CENTRE OF DOCUMENTATION, RESEARCH AND EXPERIMENTATION ON ACCIDENTAL WATER POLLUTION

715, Rue Alain Colas, CS 41836 - 29218 BREST CEDEX 2 (France)
Tel: +33 (0)2 98 33 10 10 Fax: +33 (0)2 98 44 91 38
Email: contact@cedre.fr - Website: www.cedre.fr

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• Main oil spills worldwide

Oil well gathering line rupture (Cimarex Energy Co., US)
On 1st August, in Culberson County (Texas), an oil well operator (Cimarex Energy Co.) reported the rupture of a gathering line at one of its facilities (Assault 14 Fee Salt Water Disposal), causing a spill of approximately 2,800 m^3 of oily water into the surrounding environment, affecting the Delaware River, which flows into the Pecos River. The operator and its contractors responded to the spill by implementing containment operations using booms and recovery operations with sorbents.

Severe weather events and spills from oil facilities (Hurricane Harvey, US)
On 29th and 30th August 2017, at least four oil facilities in DeWitt County, Texas, were washed out due to Hurricane Harvey, and more specifically after the Guadalupe River burst its banks: - The authorities were notified of the flooding of two ConocoPhillips oil storage sites, where at least three storage tanks had leaked an estimated 60 m^3 of an unspecified type of oil and 10 m^3 of produced water. - Not far from there, two Burlington Resources Oil and Gas sites reported crude oil spills, estimated at approximately 50-60 m^3 each, from flooded storage tanks, in Westhoff and Hochheim. Given the context surrounding these incidents, caused by a natural disaster, the oil spill response was greatly limited–if not prevented–by (i) other priorities related to the management of a disaster of this scale (human safety and assistance), and (ii) the need for the authorities to wait for the water to recede to assess the situation and the necessary action (not specified in our information sources). On 31st August, near Galena Park (Texas), Magellan Midstream Partners notified the Federal and State authorities of a petrol (gasoline) spill in a watercourse next to the Houston Ship Channel. The spill, also triggered by storage tank flooding due to Hurricane Harvey, was initially estimated at around 160 m^3 (1,000 barrels), but estimations were revised a week later to nearer 1,750 m^3 (10,988 barrels). We have little detail of the response operations, however we note that containment equipment was deployed to prevent the oil from reaching the Houston Ship Channel and, consequently, foam was applied to mitigate explosion (and health) risks due to the volatile organic compounds released from this type of light product with a high evaporation rate. Soil excavation operations were necessary within the industrial site. In terms of crisis communication, the authorities faced criticism from various associations which decried a lack of public communication and information (given that the zone affected by the vapours was an urban area).

• Spills of other substances in France

Large slurry spill and fish mortality (farm, Pédernec, Côtes d'Armor)
On 8th April 2017, on a pig farm in the Côtes d'Armor area (municipality of Pédernec), the excessive pressure exerted by the contents of a slurry pit led to the collapse of one of its walls, resulting in an instantaneous spill of 600 m^3 of agricultural effluent. Although straw bales were laid in the areas of slurry accumulation, thereby limiting the pollution of the stream running below the farm, it is estimated that some 400 m^3 flowed into the Jaudy River. Fish mortality was observed in the impacted waterways along a 13 km stretch, affecting several groups and species (bullheads, loaches, eels, lampreys, trout, salmon, etc.), including certain protected species according to the environmental organisation Eau et Rivières de Bretagne and two fishing associations. Despite a temporary shutdown of the Pont-Morvan pumping and water treatment plant (Pontrieux), the incident did not have any impact on the water supply.

• Main spills of other substances worldwide

Dilapidated wastewater system and pollution of a transboundary river (Tijuana, Mexico)
In early February 2017, a major spill from the wastewater treatment system near the city of Tijuana (Baja California) caused pollution of the river of the same name in this area located on the border of Mexico and the United States. This transboundary pollution affected Imperial Beach (US), at the point where the river runs into the Pacific Ocean. According to an investigation report issued by the International Boundary and Water Commission

(IBWC), the incident was caused by the bursting of a dilapidated pipe in the Tijuana wastewater system, resulting in an estimated spill of at least 106,000 m^3 (28 million gallons) of wastewater,[1] the flow of which was subsequently impeded by (i) a pipe system comprising numerous blocked or collapsed pipes, and (ii) sewer overflow following heavy rainfall in the greater San Diego area.

Spill of mineral-based fluid in a wetland (Rover Pipeline site, US)

In April 2017, a spill estimated at approximately 7,500 m^3 of bentonite drilling fluid occurred in a wetland near the Tuscarawas River in Stark County (Ohio). The incident occurred at one of the construction sites of a gas pipeline (the Rover Pipeline project, running over 1,000 km between southeast Ohio and southern Michigan). The operator, Energy Transfer Partners, reported an unexpected backflow of fluid in the pipeline during horizontal drilling operations. In November 2017, a similar incident related to this same project resulted in a minor spill into a tributary of the Mohican River in the same state (Black Fork River, Ashland County).

Although involving a non-toxic mineral, as confirmed by the Ohio Environmental Protection Agency, such unauthorised spills nonetheless constitute a violation of the Ohio Water Pollution Control Act. A succession of similar cases between the spring and autumn of 2017 prompted the Ohio Attorney General to bring charges against the owner and operator of the gas pipeline. Another leak of approximately 550 m^3 of bentonite drilling fluid occurred in January 2018 near the Tuscarawas River.

