Case Studies of Major Industrial Accidents Causing Pollution in the European Union

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Topics

- Terminology
- Natural hazards and industrial accidents
- Recent industrial accidents causing pollution in the EU
- Case studies
  - Buncefield, England
  - Aznacóllar, Spain,
  - AZF, Toulouse, France
- Conclusions
Terminology

- **Industrial accidents (often called technological accidents)**
  - Toxic spills from mining activities
  - Industrial accidents (non-mining)
  - Oil spills
  - Transport-related accidents

- **Traditional damage**
  - Bodily injury; property damage and economic loss (also called material damage)

- **Environmental damage**
  - Prevention and remediation of damage to natural resources

*Main source of statistics: European Environment Agency, Mapping the impacts of natural hazards and technological accidents in Europe; An overview of the last decade (No. 13/2010)*
Natural hazards

- Numbers of, and overall losses from, significant natural hazards in Europe 1998-2009 (number; losses in €billion)
  - Floods (213; 52 173)
  - Storms (155; 44 338)
  - Earthquakes (46; 29 205)
  - Extreme temperature events (101; 9 962)
  - Forest fires (35; 6 917)
  - Drought (8; 4 940)
  - Avalanches (8; 0 742)
  - Landslides (9; 0 551)
  - Volcanoes (1; 0 004)
Industrial accidents

- **Numbers of major industrial accidents in Europe 1998-2009**
  - Toxic spills from mining activities (4)
  - Non-mining accidents (339)
  - Oil spills (9)
  - Transport related accidents (figures not available)

- **Note**
  - Overlaps in above categories, eg, oil spills
  - Comprehensive data on overall losses not available
  - Wide variation in estimated losses depending on source
Natural hazards triggering technological accidents (NATECH)

- No central source of figures for numbers of, and overall losses from, major NATECH in Europe

- Example
  - Earthquake at Izmit, Turkey on 17 August 1999
    - About 17 500 deaths
    - About 44 000 people injured
    - Over $15 billion (€18m) property damage
Natural hazards triggering technological accidents (NATECH)

- **Izmit earthquake**
  - triggered 21 industrial accidents including
    - Fire at refinery that burned for 5 days and caused oil and fire fighting water to pollute the surrounding area and sea
      - costs for remediating environmental damage about $57.8m (€72.2m), 95% of which was insured
    - Spill of 6 500 tonnes of acrylonitrile, a toxic substance from an acrylic fibre production facility
      - 27 workers poisoned in initial response; animals, plants and vegetation near facility destroyed; many long-term injuries including cancer; widespread environmental damage, especially to groundwater
Toxic spills from mining and downstream processes

Major toxic spills from mining activities in Europe 1998-2010

- Aznacóllar, Spain (April 1998)
  - Dam failure
- Baia Mare, Romania (January 2000)
  - Dam failure
- Aude/Malvesi, France (March 2004)
  - Dam failure
- Borsa, Romania (November 2005)
  - Accidental release of 300m³ of cyanide solution into river
- Kolontár, Hungary (October 2010)
  - Dam failure
Industrial accidents (non-mining)

- Numbers of, and losses from, major non-mining industrial accidents in Europe 1998-2009
  - 339 major accidents reported to Major Accident Reporting System (MARS)* under Seveso II Directive and other EU legislation
    - at least 22 major accidents were reported to have caused “ecological harm”

* MARS is managed by the Major Accident Hazards Bureau at the Joint Research Centre; it provides scientific and technical support to the European Commission on the control of major industrial hazards
Industrial accidents (non-mining)

Examples of traditional and environmental damage from non-mining industrial accidents

- Bergkamen, Germany (24 September 1998)
  - Explosion of transport container for organo-metallic compounds
  - 1 fatality, bodily injuries, and material damage (over €1.8m)

- Porto, Portugal (24 October 1998)
  - Crude oil spill, followed by fire
  - 1 fatality, bodily injuries, material damage (€20m) and water pollution
Industrial accidents (non-mining)

- **Aetsa, Finland (9 June 1999)**
  - Explosion in reactor for production of chemicals
  - 1 fatality, and material damage (over €2.5m)

- **Haguenau, France (8 December 2000)**
  - Fire in glue and resin factory
  - Environmental damage, and material damage (over €15m)

