methyl mercaptan (MM) when a process pipe broke loose: approx. **70 tonnes of gaseous MM** were released into the atmosphere. Fire-fighters sprinkled the car where smoke was emanating. At 4:09 am, the toxic gas ignited, engulfing the car and producing a fireball 61 m high by 15 m wide. The car exploded (BLEVE-type explosion) emitting both MM and its decomposition products into the atmosphere. The unloading hose on a nearby car containing chlorine was destroyed: **12 tonnes of chlorine** out of the 81 contained in the car were released. The toxic cloud drifted towards the Canadian border marked by the river running alongside the site. At 12:47 pm, the leak was finally stopped.

This accident **took the lives of 3 plant employees and injured 49**. Some 2,000 people had to be evacuated. The river was closed to all forms of navigation. The investigation concluded that a corrosion-erosion phenomenon had caused the pipe to break and singled out safety rule compliance breaches. The State of Michigan negotiated a $6.2 million settlement with the industrial group to compensate local residents, consisting of $500,000 in fines and $5.7 million to improve safety and training in addition to compensating the local population.

In March 2002, the chemical company announced a **general emergency programme** aimed at mitigating the consequences of explosions, fires and toxic discharges on public health and the environment. Periodic drills were scheduled with both American and Canadian fire-fighters. Updated evacuation procedures were ordered by the Head of Emergency Services. Canadian emergency planning authorities were not notified until several hours after the toxic cloud had crossed the border causing some Canadian residents to fall ill. Upon Canada's request, an **alert protocol specific to chemical leaks was adopted between authorities on both sides of the river**. This protocol involves authorities from 5 cities and 3 industries. A revision of Federal regulations was also initiated.

Water pollution due to cyanide effluent

ARIA 17265 - 30 January 2000 - Baia Mare - Romania



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Inside a gold waste recycling facility opened in May 1999, a waste settling basin failed. **300,000 m³ of effluent containing cyanide** (400 mg/litre, for a total of 115 tonnes) **and heavy metals** (Cu, Zn) contaminated 14 hectares of ground and polluted the SASAR River. A 40-km long "cyanide wave" extended all the way to the DANUBE.

Romania, Hungary, Yugoslavia, Bulgaria and the Ukraine were all adversely affected. Strong cyanide concentrations were measured in wells on individual properties. Several people were exposed to toxic doses. All water consumption and fishing activities were prohibited. **Flora and fauna were destroyed for hundreds of kilometres around.**

A delegation of European experts analysed the event. The samples taken confirmed the persistence of this pollution. The origin of the accident was ascribed to dam design flaws, heavy rains and organisational deficiencies. It was nonetheless observed that an **alarm system** had successfully served to warn neighbouring countries. Information exchanges and measurements recorded by Romanian and Serbian authorities had undoubtedly **led to attenuating and mitigating the impacts** of this spill.

The seriousness and repetition of this type of accident led to strengthening European legislation, based on conclusions issued by experts and the Baia Mare working group, in particular through:

- the 16 Dec 2003, modification of the SEVESO 2 Directive to include the processing of ores as well as mining waste settling basins. Facility operators were required to implement safety management systems comprising risk assessments;
- the 15 March 2006 Directive relative to managing extractive industry waste in order to prevent or minimise the impacts of accidents and moreover to impose specific measures on installations capable of producing cross-border effects (e.g. informing all adjacent countries);
- within the framework of the IPPC (Integrated Pollution Prevention and Control) Directive, publication of a BREF (best available techniques reference) document as a means of reducing ordinary pollution while preventing accidents related to non-ferrous metal mining or at least mitigating their effects.

3. Lessons learnt

The accidents recorded in the ARIA database whose effects extend beyond national borders illustrate the need to address technological risks according to a global and standardised approach, as regards their prevention and specific risk management strategies. Several of the most significant events, in terms of impacting and mobilising public opinion, have given rise to regulatory modifications aimed at improving the knowledge of risks and minimising their effects, both during normal operations and in accident response. The aquatic environment is most often disturbed during events cited in the base.

For the 28 European Union member nations, the European Water Framework Directive, adopted on 23 October 2000 plays a strategic and fundamental role. It lays out guidelines for managing and protecting water on each major drainage basin across Europe, in addition to setting bold objectives for preserving and restoring the quality of surface water as well as groundwater, with the goal by 2015 of achieving a "good overall state" of water quality. Subsequent to this European initiative and in order to conduct coordinated action for the protection of border rivers and their primary tributaries, the pertinent countries founded a number of international committees, as exemplified by:

- CIPEL: International Commission for the Protection of Lake Geneva's waters, is a joint Franco-Swiss body assigned to monitor the evolution in water quality not only of the lake, but also of the Rhone River and its tributaries;
- CIPR: International Commission for the Protection of the Rhine. Nine nations have a stake in the sustainable development of this immense water basin: Switzerland, France, Germany, Luxembourg, the Netherlands, Austria, Lichtenstein, Belgium, and Italy.
- ICPDR: International Commission for the Protection of the Danube River. Founded in 1998, this body is composed of the European Union and 14 nations in the Danube region: Germany, Austria, the Czech Republic, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Serbia, Slovakia, Hungary, the Ukraine, Romania, Bulgaria, and Moldavia.

Water management in France is organised according to the underlying principles of the European Water Directive via a series of master plans on water facilities and management (French acronym SDAGE) and 2010-2015 measurement programmes. The 2007 Grenelle Environment Roundtable committed France to achieving by 2015 "good overall water ecology", which is defined as water supply capable of sustaining a rich and varied animal and plant life, exempt of toxic products and available in sufficient quantity to satisfy all uses.

For more information :

* on water management in France and nation's commitments to international programmes: www.eaufrance.fr

* detailed report on accidents with cross-border effects : ARIA 5187, 31312, 39047, 17265, 20821, 43616.