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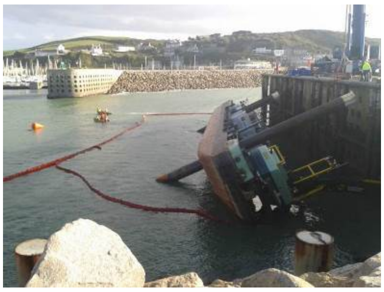
• Spills

Pollution in a port following failure of the dredger *Prins IV* (Port-Diélette, Manche, France)

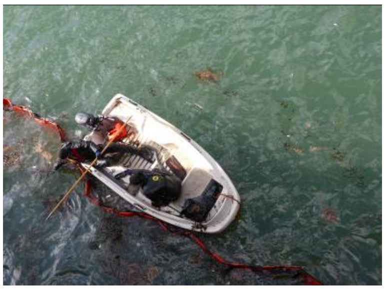
On the evening of 5th October 2014, in Port-Diélette (Tréauville, northern France), a technical failure occurred on board the dredging vessel *Prins IV* (tasked with dredging the cooling pond for the two reactors at the Flamanville nuclear power station) while in dock: one of its four foot anchors became wedged, causing the vessel to list at ebb tide, then ultimately capsize. Resting on its portside, the vessel released an unspecified share of the marine diesel on board (estimated at 17 then 23 m^3).

Two containment booms were deployed during the night: a 90 m-boom by the Manche fire brigade (SDIS 50), reinforced by another 300 m-boom from the Cherbourg Naval Base. This set-up surrounded the vessel which lay against the wharf in order to contain the oil as close as possible to the leak point. The oil was recovered manually, mainly using sorbents (booms, pads, etc.). A crisis unit was activated on-site, under the Sub-Prefect for the *arrondissement* (district) and comprising representatives of the DDTM (Departmental Directorate for Territories and the Sea), the fire brigade, the French Navy, the port of Diélette, the Pieux district community, the shipowner and the captain of the *Prins IV*.



View of the dredging vessel Prins IV *at low tide on 10/10/2014 (Source: Cedre)*

An aerial survey was conducted by the French Navy, on board a helicopter from Maupertus naval air station, based on which the floating oil was estimated to cover a surface area of 200 m^2. This relatively small spill was contained within the port. The incident management then focused on safety operations on the vessel and on controlling the risk of further leakage, before righting the vessel. The ship operator plugged the vents, while preparatory work was carried out in order to refloat the vessel. The foot anchors were cut off 10 days after the incident, with a view to refloating the vessel. According to the French authorities, inspection of the hull by divers showed that there were no leaks, and the shipowner was requested to remove the remaining fuel from the tanks.



Manual recovery of oiled sorbents within the containment area (Source: Cedre)

On 9th October, the DDTM for the Manche area called out Cedre, and an agent was sent on site to provide technical support. At this stage, the residual pollution formed a thin oily film floating at the surface, with scattered patches of sheen, circumscribed mainly within the containment area.

A few brownish accumulations, mixed with seaweed and litter, were visible at the foot of riprap. In addition to monitoring the containment system, Cedre's recommendations included recovering the fuel from the water surface using sorbents (pads, booms) and collecting floating debris, possibly contaminated, using scoop nets.

The agitation of the water in the port and the spring tides, as well as the configuration of the wharf, were detrimental to the containment system's integrity and efficacy. This system was readjusted in the afternoon of 9th October by the Manche fire brigade and Cherbourg Naval Base (which monitored the system until operations were complete), removing torn sections and repairing the mooring system (adapted to create a tidal compensator system composed of a taut vertical cable with a sliding shackle).

On 24th October, the French Vessel Safety Centre granted authorisation to tow the vessel to the Netherlands.

Heavy fuel oil spill in a protected mangrove: collision of the *Southern Star 7* (Bangladesh)

On the 9th of December 2014, following a collision with another ship near the village of Jaymoni, south of the Port of Mongla (Bangladesh), a vessel being used as a small tanker, the *OT Southern Star 7*, sank and released its entire cargo, 350 m^3 of furnace oil (similar to IFO 380), into the Shela River. This is one of the many rivers of the Bengal Delta, which is home to the world's largest mangrove known as Sunderbans, a very fragile natural region, protected due to its rich biodiversity by two global initiatives, under the RAMSAR convention and as a UNESCO World Heritage site.

In the first few hours following the incident, the Forest Department (FD) under the Ministry of Environment and Forests (MoEF) organised response operations with support from the Indian Navy[1], then the following day, shoreline clean-up, with help from the local communities.


The OT Southern Star 7 ***(left)**; Collecting fuel oil and oiled floating vegetation (directly by hand or using fishing nets) (**right**) (Source: Wildlife Conservation Society)*

On 15th December 2014, fearing severe environmental impacts and given the limits of the national spill response capacity, the Government of Bangladesh requested international assistance through the United Nations Development Programme (UNDP).

The United States and France proposed their assistance, mobilising 3 experts[2] through the United States Agency for International Development (USAID) and 2 experts from Cedre, one upon request by the Ministery of Ecology, Sustainable Development and Energy (MEDDE) and the other under the EU Civil Protection Mechanism (Emergency Response Coordination Centre, ERCC).

All these experts joined the United Nations Disaster Assessment and Coordination (UNDAC) mechanism for a joint mission with the Government of Bangladesh (GoB)[3], aimed at reinforcing the response and providing support in assessing the situation and developing an action plan[4].

Initial observations in the field revealed a relatively low degree of pollution which appeared to have stabilised. The lack of visible accumulations of oil, either floating or stranded (leading to collection operations having come to an end two days prior to the mission), or even sunken, rapidly confirmed that additional clean-up operations were not necessary. Meanwhile, visual observations of impacts on the environment in the widest sense appeared to be less severe than expected based on the photos taken on the first day after the spill.

The mission then focused on the following issues (the experts were distributed among the different groups according to their fields of competence): the extent of the areas affected by the spill and their contamination (Extent team); review of response operations and any gaps (Clean-Up team) as well as recommendations for waste management; visible and expected impacts on the environment (Aquatic team + Wildlife team + Mangrove team); health and socio-economic impacts on local populations (Human team). The experts from Cedre were attributed to the first two groups.

The points highlighted by these surveys and investigations can be summarised as follows:

- The relatively limited impact of the spill can be explained by various factors, including:
  - the ultimately moderate quantity initially spilt (without taking into consideration the very high sensitivity of the incident site)
  - the site's hydrodynamics, with strong tidal currents[5], with a high tidal range (>2.5 m) promoting natural cleaning of the affected area and disseminating the oil and oiled debris downstream

[1] In particular, for boom deployment around the wreck; the application of chemical dispersant present on board was considered, although was ultimately not authorised given the potential impacts on the environment.

[2] From the National Oceanic and Atmospheric Administration (NOAA), US Coast Guard and a university.

[3] And thus involving national experts (ministries, universities, NGOs) which had previously taken part in the response and/or indicated an interest in assessing the consequences of this incident. This UNDAC/GoB team comprised over 35 experts.