Spill of water-soluble fertiliser due to failure to follow procedures (Southern Towing barge, Kentucky, US)

On 19th December 2017, approximately 1,500 m^3 of mineral fertiliser spilled into the Ohio River from a barge belonging to the company Southern Towing, docked at the time near the cities of Hebron, Kentucky and Cincinnati, Ohio. The incident was attributed to human error, an inappropriate unloading procedure having resulted in the weight of the cargo being concentrated in the middle of the structure, mechanically deforming the hull and causing the cargo to leak.

Given the water-soluble nature of the substance, the implementation of response operations was considered inadvisable. The relatively large extent of the spill nevertheless prompted the Louisville public water treatment plant, located more than 120 km downstream, to take precautionary measures (not detailed in our information sources) to prevent the pollution of the city's water supplies. A claim for US$41,000 (over €35,000) was subsequently made against Southern Towing for the associated costs incurred by the Louisville Water Company.

• Past spills

Feedback: in-situ burning in oiled marshes in 2014 (Louisiana, US)

In the United States, controlled in-situ burning (ISB) is one of the techniques used for the clean-up of oiled marshes, which are sensitive areas, where it is considered both effective and less damaging than more "intrusive" techniques (e.g. manual or mechanical cleaning). While several types of marshes have already been treated using ISB and these cases documented, the lack of published data on *Phragmites australis* reed marshes (a non-native and invasive species) led to the publication of a study on the restoration of this type of vegetation, commonly found in estuarine marshes in oligohaline areas throughout the world.

The study was conducted at a sensitive site[2] that had been oiled in May 2014 following a spill of some 15 m^3 of crude oil partly trapped in a flooded reed bed (50 cm of water) over an area of around 6 hectares. One third of this area, the most heavily oiled part, had undergone ISB operations at the beginning of June 2014.[3]

The study was based on the comparative analysis of sites corresponding to three types of treatment ("control", i.e. unoiled/unburned; oiled/unburned; oiled/burned), for which the oiling levels observed at the start of monitoring were established (vertical spread of the oil and percent stem cover). The descriptors examined related to the contamination of the substrates (total PAHs) on the one hand,

[1] The IBWC report also mentioned the possibility that some 256 million gallons of wastewater had leaked from the system between January and February 2017.
[2] Delta National Wildlife Refuge (Louisiana), an area managed for wildlife conservation purposes.
[3] These operations were considered a success, with an estimated oil "removal" rate of 80-90%.

and the structure of the phytocenoses on the other (e.g. percentage plant cover–both specific and all species combined–and dominance ratios between the various species within the assemblages). The evolution over time of these descriptors was assessed by sampling performed in June 2014 just after the burn operations (considered as T_0 for this monitoring), and then annually between September 2014 and September 2016.

Briefly, based on the statistical analysis of the data obtained, the authors drew the following conclusions:

- The elimination of the residual oil (floating, stranded, and on vegetation) as a result of the ISB operations was significant. It should be noted, however, that at T_0, total PAH levels were significantly higher in the sediment of the sites that had undergone ISB operations, a result attributed to the initially higher levels of oiling at these sites. These levels decreased to the same level as the control sites (i.e. background conditions) within 3 months following the burning operations.
- Due to (i) the insignificant effect of the oiling on the unburned sites, and (ii) the presumed higher initial level of oiling in the areas that underwent ISB operations, it was not possible to discriminate between the effects attributable respectively to the oiling and to the ISB. It is clear, however, that their combined effects considerably affected the vegetation at the treated sites, preceding a rapid recovery of a vegetation cover comprising an assemblage of mixed indigenous species (aquatic herbaceous species including in particular the genera *Sagittaria*, *Pontederia* and *Zizania*), to the detriment of the allochthonous *P. australis*. Although the restoration process was under way, the dominance of this species had still not been re-established at $T_{+3\ years}$.

The study shows that the marshes treated by ISB resulted in the establishment of a diverse plant community. These operations can thus be considered to have a positive effect through the emergence of a heterogeneous and functional habitat, in comparison with otherwise more common marsh areas due to the proliferation of Phragmites. While the dominance of the latter may eventually (if not probably) be re-established on the burned sites, the study indicates that the restoration process for this species will take several years.

Depending on the parameters examined, this monitoring suggests that, while ISB may prove an effective operational strategy for eliminating oil pollution, its effect as a mitigator (as in this case) of the impact on plant assemblages should also be assessed taking into account the restoration potential of the dominant species. This factor must therefore be considered when deciding whether or not to implement ISB, along with the relevant contextual elements (depth of water to protect soil and rhizomes, level of oiling, etc.). It should also be noted that, in weighing up the perceived benefit of restoring a diversified habitat following a given response option, the authors raise the question of the nevertheless structuring role of the invasive species *P. australis* within the context of marsh erosion characterising the vast Mississippi Delta region.

For further information:

Zengel S., Weaver J., Wilder S.L., Dauzat J., Sanfilippo C., Miles M.S., Jellison K., Doelling P., Davis A., Fortier B.K., Harris J., Panaccione J., Wall S. & Nixon Z., 2018. Vegetation recovery in an oil-impacted and burned *Phragmites australis* tidal freshwater marsh. *Science of the Total Environment*, Volume 612, 15, Pages 231-237. https://doi.org/10.1016/j.scitotenv.2017.08.221

• Review of significant spills having occurred worldwide in 2017

This review is based on the spills recorded by Cedre in 2017 involving volumes greater than or equal to 10 tonnes and for which sufficient information was available for statistical analysis. For a certain number of incidents, the volumes spilt are unknown or were not specified in our information sources, although the data available shows that they were clearly in excess of the 10-tonne figure. These knowledge gaps and lack of precise information undoubtedly limit the accuracy in the interpretation of the results presented below.

