CENTRE OF DOCUMENTATION, RESEARCH AND EXPERIMENTATION ON ACCIDENTAL WATER POLLUTION

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Inland Waters Technical Newsletter *n°19*

LTEI 2012 - 2

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• Main oil spills worldwide

Minor pollution of a marsh with crude oil, but risk for response actions (Black Bayou, Louisiana, USA)

On the morning of 25th July 2012, an oil spill occurred in the marshland adjacent to the Black Bayou oil field (Louisiana, USA), from a well operated by Diasu Oil & Gas Co Inc. This spill, including 3 to 4 m^3 of crude oil and nearly 100 m^3 of contaminated water, occurred following the removal, the previous day, of a casing valve from the well head while it was producing, followed by a lack of surveillance of the facility overnight.

One of the main emergency actions consisted in aerial surveys, conducted by the USCG Marine Safety Unit, to monitor the spread of the pollution, which took the form of sheen in the bayou. The characteristics of the affected environment (relatively low water flow, high vegetation cover, etc.) helped to reduce the spreading of the oil. Consequently, despite the low quantity involved, the high evaporation of the oil in a relatively restricted area prevented all other response actions during the first hours following the spill. It was not until air quality monitoring measurements had indicated that there was no longer any risk for responders that they were able to conduct clean-up operations in the polluted areas.

• Spills of other hazardous substances worldwide

Hurricane Isaac and spills from oil and petrochemical facilities (Louisiana, USA)

Between 28th August and 18th September 2012 in Louisiana (USA), during and in the aftermath of Hurricane Isaac on the North American coast of the Gulf of Mexico, over one hundred spills explicitly involving oil or petrochemical products and directly linked to the hurricane were reported to the NRC[1] and to the Louisiana Department of Environmental Quality (LDEQ) by the affected operators. Only some of these reports (between 40 and 50) provide an estimation of the quantities spilt, giving a minimum total of 49,000 m^3 of pollutants or polluted waters spilt, and 190 tonnes of gas released.

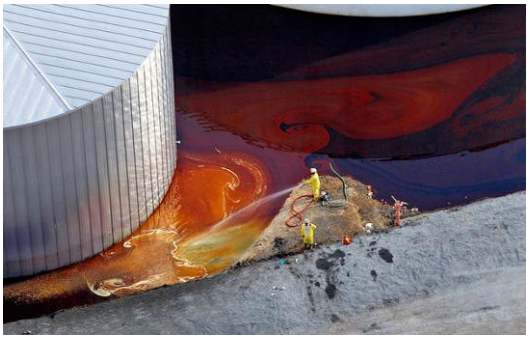
Among these events, for few of which details are provided, the most major incident appears to be the pollution of the Mississippi reported by Stolthaven New Orleans LLC, from its Braithwaite plant (Plaquemines Parish, Louisiana). On 28th and 29th August, the hurricane caused the Mississippi to breach a levee upstream of the plant, and to flood the plant under 4 m of water. It was not until the flooding subsided 6 days later that the personnel began to observe the damage suffered, in particular by the various storage tanks.

13/09/2012. Leaking tanks, at the Stolthaven New Orleans LLC chemical plant (Braithwaite), following Hurricane Isaac (Source: D Grunfeld / Times-Picayune DR)

Initially, estimating the quantities contained within the damaged structures at the time of the hurricane, and released into the Mississippi, was a delicate task. The incident report submitted to LDEQ on 4th September therefore initially indicated the rupture of one tank of octene and 2 tanks containing lubricants (lube oil), probably released into the Mississippi during the flooding (despite partial retention in the basins surrounding the tanks). This assessment evolved as on-site inspections were pursued[2], to finally result, in early October, in a total of almost 640 m^3 of pollutants spilt, broken down as follows: 310 m^3 of octene; 290 m^3 of diethylethanolamine; 35 m^3 of paraffinic oils; 5 m^3 of fatty alcohols (lauryl, myristyl, cetyl alcohol, and decan-1-ol); and 8 m^3 of paste from the neutralisation (using caustic soda) of soybean soapstock (a by-product of soybean refining).

[1] Run by the USCG, the National Response Center (NRC) is the focal point via which all releases of pollutants into the environment are to be reported to the federal government.

[2] In particular, 14 damaged storage tanks and adjacent pipes, and 142 derailed tank wagons.



13/09/2012. Setting up recovery systems for pollutants contained in the retention basins.

(Source: D Grunfeld / Times-Picayune DR)

The emergency response mainly consisted, once the flooding had subsided, in pumping the residual quantities of pollutant in the site's retention basins to a temporary storage capacity on-site, pending treatment at an appropriate facility.