[4] In particular, in terms of monitoring in order to assess the impacts of the oil on the aquatic environment, the mangrove and resources, as well as on the assets and health of the local population.

[5] Which caused the oil to be pushed upstream and resulted in the contamination of the main river, the Pushar.

Maximum level of contamination on the banks and vegetation, observed along 10% of the stretch surveyed by the UNDAC team (Source: Cedre)

  - o the favourable tidal range and cycle at the time of the spill (no flooding of the mangrove), together with the almost continuous presence of cliffs along the shores, stopping the pollution from spreading into the mangrove
  - o the suspension of the movement of all vessels on the Shela River, following a decision made by the authorities very soon after the incident. This measure prevented the horizontal spread of the oil in the mangrove, which would have inevitably been caused by an overflow effect due to bow waves.
- In terms of spill response:
  - o Given that there was no "oil spill response" section in the National Plan for Disaster Management (mainly relating to natural disasters), the Bangladesh Forest Department (FD) implemented an original initiative to encourage the population to recover the oil: paying for the oil recovered by locals.
    - o This resulted in the rapid recovery of a significant share of the pollution: 68 m^3 of fuel oil in total, i.e. around 20% of the volume spilt – a significant result given the currents (even if this was a high case scenario, as the liquid recovered was probably a mixture of oil and water).
  - o This doubtlessly helped to limit the spread and environmental impact of the oil, however the lack of personal protective equipment (with the exception of a few pairs of gloves distributed by FD and an NGO) was no doubt linked to the symptoms reported by local operators (breathing difficulties, headaches, vomiting) following collections operations, but also oil/vegetation separation (by squeezing or boiling).
  - o Original collection methods were implemented, mainly on the water:
    - ▪ Protection across entrances to channels and small rivers using nets.
    - ▪ The collection of oil using stationary nets, based on a technique used to capture fry or larvae (fish/shrimps), at the edge of the banks.
    - ▪ The most original (and apparently most efficient): use of floating vegetation (water hyacinths) to "soak up" the oil then recover it by draining.
    - ▪ The setting up of a line pirogues, positioned diagonally along the bank, to block the pollution and drifting water hyacinths, with storage directly in some of the pirogues – in various containers – which, when full, were taken to the village to be unloaded.



*Fishing net at the edge of the bank (**left**); Net attached to a frame (**centre**); Trapping oil using water hyacinths (**right**) (Source: Cedre)*

- Given the lack of an oiled waste management and tracking system (oiled nets, vegetation, etc.), it is difficult to draw conclusions about what became of this waste – although various observations in the field indicated a few theories on this point (burial within the vicinity of homes, often on the foreshore):
  - o We note an original, and effective, action implemented by a local NGO which encouraged local residents to recovered "hidden" oiled vegetation, to drain it in bamboo cages (pending subsequent treatment: incineration, etc.).
  - o Uncertainty remains over what happened to the oiled nets (some were washed with diesel, others appear to have been abandoned on site).
  - o The mission team assessed the local storage and treatment options, and made recommendations on these aspects.

- No drastic impact was observed on the flora and fauna in the mangrove during the mission.


*Piles of waste covered in mud (at the top of a bank subject to flooding) (**left**); Waste storage/draining cage (**right**) (Source: Cedre)*

Around 20 vertebrates (mainly birds, as well as a crocodile) showed traces of oil on their bodies.

No traces or odours of oil were detected on the bodies/shells (or in the stomach contents) or fish and crabs purchased from local fishermen during the surveys.

Various impacts were reported following the mission: 1 dead dolphin, according to a photo published in a newspaper, which did not appear to be oiled and could not be found; 2 dead oiled otters; an alive, heavily oiled varan, found during the first days following the spill. A decrease in catches was also reported by local fishermen.

Finally, the damages incurred by the highly impoverished local populations was still perceptible locally at the end of the field mission (i.e. 3 weeks after the spill), in the form of oil on the stilts of their houses, around their homes, on their poultry, etc. The resources on which the livelihood of certain communities depends were significantly affected during the first two weeks: oiling of boats, nets (sometimes reused after cleaning with diesel) and loss of income from fishing for some (although alternative source of income for others, see above). In this respect, the repair/compensation for this damage was problematic in this context given that, for ecological reasons (related to overfishing), fishing was banned throughout the area (but carried on nonetheless due to a lack of other sources of revenue).

The field work conducted enabled the joint UN/GoB team to draw up a number of recommendations for the short, medium and long term relating to risk prevention and contingency planning, presented in various written and spoken forms, to the various players present including UNDP, GoB and the media. The final mission report, submitted to UNDP and GoB, was made public in February 2015.

For further information:
Cedre Report EPI.15.01
http://www.eecentre.org/Modules/EECResources/UploadFile/Attachment/Sundarbans_Report_18Feb2015_FINAL_01.pdf

Heavy fuel oil spill in a port: the bulk carrier *Lord Star* (Brest, Brittany, France)

On the morning of 12th December 2014, Brest port authority (Brittany, France) contacted Cedre's duty officer following a spill of bunker fuel (IFO 380) from the Panama-flagged bulk carrier *Lord Star*. The ship had been in dock for 4 days for inspection of its structure, with a view to repairs following grounding in the Baltic Sea. The leak, from a breach in the hull, is believed to be due to an error during transfer operations between bunker tanks.

Under the effect of the ebb tide, the fuel oil was drawn under the wharf piles and out of the harbour basin. Two lengths of boom belonging to the Brest Chamber of Commerce and Industry (the port manager) were laid as an initial emergency measure. This containment system was rapidly supplemented with resources from the Finistère fire brigade and the French Navy.


Fire brigade boom at the end of the wharf QR5 (left); pumping of trapped slicks by a vacuum truck (right) (Source: Cedre)

A vacuum truck was stationed on the quayside to pump the contained oil and oiled seaweed.

Dynamic recovery by trawling in the Brest roadstead (Source: Cedre)

Although this pumping operation was carried out without a skimmer head, a large share of the oil which had accumulated against the port infrastructures was recovered.

While the facilities with water intakes within the vicinity of the spill were notified of the incident (aquarium *Océanopolis* and Plougastel-Daoulas oyster farms), surveys were conducted on the water from a French Navy tug (harbour and coastal tug), resulting in the detection of scattered patties and tarballs. Ceppol (the French Navy Centre of Practical Expertise in Pollution Response) recovered this scattered pollution dynamically using Mini-Thomsea and Notil surface trawlnets, deployed from lightweight workboats.

In addition, a French Navy *Lynx* helicopter carried out a complete survey of the maritime area of Brest roadstead in the afternoon.

On land, Cedre conducted an on-foot survey of the oiled infrastructures, which was completed 4 days later with an inspection from a boat in the presence of representatives of the P&I club and its technical expert (International Tanker Owners Pollution Federation, ITOPF). Four areas called for clean-up operations, including outer walls (horizontal band of fuel oil, a few centimetres high), the underside of piled wharfs (horizontal concrete beams contaminated with bands and drips of fuel oil ranging from a few centimetres to up to 1 m high), as well as scattered oilings at the top of riprap at the end of the harbour basin.