Spill sources

In 2017, 31 incidents followed by significant spills (≥ 10 t.) were identified in inland waters, a value below the median for the entire period 2004-2016 (37, based on similarly collected data), and below the median for each sub-period: 40 for 2004-2010 and 35 for 2011-2016. In line with the figures for 2016, the year 2017 would therefore appear to be a year during which the number of significant incidents identified by Cedre was slightly lower than that of previous years, and particularly prior to 2010. Analysis of the data suggests a trend towards a stable level, and even a slight decrease in the number of spills greater than 10 m^3 reported in our information sources.

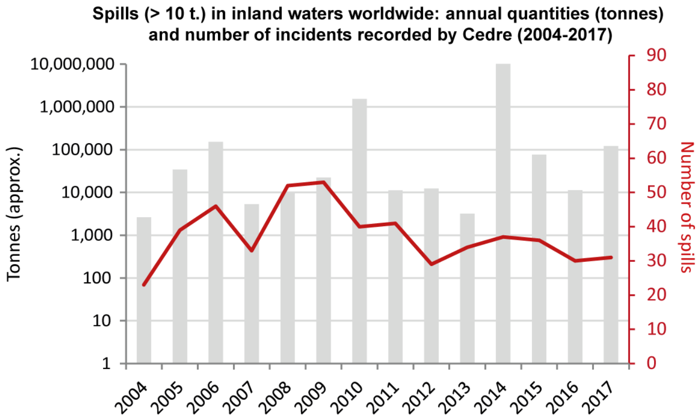


Figure 1

These incidents represented a total quantity of just over 120,000 tonnes of oil and other hazardous substances spilt (Fig. 1), an estimation well above the annual median expressed for the period 2004-2016 (around 12,000 tonnes).

However, this high value should not be interpreted as the result of a year marked by major spills, as this figure is largely attributable to a single event, namely the spill of more than 100,000 tonnes of wastewater from a Mexican water treatment plant in February 2017 (see above).

The estimated median volume of spills for the year shows that the spills in 2017 were distributed around a median value of 70 tonnes. With the exception of the above-mentioned incident, only 5 spills involved volumes of over 100 tonnes, with 4 of these being in excess of the 1,000-tonne mark.

In 2017, **onshore oil facilities** were the most frequent source of significant spills in inland waters known to us, accounting for almost 40% (with 16% from oil storage sites and the same proportion from wells; Fig. 2). The next frequent sources were **land pipelines**, **vessels** (especially tank barges), and **various onshore facilities** (with agricultural facilities at the top of the list), each of these categories responsible for 13% of the events (Fig. 2).

Onshore industrial facilities were the cause of around 10% of the events (related to spills at **power plants** and various industrial sites – in this case both chemical/petrochemical plants and metal works), a frequency equivalent to that of **tanker trucks** (Fig. 2).

Given the patchy nature of the data identified in terms of volumes spilt, the relative shares of the overall total volume cannot be accurately established, with some of these shares evidently being underestimated (Fig. 3).

Despite this reservation, and excluding the overwhelming share in the total volume (Fig. 3) attributable to **water treatment/purification plants** (related to the single wastewater spill event mentioned above), we note the share of **land pipelines** at nearly 7,700 tonnes (largely attributable to a spill of bentonite drilling fluid during a pipeline construction incident in the United States; see above). The second visible share is that of **wells**, representing around 20% of the total quantity spilt (Fig. 3).

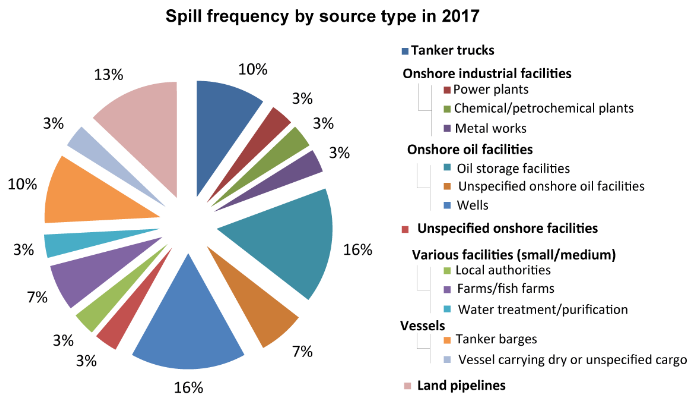


Figure 2

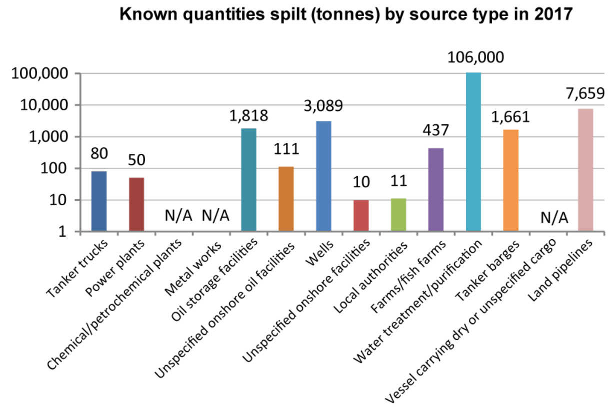


Figure 3

This was due to five incidents involving **wells**, most of which resulted in moderate spills (from 1 to a few dozen tonnes), but one of which caused a spill of more than 2,500 tonnes of produced water (rupture of a gathering line on a well in the United States; see p.2).