Given the chemical risks involved, particular attention was paid to operator safety, thanks to ad hoc protective measures and equipment. The technical coordination of these operations was provided by an Incident Command Center, immediately set up internally by the operator. Representatives of the Louisiana State Police, Louisiana Department of Environmental Quality and the Coast Guard also joined.

Finally, before having been able to inspect all the damage, the operator had indicated in initial reports to the authorities a spill scenario based on the stocks known prior to the hurricane. This scenario[3] proved to be rather different to the final estimation, highlighting the importance of and difficulty in assessing the potential health risk in this kind of incident (for responders, local inhabitants, other personnel, etc.).

For further information:
http://www.deq.louisiana.gov/portal/Portals/0/StolthavenBraithwaite/Amended%20NOPP%20WE-PP-12-01045A.pdf
http://www.nrc.uscg.mil/default.asp?standard_web+inc_seq=1024157
http://www.gulfmonitor.org/wp-content/uploads/2013/08/Isaac.GMC_.Pollution.Report.Final_.1.2.pdf

Aniline spill from a chemical plant (Tianji Coal Chemical Industry Group, China)

On 31st December 2012, in Changzhi County (south-east of the province of Shanxi, China), the employees of a chemical plant belonging to Tianji Coal Chemical Industry Group noticed a leak of aniline from a faulty pipe. The spill, of around 40 tonnes, was mainly contained within the site retention tanks, while around 9 tonnes of the substance reached the waters of the Zhuozhang River, flowing towards the neighbouring provinces of Hebei and Henan.

The pollution was not reported to the Shanxi Government until 6 days later. It immediately mobilised its resources and response teams[4] to stop the leak and to clean-up the pollution. It later emerged that Changzhi County had in fact been informed of the incident the same day, however had under-evaluated the risks and had not reported it to the province's environment authorities until 5 days later. The mayor issued a public apology following criticism over the time taken to respond to the incident.

The aniline, an aromatic compound toxic for aquatic organisms, rapidly spread downstream, affecting the drinking water supply for the inhabitants of neighbouring villages and, with the contamination of Yuecheng reservoir, of the provinces of Hebei and Henan (supply for the cities of Handan and Anyang, respectively). Following a local, temporary suspension of production, tap water in the urban networks was declared fit for consumption by the authorities, who nevertheless warned against the use of the river's water for consumption and crop irrigation.

One week after the spill, Changzhi County reported: (i) a gradual return to normal aniline levels in the Zhuozhang River (2.15 mg/l on 6th January, compared to 72 mg/l following the incident and a national permissible concentration of 0.1 mg/l); (ii) that no impacts on the environment or on the population had been identified. In terms of impacts however, significant fish mortality was observed in the province of Hebei 5 days after the incident, according to the Emergency Water Supply Headquarters of the province of Handan.

In accordance with China's tendency, established for several years now, to take measures to prevent environmental pollution, the province's Environmental Protection Bureau announced on 7th January the dismissal of 2 managers of the Tianji Coal Chemical Industry Group (the general manager and deputy manager in charge of work safety), as well as of 2 other employees in charge of the plant's storage workshop. In addition to these sanctions, the province also ordered the industrial site to suspend production, calling for corrective measures and, more generally, an overhaul of the plant's prevention and safety procedures.

[3] An initial estimated total of approximately 720 m³ was put forward, thought to include diethylethanolamine, styrene, toluene, xylene, ethylene glycol, ethylbenzene, naphthalene, and tetraethyl lead.
[4] The types of operations implemented are not specified in the information sources.

• Spills of other hazardous substances in France

Pollution of a stream following the rupture of a storage tank of black liquor at a paper mill (Biganos, Gironde)

On 5th July 2012 at around 2:30 pm, at the Kraft *Smurfit Kappa Cellulose du Pin* paper factory (Biganos, Gironde), a vertical crack formed in the wall of a storage tank, causing a spill of 4,100 m^3 of black liquor.

This sudden major release, which occurred as the tank was being filled, caused a wave effect (with an initial height of 10 m) which, by destroying the earthen bunds (2.10 m high) of the retention area surrounding the tank, caused the substance to spread across an area of over 2 hectares within the industrial facility, requiring personnel to be evacuated and the site to be shut down.

Black liquor, a by-product of the papermaking process from the cooking of papermaking pulp, is composed of around 80% water and 20% solids, mainly organic matter (lignin and hemicellulose resides notably) as well as various inorganic compounds (including caustic soda, used as a delignifying agent). It is highly corrosive and has a high pH (between 12 and 14).