*Oiling of the porous surface of concrete beams under the deck of the wharf (**left**); Horizontal band on the outside of the wharf and fenders (**centre**); Deposits and splashes of fuel oil on the upper section of riprap (**right**) (Source: Cedre)*

Recommendations relating to the clean-up of the outside and underneath of the wharf included: (i) spraying with a washing agent followed by low pressure rinsing, (ii) hot water high pressure washing. As for the riprap, the technical recommendations included collecting oiled debris, manually scraping off the layers of oil and high pressure washing with hot water to complete clean-up. In all cases, the containment (by sorbent booms) and recovery (by pumping or using sorbent) of effluents were recommended.

A specialised local company (*Le Floch Dépollution*) was contracted to conduct clean-up operations, implemented in January and February 2015, with final site inspection in early March. Only a few residual traces remained in places below the wharf, due to the porosity of the concrete, left to be cleaned naturally as they were not at risk of releasing the oil (nor of causing further contamination or disturbing uses).

Landslide and damage to the Tikhoretsk-Tuapse-2 pipeline (Black Sea, Russia)

On 23rd December 2014, the rupture of the Tikhoretsk-Tuapse-2 pipeline (operated by the State-owned company Transneft) caused a landslide, according to information broadcast in the press, leading to a spill of almost 10 m^3 of an unspecified oil into the waters of the Port of Tuapse (Krasnodar Krai, Russia), at the mouth of the Tuapse River where it flows into the Black Sea. The incident occurred while the newly built pipeline was undergoing tests.

Precipitation and wind caused the oil to flow into the sea. Response operations were implemented by the operator, together with the regional environmental authority (Environmental Prosecutor’s Office) and emergency management agency (EMERCOM under the Russian Ministry of Civil Defence and Emergencies). On-land operations, for which we lack any detailed information, included protecting the banks of the Tuapse River, and excavating contaminated soil in the leak area. On the water, containment and recovery operations were apparently carried out by the Azov-Black Sea branch of the Marine Rescue Coordination Service of Rosmorrechflot (MRS), and were made difficult due to adverse weather conditions. According to the information published in the press, around 10 m^3 of liquid waste was recovered at sea, and around 4 m^3 by the Tuapse port authority.

• Past spills

Deepwater Horizon spill: BP agrees to pay out record-breaking compensation

Over 5 years after the blow-out at the Deepwater Horizon rig in the Gulf of Mexico, BP is set to pay a record sum for the pollution caused in April 2010: the oil company announced in July 2015 that a tentative $18.7 billion (€16.9 billion) settlement had been agreed on with the US state and federal governments to settle all the suits filed by the federal state as well as by the five coastal states (Louisiana, Mississippi, Alabama, Texas and Florida) affected by the spill.

This was, according to the federal courts, the "largest corporate settlement in US history", as compensation for the damages inflicted on the Gulf of Mexico's economy and environment.

The settlement includes:

- $5.5 billion for Clean Water Act civil penalties, paid to the federal government over a 15-year time frame
- $7.1 billion paid to the federal government and the five States affected, again over a 15-year time frame, for environmental damages (as well as $232 million to cover any further damages unknown at the time of the agreement)
- $4.9 billion over 18 years, to compensate for the economic claims made by the five affected states, and an additional $1 million to settlement the claims filed by over 400 local government entities.

An additional $232 million has been set aside to be added at the end of the payment period in order to cover any further natural resource damages that were unknown at the time of the agreement.

According to BP, this settlement "resolves the company's largest remaining legal exposures, provides clarity on costs and creates certainty of payment for all parties involved". The agreements in principle will be subject to a Consent Decree with the United States and five Gulf states with respect to the civil penalty and natural resource damages.

Environmental damages caused by the *Exxon Valdez* spill: an end to legal action for the US authorities

In October 2015, the U.S. Department of Justice and the state of Alaska announced that they were ending all legal action relating to the *Exxon Valdez* spill, which occurred in Alaska in March 1989.

Following this disaster, the oil company paid out hundreds of millions of dollars in damages and spent several million on clean-up operations. The settlement approved in 1991 included a reopener clause, through which the state of Alaska or the federal government was entitled to claim an additional $100 million in the case of long term decline of natural populations which could not be foreseen at the time of the initial settlement. In light of this clause, in 2006, the federal government and the state of Alaska claimed an additional $92 million to cover long term damages to bird populations (harlequin ducks) and sea otters, given the persistence of the oil in sediment of Prince William Sound.

In 2014, a report published by the U.S. Geological Survey concluded that the sea otter populations in the areas most affected by the spill had recovered their pre-spill levels, and that the levels of residual exposure were no longer liable to generate significant impacts (see **Impacts** section below). Based on this observation, the US authorities announced, in October 2015, that they were putting an end to their legal action against Exxon.

• Review of spills having occurred worldwide in 2014

Oil and HNS spills, all origins (Cedre analysis)

• Volumes spilt

In 2014, Cedre recorded 32 spills involving volumes of over approximately 10 m^3 from its database, for which sufficient information was available for statistical analysis. Almost half of these spills occurred at sea, a quarter on the shoreline, around 20% in ports and approximately 10% in estuaries

(Fig. 1).

The number of incidents recorded in 2014 is close to the annual median (29 incidents) expressed for the period 2004-2013. However, the total quantity of oil and other hazardous substances spilt, around 9,400 tonnes, is far lower than the median expressed for the previous 10-year period (around 30,000 tonnes), placing the 2014 total among the lowest recorded throughout this period (Fig. 3).

Overall, the significant spills in 2013 give a relatively low median quantity of around 25 tonnes.

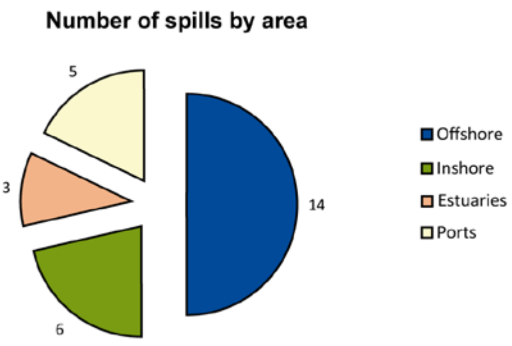


Figure 1

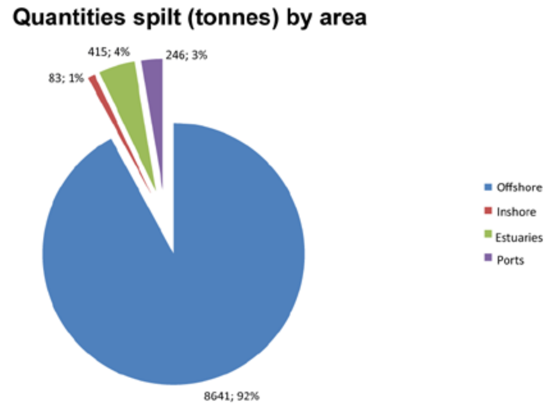


Figure 2

The vast majority (90%) of the quantities spilt in 2014 was released at sea (Fig. 2), the bulk of which was due to a leak from a subsea natural gas pipe in Alaska[6].