- **AZF, Toulouse, France (21 September 2001)**
  - Explosion in fertiliser facility
  - 31 fatalities, thousands of people injured, material damage (about €2.5 billion)
Industrial accidents (non-mining)

- Ghislenghien, Belgium (30 July 2004)
  - Explosion following leakage from gas pipeline
  - 24 fatalities, 132 people injured, overall costs about €100m

- Ancona, Italy (8 September 2004)
  - Explosion and fire during loading in storage facility
  - 1 fatality, 3 people injured, material damage (€6.5m), renovation and disrupted production (€56m), environmental damage

- Buncefield, England (11 December 2005)
  - Explosion and fire at fuel storage depot
  - 43 people injured, property damage; overall costs excluding remediation of environmental damage €1.13 billion
Industrial accidents (non-mining)

- Priolo Gargallo, Italy (30 April 2006)
  - Leakage of pipeline in process plant, followed by fire and explosion
  - 10 people injured, clean-up and restoration costs (€28m), and road and rail closures

- Coryton, England (31 October 2007)
  - Fire at refinery
  - Repair costs about €15m, refinery closed for 2 months

- Dormagen, Germany (17 March 2008)
  - Explosion and fire following rupture of pipeline
  - Material damage (direct costs about €40m), on-site and environmental damage (€3.2m)
Oil spills

- 9 oil spills of over 700 tonnes from ships in European coastal areas 1998-2009
  - Erika, France (December 1999)
  - Volgoneft 248, Marmara/Turkey (December 1999)
  - Baltic Carrier, Denmark (March 2001)
  - Prestige, Spain (November 2002)
  - Spabunker, Spain (January 2003)
  - Claudel, Netherlands (January 2007)
  - New Flame, Gibraltar (August 2007)
Oil spills

- Volgoneft 139, Russia/Ukraine (November 2007)
  - €19m total; 12% clean-up costs, 14% effect on fisheries; 74% effect on tourism
- Navion Britannia, Norway (December 2007)

- 1 oil spill of over 700 tonnes from an inland pipeline
  - Coussouls de Crau, France (August 2009)
Transport-related accidents

- No central source of figures for numbers or costs of transport-related accidents in Europe

- Examples
  - 2 parked road tankers containing liquid petroleum gas (LPG) exploded in Dagneux, France, in May 2007, causing a fire ball that injured 5 people and destroyed nearby property including businesses
  - Freight train derailed in Viareggio, Italy, in June 2009, causing LPG to be released from 2 tankers; gas cloud exploded, killing 32 people; 1 000 people evacuated
Traditional and environmental damage from industrial accidents

- **Toxic spills from mining activities**
  - Traditional damage depends on various factors including location
  - Environmental damage is generally substantial

- **Industrial accidents (non-mining)**
  - Traditional and environmental damage depends on various factors including weather conditions, location, and presence of surface water and drinking water aquifers
  - Explosions are less likely to cause environmental damage but may cause substantial traditional damage
  - Toxic spills are more likely to cause substantial environmental damage and may cause substantial traditional damage
Traditional and environmental damage from industrial accidents

- **Oil spills**
  - Traditional and environmental damage from marine oil spills depends on various factors including weather conditions and location
    - Marine conventions provide funding for traditional damage and environmental damage (but not from offshore oil and gas operations)
  - Traditional damage from non-marine oil spills depends on various factors including location
  - Environmental damage from oil spills may be substantial depending on various factors including presence of drinking water aquifer
    - 1 litre of hydrocarbons can render 1 million litres of groundwater unfit for human consumption
Case studies – Buncefield, England

- **Cause of accident**
  - 11 December 2005: a large tank at an oil-products storage depot overfilled with petrol due to the gauge enabling the operation to be monitored becoming stuck
  - An independent high-level switch that closed down operations automatically if the tank was overfilled was inoperable

- **Accident**
  - Overflowing petrol formed a vapour cloud that ignited, causing a blast that measured 2.4 on the Richter scale
  - Fire, which included 20 large fuel tanks, burned for 5 days
Case studies – Buncefield, England

- Traditional damage and socio-economic damage
  - 0 fatalities (incident occurred early Sunday morning)
  - 43 people injured
  - 20 businesses employing 400 people destroyed
  - 60 businesses employing 3,500 people badly damaged
  - Several homes destroyed and many other homes damaged
Case studies – Buncefield, England