Black liquor tank, before (left) and after (right) its rupture on 5th July 2012 (Source: DREAL Aquitaine)

The substance flowed via the internal network into an emergency lagoon belonging to the plant. While the majority of the substance was contained within the lagoon, around 100 m^3 (100 to 500 according to the operator) overflowed into a trench surrounding the site then, partially, into the Lacanau stream and, less than an hour after the spill, the Leyre (tributary to the Arcachon basin, and whose valley is classified as a Natura 2000 and ZNIEFF site[5]). Alerted as to this pollution by local inhabitants, the mayor informed the fire brigade and the Arcachon sub-prefecture, which activated an incident command post gathering the services and local stakeholders concerned. Initial surveys showed that the pollution extended over a 2 km stretch in the Leyre, colouring the water brown and forming foam at the surface.

The paper mill operator immediately activated its water pumping station in Lacanau to transfer as much contaminated water as possible (over 16,000 m^3) to an emergency lagoon on the site (before diluting it with 70,000 m^3 of fresh water). After obtaining the required authorisation in July, this contaminated water was disposed of according to the provisions in force before the incident (relating to processing at the site's treatment and purification station, before being released into the sea).

In addition to pumping, the locks on the Leyre were closed to stop the pollutant from spreading into the Arcachon basin (economically sensitive – aquaculture, etc. – and therefore a protection priority).

Given the potentially corrosive nature of black liquor, late afternoon on the day of the spill, the authorities issued a temporary ban on bathing and navigation in the Leyre. As there was no drinking water abstraction in the polluted area, there was no impact on the water supply. Oyster farmers in the Arcachon basin were informed of the spill by the authorities.

In the environment, pH measurements were taken jointly by the fire brigade and the operator in the days following the incident, at several points in the 2 affected watercourses and in the Arcachon basin. These measurements showed a rapid but temporary rise in pH in the Leyre. After having peaked at 11.5 on the day of the incident, the values returned to normal between the end of the day and the following day – on the Leyre and in the Arcachon basin: the incoming tide and spring tides at the time of the spill probably diluted the pollutant and buffered its effect (in fact, no pollution was observed in the Arcachon basin). Nevertheless, 2 hours after the spill, the basicity of the black liquor locally caused high fish mortality, notably affecting elvers and adult eels according to ONEMA (French National Agency for Water and Aquatic Environments). The day after the incident, 300 kg of dead fish had been collected between Lacanau and the Leyre. This was the only significant impact reported, due to the dilution of the pollution downstream, in particular in the Arcachon basin.

The day after the incident, an emergency order was issued to the operator to implement the following actions:

- recover and dispose of the products released (1,500 tonnes of contaminated earth was

[5] Zone Naturelle d'Intérêt Ecologique Faunistique et Floristique (natural area of special ecological interest for flora and fauna)

excavated and stored on-site prior to treatment)
- conduct a survey of the areas affected by the incident
- submit an impact study for the incident covering 4 environmental components (surface waters, sediment, ground water and soil)
- propose remediation measures
- identify the causes of the incident and the corrective measures prior to resumption of production.

Authorisation to resume production was issued on 23rd August, after a 7-week suspension period (including partial resumption to allow the treatment of the effluents contained in the retention basin, completed on 19th August in compliance with the environmental requirements laid down by the authorities).

The authorities also recommended the establishment of a Monitoring Committee for the Smurfit site, a body in charge of information provision and discussions over the actions implemented by the operator, following the resumption of production, gathering a panel of local inhabitants composed of representatives of various local associations (e.g. fishermen, oyster farmers, etc.). Among these actions was the implementation of a long term monitoring programme for the watercourses affected by the spill (according to a protocol defined in collaboration with the regional marine park and nature protection associations), to fine-tune the impact assessment and possible remediation measures – all these efforts coming under the application of the French Law on Environmental Responsibility.

In September 2013, the operator's penal liability for the tank rupture was rejected by Bordeaux criminal court, dismissing hypotheses about the tank being in dilapidated condition and of negligence by the paper mill, therefore acquitting the operator. The parties claiming civil damages decided to appeal this decision.

• Past spills

Spill of a heavy substance and long term response (Enbridge pipeline, Michigan, USA)

On 26th July 2010, Enbridge Energy Partners LLP reported a pipeline rupture near Marshall (Michigan, USA) and a resulting spill of over 3,000 m^3 of diluted bitumen (dilbit) into Talmadge Creek and the Kalamazoo River (see LTEI n°15).