Comparable shares of the annual total (3 to 4%) were spilt in ports and estuaries. These quantities mainly related to the rupture of a transfer line at the loading terminal in a South Korean refinery in January[7] and the incident involving the small tanker *Southern Star 7* in the Bengal Delta (Bangladesh, see above).

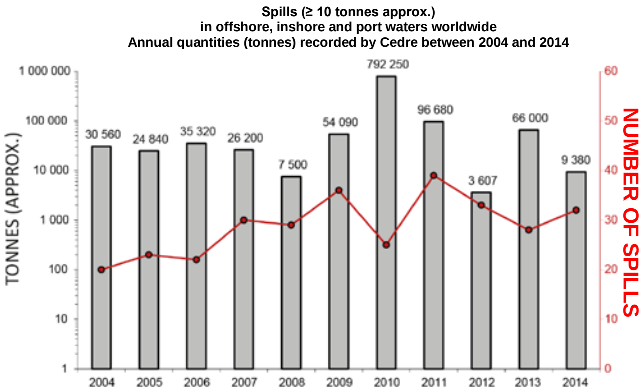


Figure 3

[6] Estimated 6,800 m^3 methane leak from a gas pipeline (Cook Inlet Gas Pipeline) near Nikiski (Alaska, US) in June 2014.

[7] See LTML n°39

• Spill locations

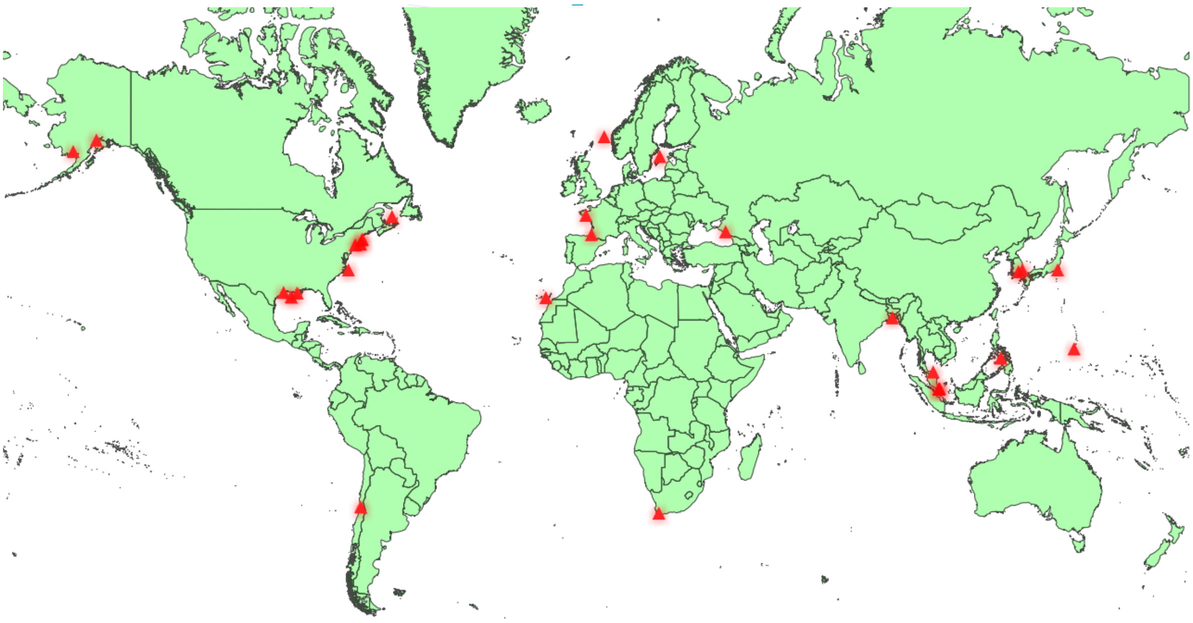


Figure 4. Location of the main oil and HNS spills offshore and inshore in 2014 recorded by Cedre.

• Incidents leading to spills

The most frequently identified incidents in 2014 (69%) were **breaches or ruptures** which occurred in various structures:

- A quarter of these incidents were associated with **collisions between ships** (25% of incidents, Fig. 5), which represented 20% of the total volume spilt in 2014. The significant spills in this category occurred in Asia (in Singapore Strait as well as in South Korea[8], then in Bangladesh[9]) and in the United States[10].
- **Strandings and groundings**, which represented around 16% of these incidents, only made up 1% of the annual total.
- **Loss of integrity** of various structures, in this case pipes within oil facilities or pipelines, represented 10% of incidents, with however a majority contribution (over 70%) to the overall quantity spilt in 2014 (Fig. 6), mainly due to a leak from a subsea natural gas pipeline in Alaska.
- **Structure ruptures** (here pipes or pipelines) accounted for 10% of incidents and represented a minimal share (2%) of the total volume spilt in 2014 (80% of which was due to the rupture of a transfer line hit by a VLCC at a terminal in a South Korean refinery)[11].

None of the other types of incidents stood out in the 2014 analysis, either in terms of frequency or of their share in the overall total (Fig. 5 and 6). No information on the incident having caused the spill was found in 16 % of the cases listed.

[8] See LTML n°39
[9] See above
[10] See LTML n°39
[11] See LTML n°39

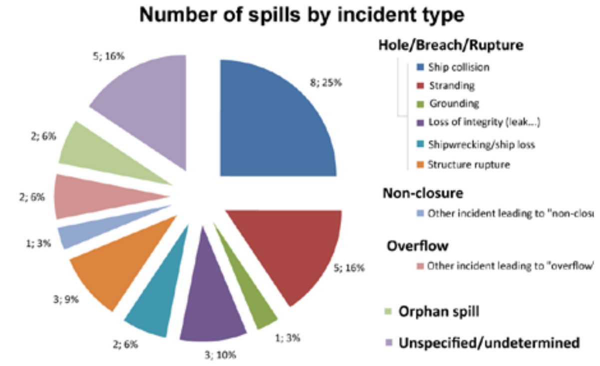


Figure 5

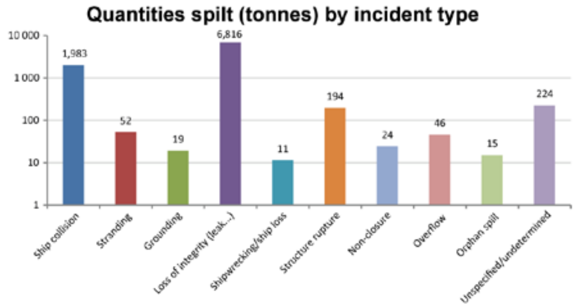


Figure 6

• Spill causes

Analysis of the causes of the spills recorded shows that in at least half of all cases (>50%), the cause was **undetermined or unspecified** (Fig. 7). Not only is this category more prevalent, it also represents the vast majority (80%) of the total quantity spilt (Fig. 8; we note however that 90% of this share is due to a single leak – which occurred for an unknown reason – from a subsea natural gas pipeline in Alaska).