Oil storage sites represented around 12% of the total quantity (expressed excluding **water treatment/purification plants**). This share can be accounted for by five spills, one of which was around 1,000 tonnes according to our information sources (in the US, following the passage of Hurricane Harvey along the Texas coastline at the end of August 2017; see p.2).

Tank barges were responsible for a roughly equivalent share (11%) of the quantities spilt over the course of the year, with spills of a few dozen tonnes and one in excess of the 1,000-tonne mark.

The other sources represented a negligible (less than 3%), or unknown, proportion of the estimated total for 2017 (Fig. 3).

Types of substances spilt

Although figures are not available for certain categories of pollutant, on the basis of the data brought to our attention and excluding the 106,000 tonnes of wastewater that can be attributed to a single incident, the largest share of the 2017 total would appear to be **oil**. The latter accounted for at least 5,300 tonnes of oil products spilt, i.e. a total share (again underestimated) of around 35% of the annual total (Fig. 4). Among these oil products we can distinguish:

- **Unspecified oils**, representing some 3,200 tonnes or around 20% of the total, due to just under ten spills, most of which were between 1 and a few dozen m^3, and one of more than 2,500 m^3 (involving produced water of an unspecified nature).
- In second position, **light refined products** (such as diesel and petrol), representing around 13% of the total quantity spilt, due to seven spills, generally of moderate scale (median value of 30 m^3), with the exception of one spill of more than 1,500 m^3 of petrol from an oil storage site in the US (Texas, in August 2017).
- In the absence of precise data on the volumes involved, it should be noted that **biofuels** and **condensates** are included in the total in connection with spills clearly exceeding 10 m^3 following the ruptures of, respectively, a pipeline (US) and internal pipes in an oil storage site (Canada) in winter 2017.

Chemical spills (excluding **wastewater**) represented approximately 11% of the total quantity spilt, a share that is much lower for 2017 than that of oil.

With the exception of a spill of a **base** (**sodium hydroxide**), which was apparently significant but for which we do not have reliable figures, this share is almost entirely dominated by the **liquid mineral fertilisers** category, due to four spills totalling almost 1,700 m^3 (one of around 1,500 m^3, and three others of between 40 and 90 m^3).

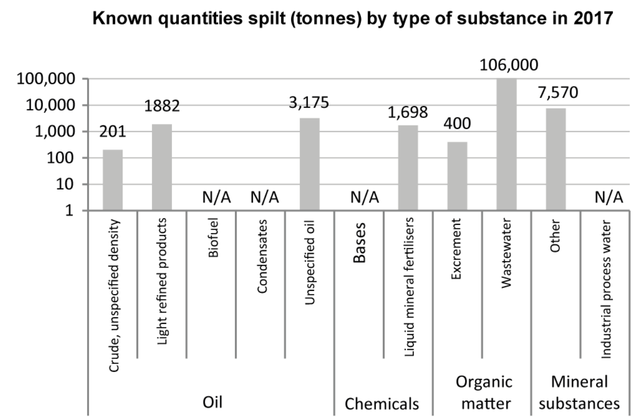


Figure 4

The **mineral substances** category also contributed significantly to the overall total, representing around 50% (excluding **wastewater**), due to a spill of approximately 7,500 tonnes of bentonite drilling fluid from a pipeline under construction in the United States (see above; Fig. 4).

Events

The most frequently reported events in 2017 were **holes, breaches or ruptures** in various structures (approximately 75% of the total; Fig. 5):

- Half of the incidents in this category were due to a **loss of integrity**, most often (in 4 out of 12 cases) related to leaks from internal pipes in onshore oil facilities. In terms of the quantities spilt, these incidents contributed only a small amount to the overall total, representing just under 400 tonnes, due to their relatively moderate scale (median of around 50 tonnes; Fig. 6).
- Incidents concerning **structure ruptures/collapse** represented 30% of cases in this category (22% of the

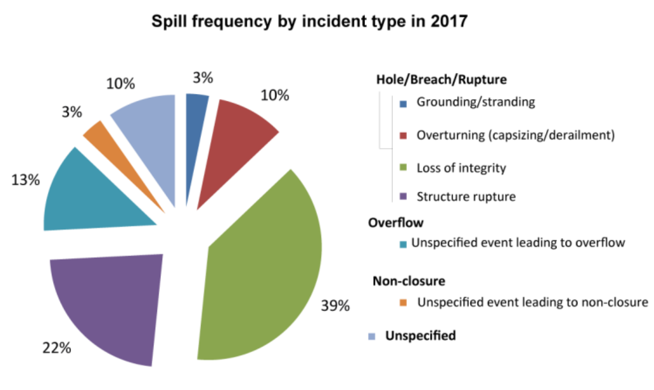


Figure 5

total in terms of the number of spills; Fig. 5). This mainly concerned tanks, storage facilities, internal pipes, pits, etc., in various onshore facilities. Distributed around a median value of some 1,000 tonnes, the quantities spilt associated with these events represented the greatest share in the overall total for the year, with notably the rupture of a dilapidated pipe in the Tijuana wastewater system (Mexico, in February 2017) at the top of this category (see above).