The following day, in accordance with the mechanisms in force in the United States, the US EPA (Environmental Protection Agency) took charge of supervising incident management, involving representatives of various levels of US administration (federal, State and local) and the industrial firm. Within this context, and according to the provisions of the Clean Water Act, EPA ordered Enbridge to conduct clean-up operations based on a precise schedule, as well as assessment actions for the contamination and potential impacts. Many recovery operations on the water and on-land sediment clean-up actions were conducted for over a year, although the initial deadline defined by EPA for the end of operations of 31st August 2011 could not be met. In particular, major deposits of sunken bitumen or bitumen trapped in sediment remained at this date in 3 operational areas: Ceresco Dam, Mill Pond, and Morrow Lake & Delta.

"Poling" operations georeferenced to locate/map sunken deposits (Source: US EPA)

In 2012, these deposits required major operations involving sediment removal (by dredging or excavation after dewatering), treatment, etc., meaning that they had to be continued the following year. Thus in March 2013, EPA defined a new deadline of 31st December 2013 for the completion of work in these 3 areas, through a new administrative order issued to Enbridge, together with an action plan (2013 Submerged Oil Removal and Assessment Work Plan)[6].

The remaining quantity of submerged bitumen was estimated at 680 m^3; of this between 50 and 80 m^3 was considered recoverable by EPA without inflicting significant impacts on the ecosystem.

[6] http://www.epa.gov/enbridgespill/pdfs/20130625/enbridge_workplan_20130513_2013sora.pdf

In addition to the removal work, sediment traps were set up in 2013 to capture any remobilised accumulations of bitumen (naturally or due to dredging operations). Located in selected areas (calm waters, conducive to deposits), these systems were composed of submerged and anchored beams, or trunks, attenuating the current and accentuating settling phenomena. The idea was to conduct recovery operations (e.g. dredging/pumping, sorption, etc.) at regular intervals to remove any deposited oil. To control the efficiency and utility of these systems (destined to be left in place for several years if need be), sedimentation collectors (sorts of earthen vases set into concrete-weighted blocks) were installed, and their content was regularly removed and sent to a laboratory for analysis.

Sediment traps, indicated by buoys on a selected section of the Kalamazoo River

(Source: L. Smith/Michigan Radio, DR)

While 2 of the 3 areas were successfully cleaned up in 2013, bitumen accumulations in the Morrow Lake still needed to be treated as the end of the year was fast approaching. In November 2013[7], the industrial firm therefore applied for permission to suspend work during the winter of 2013-2014, and to establish a new scheduled, justified by: (i) the difficulties encountered to locate appropriate sites[8] to store and treat the dredged sediment; (ii) technical obstacles for the implementation of alternative excavation strategies for polluted sediment. EPA rejected this request[9] based on the reasoning that the technical basis of Enbridge's arguments was questionable and that extending the deadline could delay the resumption of activities and uses of the affected areas. The agency thus instructed Enbridge to locate an appropriate site (or, failing that, a combination of smaller sites) as soon as possible, and to promptly complete the necessary dredging operations, considering all technical options enabling operations to be pursued during the winter, while complying with the technical recommendations laid out in the action plan defined in March 2013.

Permission to set up a "dredge pad", a storage and treatment area for the dredged sediment, was granted in February 2014 by Comstock Township Planning Commission. Authorisation was provided for use until the end of November 2014, to finalise operations in the Morrow Lake & Delta area. Preparation work began in this area in Spring 2014, in anticipation of dredging operations to be conducted during the summer.

The work carried out since the order of March 2013, i.e. between July 2013 and February 2014, resulted in the recovery of 98,000 m^3 of waste for the Ceresco Dam area, 17,000 m^3 for the Mill Pond area, and 670 m^3 for the Morrow Lake & Delta, with operations still ongoing at the time of writing. Almost 4 years after the spill, this experience illustrates the difficulties in treating spills of substances which tend to sink, and the problem of the resumption of site uses and activities – here several areas were still closed at the end of April 2014.

In July 2012, the enquiry into the causes of the incident by the federal Pipeline and Hazardous Materials Safety Administration (PHMSA) led to the highest fine issued by the Department of Transportation to date: US$3.7 M (nearly €2.7M) for Enbridge, suspected of no less than "22 probable violations" to safety regulations, several of which occurred within the pipeline control room at the beginning of the incident (“disorganized control room and bullying of inexperienced staff”).

For further information:
http://www.epa.gov/enbridgespill/
http://www.michigan.gov/deq/0,1607,7-135-3313_56784---,00.html

• Review of significant spills having occurred worldwide in 2012

This review is based on an inventory of incidents in 2012 recorded by Cedre having led to a spill of over an estimated 10 tonnes, for which sufficient information was available. We remind readers that, for a certain number of incidents, the volumes spilt are not known or divulged by our information sources, although they clearly exceed the 10-tonne mark; these missing data should therefore be borne in mind and could affect the balance of the results presented below.