This lack of information therefore hinders the analysis of the main causes of significant spills. We note the frequency of **technical failures** (around 22%, a third of which was due to the **defectiveness/dilapidation** of facilities), followed by that of incidents caused by **human failures** (16% of cases, the majority of which were due to poor surveillance/control as identified in the case of collisions of container ships in Singapore Strait[12]) (Fig. 7). With a total of 1,630 tonnes, human failures represented approximately 17% of the total annual quantity spilt, however it is difficult to draw comparisons given the lack of accurate data for the quantities spilt due to the other causes identified (Fig. 8).

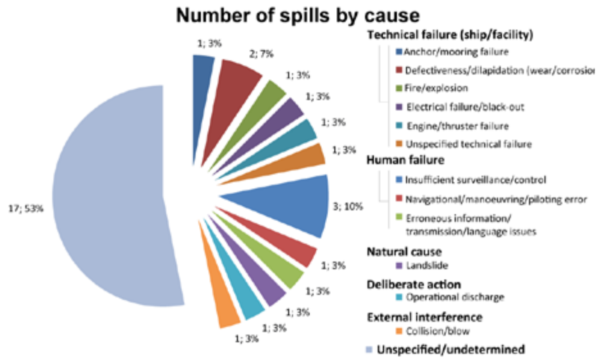


Figure 7

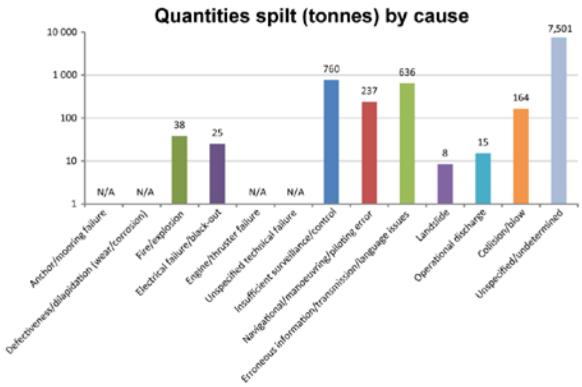


Figure 8

• Substances spilt

The vast majority of spills (around 90% of occurrences in 2014) involved oil. Among these oil spills, the most commonly spilt products were **light refined products** (8%), followed by **heavy/intermediate refined products** (unspecified IFO grades of <380) and **heavy refined products** (IFO≥380). This was followed by **crude oil** (13% of the total and in half of cases the density was **unspecified**).

In addition to oil products, we note 2 spills in the **HNS** category (hazardous and noxious substances)[13] (Fig. 9).

[12] Ships *Fei He*, *NYK Themis* and *Hammonia Thracium* (January and February 2014; See LTML n°39)

[13] (i) Spill, of unknown type and cause, of over 10 m³ of a solution of zinc bromide from an offshore facility (Vermilion Block 342) on 14th November, around 140 km off the coast of Louisiana (Gulf of Mexio, US); (ii) Overflow and run-off of around 35 and 40 m³ of extinguishing water into Pequonnock River then Long Island Bay, in September, following fire fighting operations conducted at an industrial chemical site (Bridgeport, Connecticut, US).

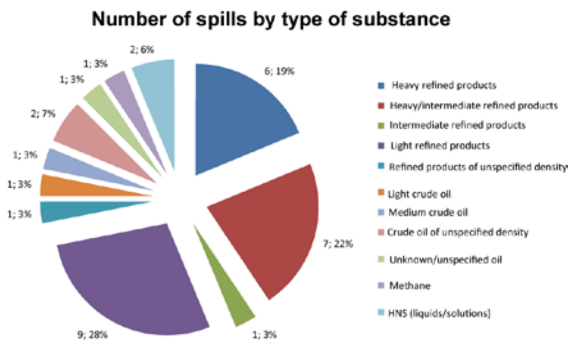


Figure 9

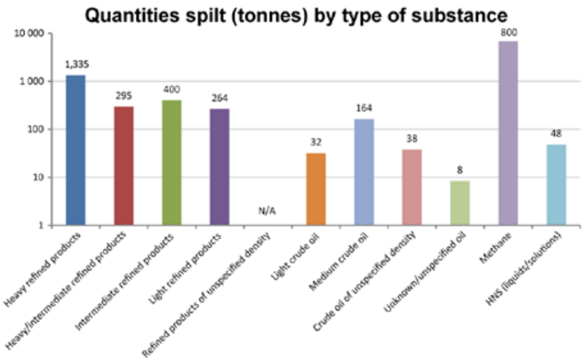


Figure 10

In terms of the quantities released, we note the majority share of gases, in this case methane (Fig. 10), in the 2014 review, due to a leak in June from a subsea pipeline, near Nikiski (Alaska, US).

The share of oil products in the total annual quantity spilt is mainly dominated by **refined products** (around 25% of the total, compared to <3% for crude oil), in particular **heavy products** (14%), followed by **intermediate products** (4%), **unspecified heavy to intermediate products** (3%) and **light products** (white products, 3%).

Ship-source oil spills in 2014: ITOPF statistics

The 2014 statistics provided by the International Tanker Owners Pollution Federation (ITOPF) on ship-source oil spills once again confirmed the downward trend of major spills from ships observed since the 1970s.

A single oil spill of over 700 tonnes was reported by ITOPF for 2014 (compared to 3 in 2013), with the sinking of a small tanker in the South China Sea loaded with a cargo of approximately 3,000 tonnes of bitumen. Four medium spills (according to ITOPF's terminology, representing between 7 and 700 tonnes) were also recorded. This figure is still below the annual averages calculated for the four previous decades and is the lowest total since the early 2010s.

The data published by the UK-based organisation shows that the total volume of oil spilt by ships in 2014, approximately 400 tonnes (compared to 7,000 the previous year), is in line with the values recorded since 2008, all below the 10,000-tonne mark (1,000 to 7,000 tonnes) with the exception of 2010.

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

• Summary of illegal discharges

Pollution reports: analysis of 2014 POLREPs (mainland France)

Since 2000, Cedre has been drawing up an annual summary of POLREPs (Pollution Reports) in the waters under French jurisdiction, submitted by the Maritime Rescue Coordination Centres (MRCCs) - directly until 2010 and since then via the French maritime database *Trafic 2000*. Despite inter-annual variation in observation pressure, the 2014 results, together with those of previous years, show the evolution of incidences of marine pollution (spills, operational discharge and illegal releases) detected by the aerial surveillance effort in French waters.

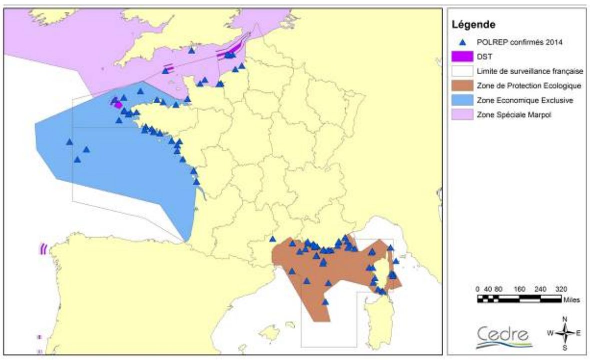
The review of 2014 data for confirmed POLREPs shows:

- a total of 96 POLREPs, slightly down from the 2013 total (118)
- confirmation of the downward trend described in previous years (292/year on average for the period 2000-2012[14])
- the distribution once again of the majority of POLREPs off the Mediterranean coast, where 48 % of reports were made
- like in previous years, oil was by far the most frequent category of pollutant, involved in

[14] excluding the *Erika*, *Tricolor* and *Prestige* spills.

approximately 70% of POLREPs (like in 2013 and 2012)

- the origin of the discharge was determined for 34 % of POLREPs (compared to 29% in 2013 and 18% in 2012), an increasing percentage for the third year running.