- **Losses: £894m (€1.113 billion) total**
  - £625m (€780m): compensation claims
  - £245m (€306m): losses to aviation industry
  - £15m (€19m): competent authority and governmental response measures
  - £7m (€9m): emergency response costs including fire and rescue service
  - £2m (€2.5m): alternative sourcing of drinking water due to incident necessitating closure of public water abstraction supply borehole

- **Most losses were insured but payment process was protracted**
Case studies – Buncefield, England

- Environmental damage
  - Air pollution: minimal due to nearly complete combustion, buoyancy of high plume and favourable weather conditions
  - Surface and ground water pollution
    - mostly caused by pollutants from fuel, 786 litres of foam concentrate containing zinc and perfluorooctane sulfonate (PFOS), and 68m litres of fire fighting water
    - surface water pollution was minimal; concentrations of pollutants dropped about 1 month after incident
    - groundwater pollution in an area of over one hectare
Case studies – Buncefield, England

- **Cost of remediating environmental damage**
  - Unknown
  - Remediation of groundwater is continuing

- **Other losses**
  - Storage and treatment of 16 million litres of fire fighting water contaminated with oil, zinc and PFOS
  - Legal fees for Chevron and Total for civil claims totalled around £58m (€72m)
Case studies – Buncefield, England

Operators and offences

- **Hertfordshire Oil Storage Ltd (HOSL) (joint venture between Total UK (60%) and Chevron (40%))**
  - £1.45m (€1.8m) plus £1m (€1.25m) costs for breaching Seveso and health and safety legislation and causing fuel and firewater chemicals to enter groundwater

- **Total UK (managed site on day-to-day basis)**
  - £3.6m (€4.5m) plus £2.6m (€3.25m) costs for breaching health and safety legislation and causing fuel and firewater chemicals to enter groundwater

- **British Pipeline Agency (joint venture between BP and Royal Dutch Shell)**
  - £300 000 (€374 631) plus £480 000 (€599 410) costs for breaching Seveso and health and safety legislation and causing fuel and firewater chemicals to enter groundwater
Case studies – Buncefield, England

Offences

- **TAV Engineering** (manufacturer of failed alarm)
  - £1 000 (€1 249m) plus £500 (€624) costs for breaching health and safety legislation

- **Motherwell Control Systems 2003** (responsible for installing and maintaining fuel level equipment)
  - £1 000 (€1 249m) plus £500 (€624) costs for breaching health and safety legislation
  - Motherwell entered liquidation shortly after incident

- **Total fines and costs**: £9.5m (€11.8m)
Case studies – Buncefield, England

- UK Government applied for funding from EU Solidarity Fund
  - Subsequently withdrew application because did not meet criteria for eligibility
- Report on accident recommended mechanisms to provide
  - Immediate financial support to affected communities
  - Funding to assist recovery of communities
Case studies – Aznacóllar, Spain

- **Cause of accident**
  - 25 April 1998: a dam at a 1.5 square km tailings pond at the Los Frailes pyrite mine collapsed
Case studies – Aznacóllar, Spain

**Accident**

- Acidic water and heavily contaminated slurry tailings spilled into the Agrio, Guadiamar and Los Frailes Rivers
- Water contaminated about 4,500 hectares of agricultural land; tailings covered about 2,600 hectares
- Over 50 irrigation wells were closed
- Sale of agricultural produce and shellfish affected by the spill was banned
- Most of nearby Doñana national park, a Natura 2000 and World Heritage site was saved from contamination by the emergency construction of barriers
Case studies – Aznacóllar, Spain

- Traditional damage and socio-economic damage
  - No deaths or injuries
  - Economic impacts on the agriculture industry, fishing industry, mining sector and tourism

- Losses for traditional damage
  - Operator, Boliden Apirsá (Apirsa) paid €10m compensation for claims for bodily injury and property damage
    - included €6m to farmers for damage to crops
Case studies – Aznacóllar, Spain

- Environmental damage, remediation and other costs
- By May 2002:
  - Boliden BV (parent company) had paid €96m for clean-up costs and costs from the cessation of mining activity during 1998
  - Regional Government of Andalucia had spent €145m for clean-up costs and acquisition of contaminated land
  - National Government had spent €136.7m for clean-up costs and restoration of surface water
Case studies – Aznacóllar, Spain