[7] http://www.epa.gov/enbridgespill/pdfs/enbridge-letter-20131111-request-morrow-dredge-extension-enclosures.pdf
[8] i.e. meeting all the following criteria: significant distance from private homes; minimum impact on local economic activities; avoidance of unwarranted disturbance or interference with local community activities; sites approved as Heavy Industrial Zones or suitable for obtaining a Special Use Permit.
[9] http://www.epa.gov/enbridgespill/pdfs/enbridge-letter-20131121-denial-delta-extension.pdf

Spill sources

In 2012, 29 incidents resulting in significant water pollution were identified, of which only 10 occurred in the 2nd half of the year.

This number is one of the lowest annual totals recorded using the same approach since 2004 (with an annual mean of around 40 spills for the period 2004-2011). The total quantity of oil and other hazardous substances spilt in inland waters was just under 12,500 tonnes[10]. This estimation is close to that of 2011 (Fig. 1) and, more generally, roughly comparable to the annual medians expressed for the periods 2004-2007 (19,900 tonnes) and 2008-2011 (16,800 tonnes). Despite a lower value in 2012, we should be wary of concluding, at least at this stage, in a downward trend in the quantities spilt in inland waters.

Spills in inland waters worldwide:
annual quantities (tonnes) recorded by Cedre between 2004 and 2012

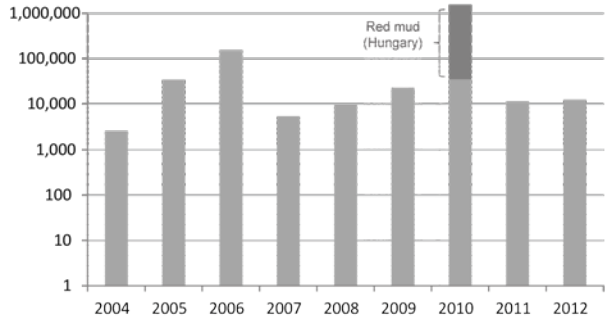


Figure 1

The largest spill identified in 2012 (several thousand m^3) was the Rio Guarapiche spill in the Venezuelan State of Monagas[11], followed by those, of over 100 tonnes, from: the Stolthaven Braithwaite Terminal in the United States in August (around 700 tonnes; see above); 2 oil facilities in Alberta (Canada) in May and June[12]; a black liquor storage tank at a French paper mill in July (see above).

Storage facilities (oil facilities, factories, etc.) were the most frequent source (24 %) of spills in 2012, closely followed by **pipelines** (involved in approximately 21 % of cases) (Fig. 2).

Ships caused 17 % of incidents in 2012, followed by **tanker trucks** and **internal pipes** at oil or industrial facilities, in roughly equal proportions (approximately 14 % of cases).

The other sources identified (tank wagons, wells, etc.) each represented less than 5% of significant spills for the year (Fig. 2).

Spill frequency by source type

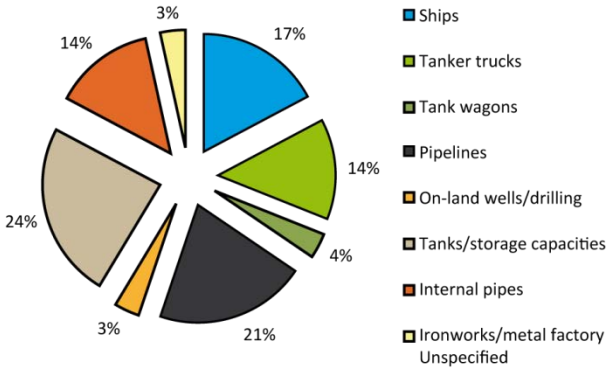


Figure 2

In terms of quantities, and in line with the observations of previous years, we note the major share (over 80 %) of **pipelines** in the 2012 total (Figure 3). The most significant spills (for which detailed information is available) from such structures were those in Venezuela in February and in Canada in June[13]. The lack of detailed or reliable information on the quantities spilt for several other cases means that the share of these structures in the annual total is probably underestimated.