Location of confirmed POLREPs in 2014 in France (Source: Cedre)

The distribution of POLREPs between and within France's different coastlines is consistent with the now well identified pattern, closely related to shipping routes in the Channel (Ushant and Casquets traffic separation schemes) and the Mediterranean (routes between Genoa and Catalonia on the one hand and Marseille on the other; Corsican coastal waters due to the Genoa-Strait of Messina and Marseille-Corsica routes).

The monthly evolution of the number of confirmed reports is similar to that recorded for the 2000-2013 period: a summer peak is still visible, although is less marked and shorter this year[15].

In 2014, given the low number of confirmed POLREPs for oil with (i) data enabling the surface area to be estimated and (ii) an indication of the Bonn Agreement Oil Appearance Code, the average surface area of slicks/sheen could not be estimated (as an indication: approx. 4.5 km² in 2013[16]; approx. 5 km^2 for the 2000-2012 period) and the range of volumes for all incidents could not be determined (between 4 and 25 m^3 in 2013[17]).

For further information:
Cedre report R.15.39.C "Analyse et exploitation des POLREP en zone de surveillance française - Année 2014".

• Response preparedness

IPIECA guidelines: updates and new references

Since early 2015, as part of the effort to revise the IPIECA Good Practice Guide Series[18], under JIP 12 of the OSR-JIP (Oil Spill Response-Joint Industry Project) launched in 2011 and led by IPIECA for the International Association of Oil & Gas Producers, new publications have been added to the list of the eight already available:

- Tiered preparedness and response (January 2015)
- Contingency planning for oil spills on water (April 2015)
- Aerial observation of oil spills at sea (February 2015)
- Dispersants: surface application (April 2015)
- Dispersants: subsea application (June 2015)
- Response strategy development using net environmental benefit analysis (NEBA) (June 2015)
- Oil Spill preparedness and response: an introduction (June 2015)

These publications include the release of revised and extended versions of existing guides, as well as newly drafted documents, including the guide on aerial observation, but also that on subsea application of chemical dispersants (based on emerging needs identified in the OSR-JIP following the Deepwater Horizon disaster).

For further information:
http://oilspillresponseproject.org/

[15] (maximum of around 15 POLREPs in June then in July).
[16] Calculated based on 60 confirmed POLREPs
[17] Calculated based on around 30 POLREPs
[18] Which updates and replaced the 'Oil Spill Report Series' published between 1990 and 2008.

Spill response training in the Mediterranean: the POSOW II project

The POSOW II project (Preparedness for Oil-polluted Shoreline clean-up and Oiled Wildlife Interventions II) was launched at a meeting of the technical partners involved in March 2015 at Cedre (Brest, France).

This 2-year project follows on from POSOW I (2012-2013)[19], also supported by the European Union under the EU civil protection mechanism (DG ECHO). Coordinated by Cedre, it involves several Mediterranean players: REMPEC (Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea, Malta), ISPRA (*Istituto Superiore per la Protezione e la Ricerca Ambientale,* Italy), FEPORTS (*Instituto Portuario de Estudios y Cooperacion de la Comunidad Valenciana*, Spain), AASTMT (Arab Academy for Science, Technology and Maritime Transport, Egypt) and DG-MARINWA (General Directorate of Maritime and Inland Waters, Turkey).

POSOW II aims to extend and promote the tools developed as part of POSOW I among the countries in the Mediterranean area neighbouring the EU (Algeria, Egypt, Lebanon, Libya, Morocco, Tunisia and Turkey). The training materials and manual produced during the first project phase will be translated in order to train personnel in spill response: the fields addressed focus on volunteer management, site surveys, shoreline clean-up and wildlife rescue. POSOW II will also see the development of 2 new themes: the involvement of fishermen in response on the water and waste management.

For further information:
http://www.posow.org; http://www.posow.org/news/POSOW2newsletter1.pdf

Cedre Operational Guides: Skimmers

In November 2015, Cedre extended its series of Operational Guides with the addition of a new guide devoted to skimmers. This document presents Cedre's knowledge on this question, both in terms of equipment and its use.

Based on the information provided and the many illustrations, it aims to provide readers with the details required to determine the most appropriate equipment and systems for the situation with which they are liable to be confronted, as well as to assess their relevance during exercises or training courses.

This guide, produced with funding from TOTAL, mainly targets operating personnel at oil sites, rescue and protection services, fire fighters, personnel from local authorities' technical services and, more generally, all personnel liable to be involved in the response to a spill in surface waters (offshore, inshore, rivers, lakes, etc.).

In addition, the French version of the Operational Guide "*Traitement aux dispersants des nappes de pétrole en mer*" (English version "Using dispersant to treat oil slicks at sea"), published in 2005, was revised in October 2015, in order to take account of changes in practices and knowledge of dispersant application by plane and by boat.

For further information:
http://wwz.cedre.fr/Nos-ressources/Documentation/Guides-operationnels/Recuperateurs
Peigné G. *Les récupérateurs, Guide opérationnel*. Brest: Cedre, 2015. 93 p.
http://wwz.cedre.fr/Nos-ressources/Documentation/Guides-operationnels/Dispersants

• Containment

Grintec lightweight self-inflatable boom BC650

The Spanish firm Sorbcontrol markets a range of oil spill equipment under the brand name Grintec: containment booms, reels, skimmers, power packs, sorbents, temporary storage tanks, etc.

The manufacturer recently added a self-inflatable containment boom to its range, Grintec Ràpid

[19] POSOW II aimed to develop technical documents (e.g. practical datasheets) relating to the principles and implementation of oiled shoreline clean-up and oiled wildlife response, targeted towards potential responders on the shoreline – professionals and volunteers (NGOs, municipalities, civil protection agencies, etc.) from EU member countries bordering the Mediterranean (Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia and Spain).

BC650, which exists in 2 versions: L (light), designed to be used in sheltered waters (harbours, relatively calm watercourses, etc. and HD (heavy duty), for use in more open waters (coastal waters, etc.). They have the same dimensions (25 m long, total height of 1.10 m with a draught of 0.65 m) but different tensile strengths, due to the density of the fabric.

The boom structure contains no metal components, making it as compact as a conventional inflatable boom, enabling it to be stored on standard reels (also on offer from Sorbcontrol), and relatively light (6.5 and 9.5 kg/m according to the model).

The BC650 has 2 skirts, between which flexible inlet pipes are placed which, when the boom is deployed from the reel, let air in, rapidly inflating the 5 chambers in each section of boom (the chambers are opened by a system of flexible hoops).