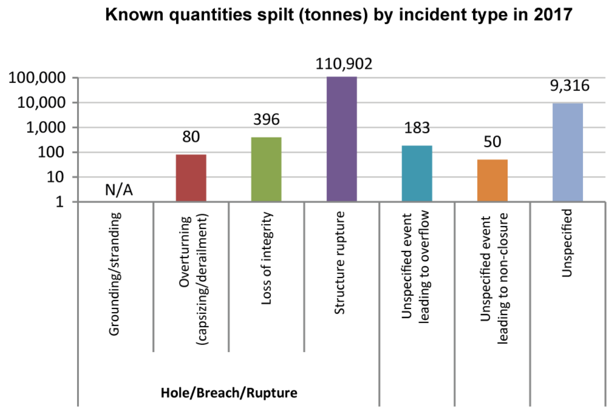


Figure 6

- **Overturning incidents (capsizing, derailment, etc.)** represented 13% of such incidents (10% of the total in terms of the number of spills; Fig. 5). These events did not represent a significant share in the total quantity spilt in 2017 (Fig. 6). They concerned the overturning of tanker trucks, which resulted in relatively moderate spills (roughly 10 to 40 m^3).

Spills due to **overflow** totalled 13% of cases but represented a low share of the 2017 total given the small quantities involved (Fig. 6).

The frequencies of the other categories of events did not exceed 3% (Fig. 5), nor did they have a significant impact on the total quantity spilt.

Causes

Analysis of the frequencies of each cause shows that these were **unknown or unspecified** in more than a third (36%) of the cases recorded (Fig. 7). For example, the cause of the spill of over 7,000 tonnes of bentonite drilling fluid into a wetland near the Tuscarawas River in the United States in April is unknown. In terms of volume, this category occupies a significant share in the estimated annual total, accounting for 53%, excluding the (single but major) spill following the rupture of a pipe in the Tijuana wastewater system in Mexico (Fig. 8).

Technical failures of facilities caused around 42% of events recorded (Fig. 7), and accounted for the majority share of the total quantity spilt in 2017 (Fig. 8):

- The most frequent such incidents (29%) were due to the **defectiveness/dilapidation** of various elements. Almost half of these cases occurred in onshore oil facilities (notably involving internal pipes and seals), with spills typically distributed around a volume of 70 m^3 (median value). However, it was the defective wastewater system in Tijuana that makes this category the biggest contributor to the total quantity spilt in 2017 (Fig. 8).
- The frequencies of cases associated with **unspecified technical failures** and **facility failures** were lower, estimated at 10% and 3% respectively.

We note the frequency of **natural causes** in 2017 (involved in around 16% of events; Fig. 7). These were related to **atmospheric/metocean conditions**, and more specifically to **flooding/precipitation**, with several cases recorded in the United States in late August in connection with the passage of Hurricane Harvey, which caused the flooding of storage facilities at petrochemical sites. Most probably, this type of severe weather event generated a large number of more or less diffuse spills, only partially accounted for by the five

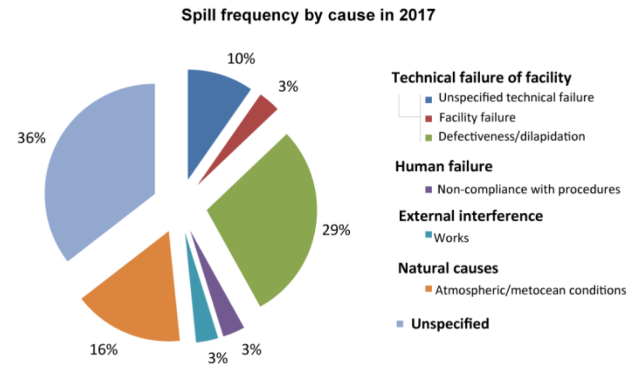


Figure 7

cases brought to our attention, with a no doubt underestimated share in the total quantity spilt (estimated here at nearly 2,000 tonnes; Fig. 8).

Human error accounted for only about 3% of the events recorded (Fig. 7), but nevertheless contributed more than 1,500 tonnes to the total volume spilt (Fig. 8), mainly in connection with the structural failure of a tank barge in the United States caused by an inappropriate unloading procedure.

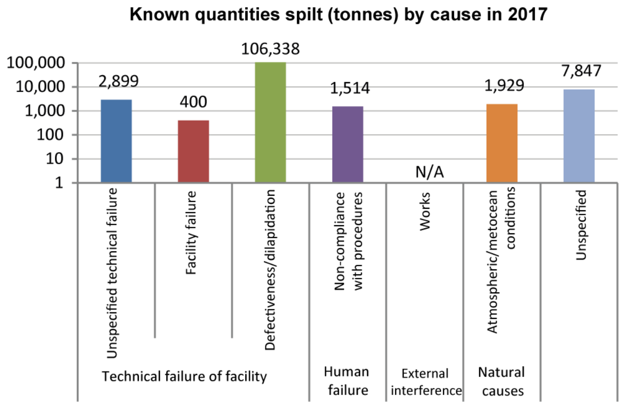


Figure 8

- ## Containment

Boom towing: small auxiliary boats from Seismic Workboats
Portuguese company Seismic Workboats (SWB), based in Peniche, developed an oil spill response craft in conjunction with Portuguese, English, American and Norwegian engineers. The boat was tested and validated by the National Maritime Authority in Portimão at the end of 2017 following its participation in a response exercise concerning an oil spill in the vicinity of port waters. Particularly appreciated aspects of its design included the stability of the vessel, its manoeuvrability, and its ability to tow at low speeds (due to a variable pitch propeller).

For further information:
http://www.swb.pt/

Submerged oil: the MarkMaster V oil filter boom

American company Parker Systems, Inc. (PSI) recently added the MarkMaster V model to its range of Oil Filter Curtain Booms. The MarkMaster V is marketed as being suitable for the containment of "Group V Class" oils, according to the American Petroleum Institute (API) classification, i.e. those with a relative density that makes them likely to become submerged and to drift in midwater (and even eventually to sink).