The other main contributors to the sum total were **storage facilities** and **internal pipes** at on-land facilities – mainly oil facilities – each representing around 8% (i.e. around

Quantities spilt (tonnes) by source type

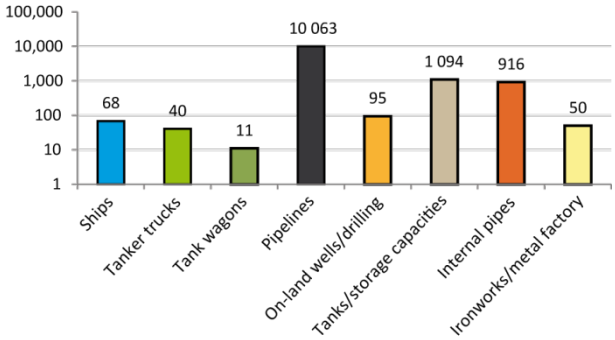


Figure 3

[10] Minimum estimation due to a lack of detailed data for several incidents.
[11] Spill, in February, of around 9 000 m^3 of crude oil caused by a crack in a pipeline belonging to the State-owned company PDVSA (see LTEI n°18).
[12] Approximately 800 m^3 spill of crude oil in the wetlands around Rainbow Lake in May, then of between 460 and 470 tonnes of light crude oil in Red Deer River (see LTEI n°18).
[13] Incidents respectively involving the pipeline operated by Petroleus de Venezuela SA (PDVSA) and Rangeland Pipeline (operated by Plains Midstream Canada) (see LTEI n°18).

1000 tonnes; see Fig. 3).

The other structures involved each represented less than 1% of the total quantity spilt; in 2012 once again, spills by **tanker trucks** fell into this category, as, although they were relatively frequent, they involved small quantities and therefore only represent a minor share of the total.

Types of substances spilt

In 2012, like in previous years, the vast majority of pollutants spilt were oil (around 90 %) (Fig.4).

Crude oils represented the greatest quantities by far: involved in 7 incidents, the majority (over 85 %) of their contribution was due to the incident in Venezuela in February[14].

The other oil products identified only contributed to a small extent to the total quantity spilt during the year (1 % each for **white oils** and water containing **unspecified oil**, or even less for other heavy refined products).

Once again in 2012, the quantity of chemicals spilt was lower than that of oil products.

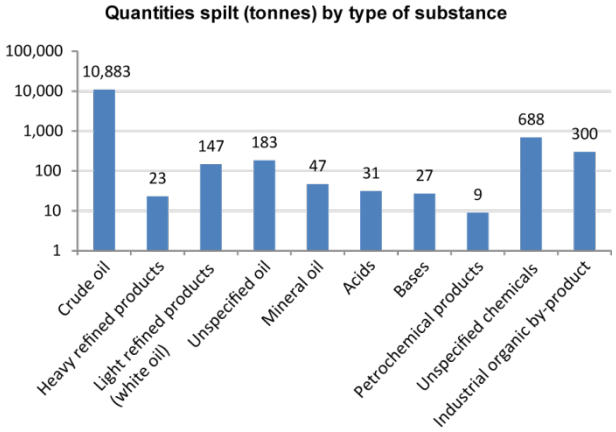


Figure 4

2 main categories, representing over 100 tonnes, can be mentioned with respectively 6 % and 2 % of the annual total: one of these was a spill of water containing various toxic compounds (**unspecified**) caused by the flooding of a petrochemical plant in New Orleans (Louisiana, US) following Hurricane Isaac in August 2012 while the other was a black liquor spill (**organic by-product** of the papermaking process) following the collapse of a storage tank near the Arcachon basin, France, in July (see above).

Causes

First we note that the cause – or event – responsible for the spill was not indicated or unknown in our information sources in nearly a third of the cases recorded in 2012 (Fig. 5), jeopardising the accuracy of the following analysis.

When the cause was specified, the distribution of the frequency of causes suggests the prevalence, in 2012, of leaks due to faulty equipment (**wear, cracks, corrosion**) (around 25 %), mainly internal pipes and storage capacities.

Road accidents, involving tanker trucks, caused around 15 % of spills in inland waters. **Weather conditions**, **ship collisions** (for unspecified reasons) and **acts of vandalism/sabotage** represented 7 % of all incidents.

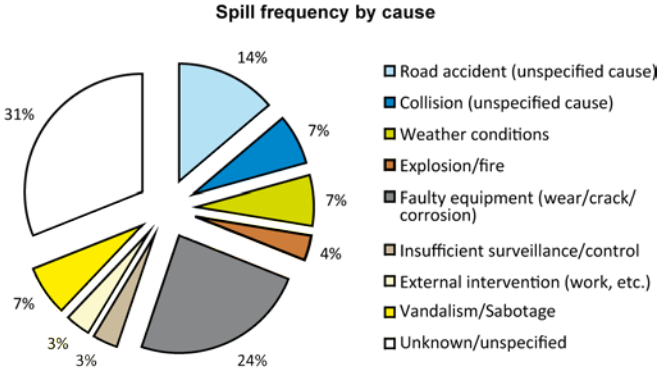


Figure 5

With the exception of **explosions/fires**, the frequency of other causes identified was less than 4 % (Fig. 3).