- Expert report prepared for Court of Sanlúcar la Mayor concluded dam failure was caused by negligence
- Prosecution brought against Apirsa, but withdrawn
- Spanish Ministry of the Environment demanded €45m from Apirsa for clean-up costs, damages and fines
- January 2005: Apirsa initiated insolvency proceedings (ongoing)
- Demand by receivers in bankruptcy to Boliden BV, Boliden AB and Boliden Mineral AB to pay monies not paid by Apirsa
Case studies – Aznacóllar, Spain

- November 2002: Regional Government filed a civil action against Apirsa, Boliden BV and Boliden AB for €89.9m in damages and clean-up costs

- 2003: following an appeal, the dismissal of the Regional’s Government’s action was confirmed

- Local government then commenced administrative proceedings against Apirsa, Boliden BV and Boliden AB concerning the same claim; Regional Government joined the claim

- 2011: Spanish Supreme Administrative Court ruled that the local government’s demands were invalid
Case studies – Aznacóllar, Spain

- May 2012: Following protracted litigation, the Spanish Supreme Court ordered the judge of first instance to resume the Regional Government’s claim for €89.9m

- 2002: Apirsa claimed against the companies responsible for the design and construction of the dam and their insurers

- January 2012: following protracted litigation, the Spanish Supreme Court rejected Apirsa’s claims
Case studies – AZF, Toulouse, France

- **Cause of accident**
  - 21 September 2001, a few dozen kilos of sodium dichloroisocyanurate (used in treating swimming pool water) was inadvertently mixed with 500 kg of ammonium nitrate in AZF’s storage warehouse for granular ammonium nitrate in Toulouse
  - Ammonium nitrate had been spilled 20 minutes earlier
Case studies – AZF, Toulouse, France

- **Accident**
  - Mixture resulted in an explosion measuring 3.4 on the Richter scale
  - Explosion caused 7m deep x 40m wide crater
  - Nitric acid and ammonia entered the River Garonne causing large-scale destruction of aquatic fauna and flora
  - Clouds of nitrogen oxide and ammonia were released over surrounding area
Case studies – AZF, Toulouse, France

- Traditional damage and socio-economic damage
  - 31 people died
  - 2 400 people were injured
  - Many buildings, including 118 schools and 27 000 flats were damaged or destroyed
  - Telecommunications and electricity networks were severely disturbed for days
  - Over 1 200 households were relocated
Case studies – AZF, Toulouse, France

– 100 000 demands for compensation from private individuals and companies
  – Included nearly 1 300 companies, representing around 20 000 employees
– Insurance paid many claims but process was protracted
– Overall, Total and its insurers paid over €2 billion in compensation for bodily injury and property damage claims
Case studies – AZF, Toulouse, France

- Environmental and other damage
  - Clean-up costs and rehabilitation of the site estimated at over €250m
    - Included over €100m spent by Grande Paroisse Group to rehabilitate the site
      - (Grand Paroisse, owner of AZF, is part of Atofina, the chemical division of Total)
Case studies – AZF, Toulouse, France

- French Government
  - Provided €24m to help reconstruct houses and public infrastructure
  - Allocated €10.4m to help companies affected by the explosion
  - Provided €1.7m to affected companies in the form of tax exemptions
Case studies – AZF, Toulouse, France

- **Offences**
  - 2009: civil trial of over 4 months against Grande Paroisse Group
  - Court of Justice of Toulouse
    - Imposed €225 000 fine against Grande Paroisse Group
    - imposed €45 000 fine against plant manager and 3 year suspended sentence
Case studies – AZF, Toulouse, France

- Offences
  - Public Prosecutor appealed
  - November 2011: new trial involving
    - 2,700 claimants
    - 60 lawyers
    - Over 200 witnesses
  - 24 September 2012: Court of Appeal
    - Confirmed €225,000 fine against Grande Paroisse Group
    - Sentenced former plant manager to 1 year in prison for manslaughter
Conclusions

Comparison of 3 case studies of industrial accidents

- All were caused by negligence
- Operators in all cases were fined for breaching law
- All resulted in traditional damage; more substantial at Buncefield and AZF than Aznacóllar
- All caused environmental damage; most substantial at Aznacóllar; substantial but less so at AZF followed by Buncefield
- All resulted in need for immediate financial support to affected communities even when insurance in place
- Governmental recovery of funding particularly difficult at Aznacóllar
- Operator entered insolvency proceedings at Aznacóllar, and Buncefield (small operator)