From a structural perspective, the MarkMaster V is similar to a silt curtain. It comprises a permanent float, which is available in different diameters (from 15 to 30 cm), supporting a detachable skirt made of oleophilic *X-Tex* filter fabric (from Ultratech International),[4] with dimensions ranging from 0.12 m to 0.37 m.

Available in sections measuring 0.75 m, 1.50 m or 3 m in length, the system is designed for use as protection in rivers with weak to moderate currents (e.g. in front of sensitive sites or along riverbanks) in the event of sunken oil, a recurring problem in North America in particular and linked to the increasing use of non-conventional oils (oil shale, oil sands, etc.).

The MarkMaster V boom with detachable oleophilic filter skirt (source: www.parkersystemsinc.com)

For further information:
http://www.parkersystemsinc.com/booms-barriers/markmasterv/

Chemical containment boom: the DESMI ChemBoom

Danish manufacturer DESMI recently developed a containment boom called ChemBoom, designed for use with chemicals.

[4] Made of recycled synthetic fibres, its interstitial structure is designed to ensure a large contact surface between the fibres and the liquid to be filtered, while ensuring free circulation of this liquid (see LTEI n°21).

This permanent flat boom has a fence of a height of 60 cm made of a chemically resistant fluoroelastomer, the Viton® fluorocarbon rubber from DuPont/Chemours Company, and a synthetic MPD-I fibre,[5] here Nomex® (a registered trademark of the same manufacturer), ensuring low combustibility and improving the tensile strength of the boom.

The boom's buoyancy is ensured by stainless steel floats. The weights and connectors of the ChemBoom sections (available in lengths of 10 or 25 m) also made of stainless steel.

View of a section of the DESMI ChemBoom (source: DESMI)

According to DESMI, the ChemBoom provides good chemical resistance against mineral and vegetable oils, a wide range of inorganic acids (with the exception of concentrated solutions of some of these products), and sodium hypochlorite or calcium hypochlorite solutions, for example. However, it would appear that it is not recommended for use with amides, ketones or aldehydes, and is considered as suitable to variable extents for certain other products (e.g. alcohols, phenols or glycols).

Rapid deployment system for the lightweight HARBO T-Fence boom

Dutch workboat manufacturer *Tideman Boats*, specialised in high-density polyethylene (HDPE) hulls, has developed a dedicated oil spill response craft (OSRC) in partnership with HEBO Maritiemservice.

This craft is specially designed for deploying disposable T-Fence Booms (designed by Israeli company HARBO Technologies) in semi-sheltered waters. Indeed, following the development and testing of its fence boom concept,[6] HARBO Technologies had announced that it was working on developing a rapid deployment system (see LTML n°44).

Prototype of the OSRC (developed by Tideman Boats) with HARBO disposable boom deployment chute (source: www.harbo-technologies.com)

View of a "cartridge" containing 25 m of lightweight HARBO T-Fence boom (source: Cedre)

HARBO presented its now marketed product at the Interspill 2018 exhibition (London, 13th-15th March 2018).

According to the manufacturer, this deployment chute for cartridges (with dimensions of 40 x 75 x 65 cm), each containing 25 m of lightweight boom (draught of 20 cm and freeboard of 12 cm), works in a similar way to launch systems for inflatable life rafts. The removable cartridge carrier is relatively small (1 x 1.3 x 0.2 m).

For further information:
http://www.harbo-technologies.com/product/
http://www.harbo-technologies.com/wp-content/uploads/2018/03/HARBO-spec.pdf
https://www.youtube.com/watch?v=dy6g6sQrugs&feature=youtu.be

- ## Recovery

Fast flowing rivers and estuaries: testing the Speed Sweep (DESMI) and MOS 15 (Lamor/Egersund) systems

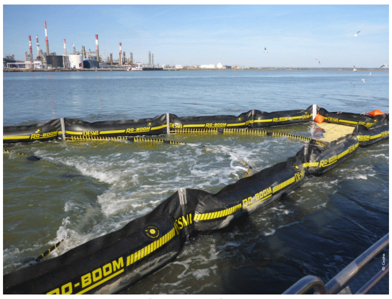
In 2017, at the request of two of its public partners (Maritime Affairs Directorate and Cerema[7]) and an industrial partner (Total), Cedre conducted an assessment in the Loire estuary of the *in-situ* performance of containment and recovery systems designed for areas with strong currents. These assessments benefited from the logistical support of the Port of Nantes Saint-Nazaire, the Sea Invest group, the "Phares et Balises" (lighthouses and beacons) subdivision of Saint-Nazaire, Total's

[5] Poly(m-phenylene isophthalamide).
[6] This lightweight, disposable boom is designed to be pre-positioned at high risk sites (oil facilities, ports, etc.) and is not intended as a substitute for conventional booms but rather as an initial emergency measure, pending the mobilisation and deployment of more substantial equipment.
[7] Centre for Studies and Expertise on Risks, the Environment, Mobility and Urban Planning.

FOST,[8] as well as the provision of equipment and experts by the companies DESMI, Lamor and Egersund.