[14] Rupture of a pipeline belonging to the State-owned company PDVSA, polluting the Guarapiche River (see LTEI n°18).

In terms of the quantities spilt, **explosions/fires** were the number one cause in 2012 (57 %; Fig. 6), due to the explosion having caused the rupture of a pipeline and the pollution of the Rio Guarapiche with thousands of tonnes of crude oil (Venezuela; see LTEI n°18).

Weather conditions, although the cause of relatively few cases, were the 2nd cause identified in terms of quantity (approximately 6 % of the annual total), followed by **faulty equipment** (4 %) – a more frequently reported cause (see above).

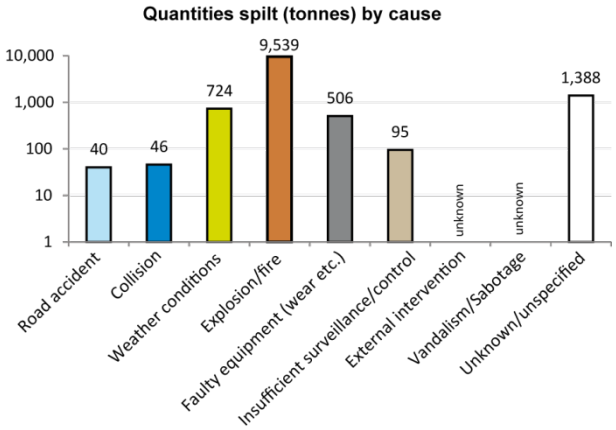


Figure 6

The respective contributions of other types of causes, when the volumes were indicated, do not exceed 1 % of the annual total. This observation suggests here the low volume of spills caused by the most frequent types of incident (see Fig.), i.e. those caused by road transport (**road accidents** involving tanker trucks) or river transport (ship **collisions**).

• Response equipment

Remote sensing

Remote sensing by compact sensor unit

OceanEye is a remote sensing system for detecting floating oil by both day and night, in the form of a small helium-inflated balloon, developed by the Norwegian firm Maritime Robotics AS, which provides a relatively high observation point (maximum altitude of 140 m).

It has a payload capacity of 3 kg, partly reserved for its cameras: high definition video and uncooled infrared[15], whose images are transferred live by radio to the vessels present on site. It has a range of around 7 km (4 nautical miles) at 120 m altitude.

Imagery (visible and IR) acquired by OceanEye (Screenshot/Source: NOFO)

OceanEye, developed through a research and innovation programme[16] funded by the Norwegian Coastal Administration and NOFO[17], was tested and finalised in 2012 and 2013 during NOFO exercises at sea, during which it attracted great interest from international participants according to the Norwegian cooperative, with results ranking it as a "good operational tool" in conditions of low visibility (fog, dark, etc.). The device was first marketed in the 2nd half of 2013[18].

Testing OceanEye offshore (Source: Maritime Robotics)

Despite initially being designed for spill response in offshore or inshore waters, this compact system with its small footprint (120 x 80 cm on the ground[19]; 1.60 m high) does not restrict it to this sole use, meaning that it can be installed on small vessels (see right-hand photo) for deployment in shallow waters and in environments such as rivers, lakes, estuaries, etc.

Deployment from a small boat (Source: Elastec)

For further information:
http://www.maritimerobotics.com/products/oceaneye/

[15] (less expensive, requiring less maintenance, and with a theoretically longer life time than cooled models)
[16] Oil Spill Response 2010
[17] Norwegian Clean Seas Association for Operating Companies
[18] distributed in America by Elastec/American Marine.
[19] equivalent to that of a EUR-EPAL standard pallet

http://www.elastec.com/oilspill/oceaneye/

Containment

Floating booms with zip connections

The French firm Eurofilet manufactures floating booms for various applications: protection against jellyfish, litter, but also spill containment.

To contain surface spills, the company offers 3 models (BS200, BS250 and BS300) of permanent booms – with buoyancy provided by expanded polystyrene cylinders – with increasing dimensions. Sold in 20 m sections, they have a freeboard of 20, 25 and 30 cm and skirt lengths of 50, 70 and 80 cm. A sheath 20 cm in diameter runs along the bottom of the skirt for chains of suitable weight according to the required use (calm waters or strong currents) to be inserted.