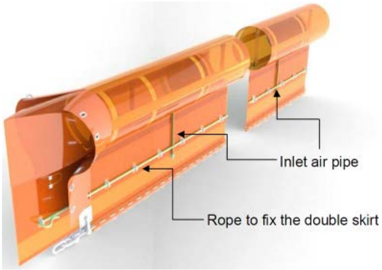


Diagram of the BC650 (Source: Sorbcontrol)

The boom can be deployed from a permanent reel (placed on the bank, wharf, deck of a boat), but also by helicopter using a special reel (like the Quick Response Oil Boom by CoastSaver AS in Norway).

For further information:
http://www.sorbcontrol.com/en/product/self-inflatable-booms/

• Recovery

Skimmer for ice-infested waters: Lamor Sternmax

The Finnish manufacturer Lamor has released a new concept to recover oil in ice-infested marine waters: the Sternmax skimmer.

This recovery system is designed to be fitted to icebreaker vessels capable of working in up to 1.1 metre-thick ice.

As its name suggests, the Sternmax is deployed at the stern of the vessel from an articulated arm. This large skimmer is placed in a metal cradle, composed of an isolation grate which retains the ice and allows the oil to flow towards the skimmer's brushes. Despite its heavy weight (32 tonnes) and high recovery rate (230 m^3/hour), this system only requires a single operator.

The skimmer itself is an oleophilic skimmer, composed of a series of 28 circular brushes mounted on a horizontal axis, and is used with 2 Lamor GTA 115 screw pumps.

The large isolation grate (l x w x h (m) = 9 x 2.4 x 1.1) is supported by an A-frame attached to an articulated arm with an operational reach of 7 m. Partially submerged, the isolation grate separates the oil and water from the ice broken by the bow of the vessel: it is regularly lifted and tilted to remove any ice obstructing it.

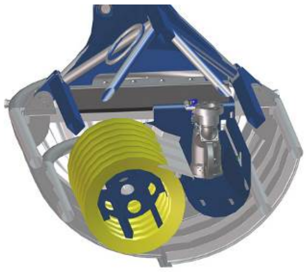


Diagram of the whole Sternmax system (top); cross-section of the skimmer part (bottom) (Source: Lamor)

The skimmer is equipped with a hot water injection system to constantly keep the brushes, scrapers, hopper and pumps warm. The isolation grate is pre-heated prior to deployment by an internal steam heating system.

The Sternmax fitted to the stern of a spill response vessel (Source: Lamor)

This system is certified in accordance with DNV 22.2 Lifting Appliances and it is Ex-Zone 1. The removable isolation grate of the Sternmax means that this skimmer can also be used in non-Arctic

environments.
For further information:
http://www.lamor.com/oilspillresponse/vessel-systems/sternmax/

A concentration, collection and storage system: Oil Trawl by NorLense

The Norwegian firm NorLense has designed and developed a system to recover oil at speeds of 1 to 4 knots. This system can be used either in dynamic mode, for trawling on open water bodies (open sea, coastal waters, large estuaries and wide rivers), or in stationary mode (moored to a bank) facing into potentially quite strong currents (estuaries, rivers, etc.). It has a high encounter rate (swath width x speed) to respond to very widely spread spills, which it can concentrate, thicken and collect directly, without requiring a skimmer or pumping unit, by channeling the oil into a floating storage bag connected to the rear of the system.

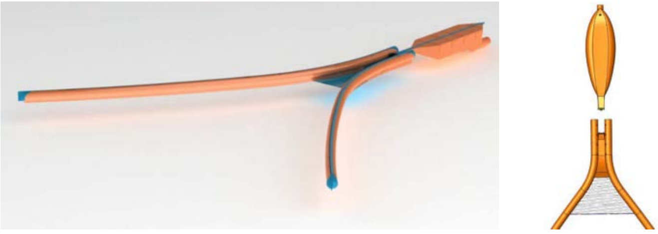


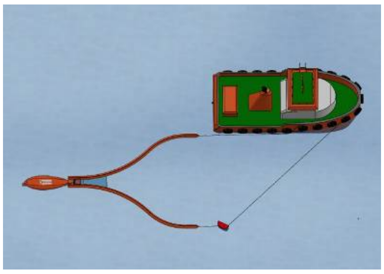
Diagram of the Oil Trawl system (Source: www.norlense.no)

The Oil Trawl is composed of three parts: a deflection boom, a concentrator-oil/water separator and a storage bag for the recovered oil.

The boom is designed to provide a large swath width (around 25 m) while reducing tensile stress and channelling the oil towards the concentrator-separator.

Downstream of the concentrator-separator, a quick connection system is used to connect the collection bag to the system. The connectors are designed to allow the bag to be easily changed during operations at sea. Inside the storage bag, a valve prevents the oil from leaking out. A pump can optionally by incorporated in the storage bag to continuously transfer the recovered oil to the tanks of a support boat.

The boom is stored on a reel housed in a 10-foot container. The Oil Trawl is powered by a diesel power pack which drives both the hydraulic system and the air compressor, also housed within the container, that is used to inflate the boom.



Implementation diagram (Source: Norlense)

Rear view (Source: Norlense)

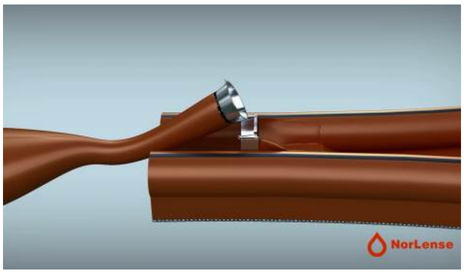
The boom is inflated automatically and it can be operated from a single boat if a paravane is used to help deploy it.

The manufacturer emphasises how easy the system is to deploy and use: a single boat and a single operator.

The system was tested many times between 2012 and 2015. Following trials at OHMSETT, in early then late 2012, on various types of oil, with and without wave action and at different towing speeds, various improvements were made to the system.

The improved version underwent a new series of tests (again at OHMSETT) in late May/early June 2013.

Deploying the system



Connecting the collection bag (Source: Norlense)

Since 2014, two models of the Oil Trawl have been marketed by NorLense:

- the NO-T-600-S, characterised by a 60 cm freeboard, a skirt depth of 15 to 30 cm and a boom weight of 8.5 kg/m (see http://amsnor.com.au/wp-content/uploads/2014/12/Tecnical-specification-NO-T-600-S-SV.pdf)
- the NO-T-1000-S, with a 1 m freeboard, a skirt depth of 50 cm and a boom weight of 22 kg/m (see http://amsnor.com.au/wp-content/uploads/2014/12/Tecnical-specification-NO-

T-1000-S-SV.pdf)

Three sizes of storage bag are also available: 10 m^3, 20 m^3 and 30 m^3.

The NO-T-600-S (left) and a diagram showing trawling with a paravane (right) (Source: Norlense)

In mid-2014, NorLense announced that it had supplied over 20 of these systems to oil companies, and that the Oil Trawl system had been adopted by the Norwegian Coast Guard as their standard recovery system.