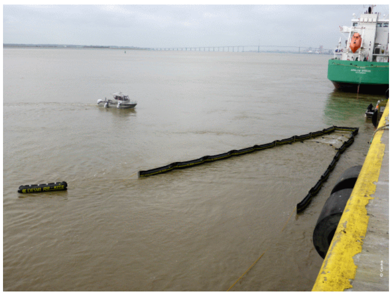
Following on from the NOFI system trials in 2013 and 2015 (Current Buster® 4 and Current Buster® 2, respectively), the aim in 2017 was to test various ways of deploying the Speed Sweep (DESMI)[9] and MOS 15 (Lamor/Egersund Group)[10] recovery booms: in dynamic mode (towed behind two vessels, or one vessel using a paravane), and in static mode (moored to a fixed point on the quayside and opening by a paravane; reversal when the tide turns).

The tests determined the manoeuvrability and effectiveness of the booms in recovering floating slicks (simulated with oranges and popcorn) in these different configurations and at current speeds exceeding 3 knots. The tests also provided valuable information in terms of the additional resources required to implement these systems (handling, towing, etc.). At the test site, a macro-tidal estuary characterised by strong currents alternating when the tide turns, it was also possible to test the rapid repositioning procedure (at slack water) for these systems when used in static mode, as defined during previous trials (in 2013).



Attenuation of the surface current by successive Kevlar screens integrated in the DESMI Speed Sweep (source: Cedre)

View of the Lamor MOS 15 with its deflectors concentrating the pollution towards the recovery channel and collector pool (source: Cedre)



Positioning of the Speed Sweep in static configuration using the Ro-Kite (source: Cedre)

The results were satisfactory for both systems in terms of current attenuation in the collector pool, with containment of the simulated slicks at currents of up to 3 knots at the inlet of the systems, the different tests showing a decrease in effectiveness beyond this value. When deployed by a single vessel, the systems were opened sufficiently by the paravanes in currents of between 0.7 knots (DESMI Ro-Kite 1500) and 1 knot (Egersund Seafoil 15). It is worth noting, however, that the deployment of the DESMI system requires the use of appropriate nautical assets (e.g. with sufficient power).

The static mode tests also validated the technical feasibility of continuous pumping from the dockside (maximum height tested of around 5 m), and identified the potential additional resources necessary for turning manoeuvres at slack water (e.g. lifting equipment).

In conclusion, these booms do indeed push the envelope where the effectiveness of traditional booms is concerned, from around 0.7 knots in oncoming current to around 3 knots (frequent in estuaries). However, their use in dynamic mode (in rivers or estuaries) clearly requires (i) the use of appropriate nautical means (e.g. for opening the booms, the size of the paravanes, etc.) and (ii) a certain level of technical skill, highlighting the importance of regular training and exercises for the operators using these systems.

- **Sorbents**

Möbius hydrophobic sorbent manufactured from recycled tyres

Cedre recently successfully tested the sorbent manufactured by Ukrainian company Möbius Group LLC, a bulk sorbent consisting of black granules made from a mixture of cellulose and carbon black – the latter obtained from recycled used tyres. It is chemically treated to give it hydrophobic properties, and floats thanks to its low density.

[8] Fast Oil Spill Team.
[9] See LTML n°41.
[10] See LTML n°36.

The results of tests conducted in accordance with AFNOR standard NF T90-360 show that it has an absorption capacity of four times its weight and good hydrophobic properties (water retention capacity/oil retention capacity less than 0.25). This sorbent is now included in the list of substances validated by Cedre).

Möbius Group LLC offers its product either in bulk or as sorbent booms consisting of a polymer net (3 m long with a diameter of 13 cm).

For further information:
http://mobius-sorbents.com/

Sorbent made from treated cellulose granulate and carbon black, packaged in nets/booms (source: Möbius)

SpillBoa™: filtering material packaged in bales for compact storage and quick deployment

American company Meltblown Technologies Inc. (MBT) markets a hydrophobic and oleophilic filtering textile (Spilltration®) packaged in compressed and coiled bales – hence the textile's commercial name of SpillBoa™. The manufacturer (HalenHardy) of the Spilltration® fibre (also available in mats, pads, etc.) claims that a specific vacuum packaging process, also apparently patented ("Smoosh Packaging"), allows the SpillBoa™ to be packaged in a very compact form, reducing the volume of material by 75% when rolled.

The aim is to decrease the ratio between storage space and the quantity/linear length of boom without altering the performance of the product, which quickly regains its original shape, volume and density as soon as it is unwound. MBT also suggests that the tight packaging in bales allows the SpillBoa™ to be deployed much faster than "conventional" polypropylene sorbent booms of equivalent lengths. The product is thus intended to meet a need in terms of emergency spill containment, pending the mobilisation of more substantial equipment.

When deployed, the SpillBoa™ consists of a sorbent/filtering boom with a flattened cross-section (designed to maximise the contact surface between the fibre and the floating oil), measuring approximately 7.5 m long and 12 cm wide, and weighing around 2 kg. According to MBT, the SpillBoa™ has an absorption capacity of around 13 litres of oil per kg of sorbent boom (i.e. around 26 litres per SpillBoa™).

For further information:
https://meltblowntechnologies.com/products/spilltration-spill-control-products/spill-boa-sorbent-barrier/
https://www.halenhardy.com/spilltration/

• Floating litter/debris

Specific equipment for litter recovery: *DESMI EnviRo-Clean*

Danish manufacturer DESMI markets a range of equipment called EnviRo-Clean (with a dedicated website), specifically designed to be used with systems for the recovery of floating objects (litter, plant debris, seaweed, etc.) in various types of environments, including rivers, estuaries and lakes.

We note two static systems for trapping floating debris:

- The EnviroEnhancer (or Trash Trap) consists of a removable recovery basket (made of galvanised steel mesh) housed in a steel frame, which floats thanks to either permanent fenders (heavy-duty HDPE pipes with foam filling) or inflatable fenders. This filtering "trap" is secured on pilings via a tide/flood compensating system, with the opening facing into the current. In addition, deflector booms are anchored upstream of the system.