One of the originalities of the models produced by this manufacturer resides in the boom section connection system, which uses industrial marine zippers, claimed to withstand tensile loads of 4 to 8 tonnes per metre. The sought advantage is to be able to deploy the boom without any tools, while ensuring an efficient oil-tight seal.

Close-up of the S140 connection system (Industrial Marine Zipper) (Source: www.eurofilet.fr/)

Other models (BS250S and BS300S) also exist which, with the addition of submerged curtains, are designed to contain (up to a depth of 12 m according to models) sediment and matter in suspension – for use in the case of maritime operations (e.g. port development work, etc.).

For further information:
http://www.eurofilet.fr/

Recovery

Grooved oleophilic disc skimmer

Following the Macondo well blow-out in the Gulf of Mexico in spring 2010 (see LTML 29-30), the private foundation X Prize, with support from Shell, launched a competition known as the Wendy Schmidt Oil Spill Cleanup X Challenge, the aim being to promote the emergence of more efficient offshore recovery equipment than that used in response to this spill, considered disappointing.

The challenge given to the manufacturers taking part in this competition was to develop equipment meeting minimum performance requirements in terms of rate (10 m^3/min) and selectivity (water content not exceeding 30 % in the recovered liquid). The performance of the resulting equipment was measured in controlled conditions during trials run at Ohmsett[20].

First prize was awarded (in late 2011) to a new model of oleophilic skimmer, manufactured by Elastec/American Marine, with an average measured recovery rate of 18 m^3/min and an average selectivity of approximately 90 %. The commercially released model, baptised X 150, was launched in spring 2012 (unveiled at Interspill in London in March) and was also tested at Ohmsett in May.

Close-up of the grooved surface of the Elastec X150 skimmer's oleophilic discs (Source: Cedre)

Based on a similar principal to that applied by the brand to its groove drum skimmer (see LTML 2006-2), this is a modified version of a disc skimmer in which each of the faces features grooves, increasing the contact surface between the oelophilic coating and the oil.

[20] Oil and Hazardous Materials Simulated Environmental Test Tank, located in Leonardo, New Jersey (USA). Ohmsett is maintained and operated by the Bureau of Safety and Environmental Enforcement (BSEE), an agency under the United States Department of the Interior.

View of the X150 skimmer's two rows of discs (Source: Cedre)

The X150, smaller in size than the prototype, features 2 axes each bearing 5 grooved polyethylene discs, housed within a 2 m x 3 m steel frame. According to the manufacturer, the skimmer has a recovery rate of 150 m^3/hour (hence the model's trade name).

The skimmer can be used statically, or can be equipped with booms (acting as arms in a V-formation to concentrate the oil) to be used dynamically even in strong current.

For further information:
http://www.elastec.com/

• Legislation/Convictions

Damages for spills of hazardous substances

In April 2009, a faulty seal on a pipe led to a spill of 98 % sulphuric acid within a nickel processing plant (Vale Inco) in New Caledonia's South province. Due to a defective retention basin, several m^3 of acid spilled into a watercourse (North Bay Creek), causing a sudden drop in pH and fish and shrimp mortality (see LTEI n°12).

The company was fined 300,000 CFP francs (around €2,500) by the Nouméa court of appeal, but, in late 2013, the lawyers of environmental protection associations – stressing a lack of action by the relevant institutions – decided to plead before the civil chamber of the court of appeal in favour of a "true financial sanction" (700 million CFP francs). Thus in February 2014, the firm was fined 40 million CFP francs (€335,000), for "environmental damage", to be paid to 5 associations claiming civil damages.

In October 2010, due to heavy rainfall, the leaching of agricultural land (vegetable fields) in Plougoulm (Finistère), recently sprayed with insecticide (Trimaton extra, i.e. metam sodium), polluted a watercourse (the Guillec) and caused high fish mortality at a fish farm situated 5 km downstream (see LTEI n°15).

In January 2011, Brest's chief prosecutor initially filed the complaint made by the Saint-Pol-de-Léon AAPPMA (fisheries and aquatic environment association) without taking any further action. Eight associations then filed for civil damages in a direct committal proceeding against the farmer and his company.

In early November 2012, the court of Brest demanded a €82,000 settlement to be paid to the parties claiming civil damages, broken down as follows: €50,000 for ecological damage to the Saint-Pol-de-Léon AAPPMA; €1,000 to €5,000 for non-material damages to each association claiming damages; €9,000 for material damage to the Finistère fisheries and aquatic environment federation. Another court case will however take place, as this sentence was appealed by the responsible party.