- The lighter, smaller capacity EnviroTube (or Trash Tube) is designed to be framed by two sections of deflector/funnel booms using standard (ASTM) connections. Located at the apex of the collector pool, this metal plate is equipped with a rear hole to which a storage bag is connected for the recovered debris. This bag is removable, potentially reusable, and its dimensions (volume, mesh size, etc.) can be adapted according to the customer's requirements.

Above: The Trash Trap (top) and Trash Tube, here coupled with GlobeBoom *sections (bottom) (source: DESMI)*

The Debris Trawl/River Sweep (alias the Scan Trawl) (source: DESMI)

The River Sweep (or Debris Trawl), a variation of or even another name for the *Scan Trawl*,[11] is a dynamic recovery system by surface trawling, consisting of two inflatable RoBoom sections (20 m each) connected at the apex of the collector pool to one or more (up to three) nets (volume of 10 m^3) connected in series and successively detached as they become filled with floating debris.

Finally, operated from the shore, the Impounder (or Trash Cat) is a mobile system with a four-wheel drive control power unit for recovering accumulations of litter. Recovery is performed by three rotating drums (operated by a hydraulic power unit) equipped with long flexible "rubber fingers" for gripping and lifting floating objects through the collector-head into the conveyor (on a telescopic arm) to move them to the storage units (skips, containers, etc.) installed to the rear of the system. This relatively large unit is designed (recovery rate, size, etc.) to handle large volumes of debris.

View of the DESMI Trash Cat (or Impounder) (source: DESMI)

For further information:
https://www.desmi.com/UserFiles/file/oil%20spill%20response/DESMI_EnviRO-CLEAN_low.pdf
https://www.desmi.com/UserFiles/file/oil%20spill%20response/DESMI_EnviRO-CLEAN_clean-up_operations_LOW.pdf
https://www.desmi.com/enviro-clean.aspx

Seabin, PortBin, Trash Bin: "filter bins" for waste recovery in sheltered waters

Wärtsilä, a specialist in boat propulsion systems and increasingly concerned with current environmental issues, supported the implementation in Scandinavia in spring 2017 of the Seabin project, with the installation of its first Seabins in several Finnish ports (notably Uunisaari and Helsinki in May and June, respectively). The brainchild of two Australian boat builders, working together since 2015 within the company Seabin Pty Ltd, this project promotes equipment for collecting litter in port waters (or on any relatively sheltered body of water where floating litter can accumulate). It currently mobilises half a dozen partners to assess the effectiveness of the Seabin system on various pilot sites: in France (La Grande Motte), Montenegro (Porto Montenegro), Spain (Port Adriano), Bermuda (Butterfield) and the United States (Safe Harbor Marinas).

The floating litter, carried by the current into the vortex created at the weir lip, is collected in a removable and reusable catch bag, with a mesh size designed to retain micro-plastics bigger than 2 mm.

Within the framework of this project, these prototypes were donated to the various pilot sites, the managers of the ports concerned being responsible for maintaining and monitoring them as well as for providing Wärtsilä with data on collection performance (quantity and quality of waste collected) or any technical issues. The objective of placing them on the market by the end of summer 2017 has now been achieved.

Also worth mentioning is the launch in 2017 of the PortBin system, again of Scandinavian origin, by Norwegian company SpillTech AS, the exclusive dealer of the range of oil spill response equipment manufactured by Henriksen. This is a vortex skimmer for floating litter that is attached to a quay (and boasts a tide-compensating design), combining robust components (container derived from an oil skimmer) and displaying a significant water inflow rate (147 m^3/hour). The container consists of a basket with an open mesh,[12] which would appear to make the PortBin suitable for collecting macro-litter. Based on a similar concept of vortex collection, the manufacturer DESMI has developed its Floating Trash Bin, derived from its weir skimmers for floating waste.

For further information:
http://seabinproject.com/
http://spilltech.no/index.html

[11] Surface trawler for the recovery of weathered tarballs.
[12] With a mesh size of a few centimetres, it would seem, according to the images and films available on http://spilltech.no/index.html.

• Conferences

CLEAN WATERWAYS series of conferences

We note the organisation since 2017 in the United States of the CLEAN WATERWAYS series of conferences, an event specifically dedicated to spill preparedness and response operations in inland waters. CLEAN WATERWAYS is organised by the private sector, in association with state-level representatives of various federal public agencies. It can be considered as a "freshwater" version of the CLEAN PACIFIC and CLEAN GULF events.

Through conference sessions and workshops, it aims to bring together the various public and private stakeholders in the field of spill response in inland waters: operational staff, regulatory or environmental authorities, companies supplying equipment or services, industry OSROs, private consultants, etc. Very much specific to the broader North American context (regulatory and administrative framework, structuring of response operations, etc.), it is nevertheless one of the only events of this scale (if not the only one) in this field since the end of the Freshwater Spill Symposium (also in the US) in 2009.

After a first edition in Louisville in June 2017, a second in St. Louis in April 2018, the 2019 conference is scheduled to be held in Cincinnati in April. The previous conferences were organised around two simultaneous sessions devoted to the various aspects of planning (regulations, emerging technical challenges and issues, oiled wildlife response strategies, communication, etc.) on the one hand, and response operations based on feedback (ice-infested waters, responder safety, sunken/submerged oil, etc.) on the other.

For further information:
http://2019.cleanwaterwaysevent.org/

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