The NO-T-1000-S model, with a 30 m^3 storage bag and an integrated Framo TK 150 pump, was tested in spring 2015 during the Oil-on-Water exercise 2015, organised by NOFO in the Frigg field in the North Sea. NorLense stated that the trials had been carried out in harsh conditions but had nevertheless demonstrated the system's capacity to efficiently recover emulsified oil, collect it in the floating bag and extract it by continuous pumping to the storage tanks of the support vessels.

For further information:
www.norlense.no
http://www.norlense.no/en/news-archive/157-oil-on-water-2015

• Sorbents

Reuseable hydrophobic sorbent OPFLEX

The American firm OPFLEX Environmental Technologies manufactures and markets a range of sorbents designed for oil spill response on water. The material used is foam derived from a copolymer of ethylene/methyl acrylate (EMA). It is apolar and therefore oleophilic and hydrophobic.

Its open-cell cavity structure (comparable to that of a sponge for instance) is said to have a good oil sorption capacity and means that these foam products can be reused 5 to 6 times after extracting the oil by squeezing/wringing, thus reducing the quantity of oil to be disposed of. OPFLEX exists in various shapes and sizes: pads, belts, eelgrass...

We note in particular the existence of forms providing a large surface area for contact between the sorbent and the environment: the Cube Boom, composed of cubes (5 cm edge) contained within a coarse mesh tube and the Eelgrass form, designed to collect oil at the surface or ballasted in the water column.

*IOSC 2014: OPFLEX sorbent Cube Boom (**left**) and Eelgrass (**right**, here used with sections of fence boom) (Source: Cedre)*

According to the manufacturer, this material's tensile strength and elasticity mean that it can be used in currents and rough water: rivers, estuaries or even inshore and coastal waters.

OPFLEX Environmental Technologies has a strong presence on the spill response market (for instance during the 2014 International Oil Spill Conference) and conducts tests at the OHMSETT facilities to evaluate (i) the performance of its products in various configurations (e.g. forms, lengths, thicknesses, etc.) and (ii) their implementation using the equipment proposed by the manufacturer (deployment by towing from reels, wringing system, etc.). The tests, following which further developments are planned according to OPFLEX Environmental Technologies, have apparently included both dynamic (e.g. towing through floating slicks) and static (shoreline protection) collection methods.

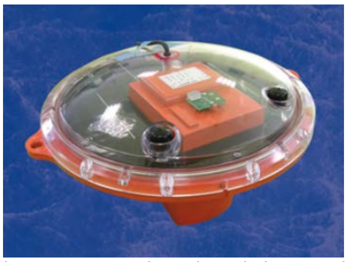
For further information:
http://www.opflex.com/index.php/opflex-foam

• Slick drift

McMurdo/Kannad slick drift tracking buoy Oceania

McMurdo Marine Solutions (Kannad Tracking Solutions) have launched a new marine tracking buoy designed for a range of applications including tracking objects at sea (oil slicks, vessels in difficulty, containers lost at sea, icebergs, etc.).

This flat, disc-shaped buoy, named Oceania, is compact (40 cm in diameter and 20 cm high) and lightweight (4 kg). With a capacity to resist up to a 30-metre fall, the buoy can easily be deployed from a helicopter. It can operate at temperatures between -20°C and +50°C.



(Source: mcmurdomarinesolutions.com)

Two versions of the buoy exist. For long term/long range tracking, the Oceania LR is equipped with an Iridium transceiver (universal cover by Iridium satellite constellation) which provides real time control from anywhere in the world.

For short range tracking, the Oceania SR is equipped with an AIS ATON system for direct transmission to a vessel in the area.

The buoy is fitted with a GPS, a high intensity light beacon, a surface temperature sensor and an out of water sensor. The solar panel option (not possible for oil spill uses) enables up to 2 years continuous operation before the battery needs replacing. For oil spill tracking, the alkaline batteries allow the buoy to operate for up to 150 days (with a reduced transmission frequency of 10 minutes).

The data is sent to a server running the McMurdo Kannad software which can track up to 2,000 buoys at a time and allows simultaneous access by different users, with the possibility of allocating specific access rights.

The French Navy has purchased several of these units which have thus far mainly been used to mark and track containers lost in the Bay of Biscay and the Channel. Cedre has also purchased 3 of these buoys for long term slick drift tracking and for experimentation at sea.

For further information:
http://www.mcmurdomarinesolutions.com/images/downloads/doc11046e_oceania_gb_mcmurdo_syfp.pdf

• In situ oil detection/monitoring

Remote sensing: development of a surveillance balloon

The TOTAL group has developed its very own surveillance balloon to provide its subsidiaries with a system for tracking an oil spill from a vessel by both day and night.

Following an initial phase devoted to selecting the most suitable sensor technologies, including a series of trials conducted with different crude oils in Cedre's test basins, the developers ultimately opted for an infrared sensor coupled with a video camera operating in the visible spectrum.

The helium-filled balloon, with a volume of 8.5 m^3 and a payload capacity of approximately 3 kg, is equipped with a stabilised turret comprising a FLIR TAU 640 uncooled infrared camera and a high definition video camera with a zoom.

The aerostat (Source: Cedre)

The turret, designed by Survey Copter, attached to the underside of the balloon, is motor-driven in 2 directions, thus enabling 360° panoramic rotation as well as inclination of up to 90°. The images obtained by the cameras are georeferenced and transmitted in real time by VHF to the receiver on the vessel's deck.

View of the turret with IR and video cameras (left) and of the compact command panel (right) (Source: Cedre)

The cameras are operated from the vessel relatively intuitively using a multifunction controller.

The whole system can be deployed in under an hour (the balloon takes 10 minutes to inflate) and requires a 2 m by 4 m area on the deck of the vessel as well as a relatively open space for launching the balloon. The maximum wind speed for using the system is 15 knots.

The first trials conducted by TOTAL on an oil slick showed a detection range of up to 3.5 km at an altitude of 150 m and a run time of over 8 hours.

• Conferences

International Forum on Group V (Non-Buoyant) Oils

On 9th and 10th September, the International Spill Control Organization (ISCO) organised a forum on the issue of sinking oils. This forum, sponsored by the US Coast Guard, NOAA and industrial partners, gathered almost 150 participants in Detroit (US).

The aim of the forum was to bring together spill response professionals (public, private, associations, academics, etc.) to exchange information and hold discussions on the problems raised by growing production – and thus an increased spill risk – of Group V oils, based on the classification defined by the American Standard of Testing Materials (ASTM). Six sessions were run at the two-day forum, during which 19 speakers presented reviews, feedback, research, techniques and equipment devoted to spills of sinking oil.

A large share of the presentations focused on the issues posed by spills of diluted bitumen (dilbit). This type of oil is mainly produced in Alberta (Canada) from bituminous schist (mixture of sand 80-85%, water 4%, clay 3% and heavy oil 12%). Chemically speaking, this crude oil is similar to bitumen due to the large share of high molecular weight compounds. To reduce its viscosity and facilitate its transportation, a light oil (between 25 and 40% of the total volume) is mixed with this oil, a practice commonly employed for heavy fuel oils. The type of diluent determines the name given to the product: Dilbit if condensates are used, Synbit if the flux is a synthetic crude oil, Dilsynbit if the synbit is mixed with a condensate. All 4 of these products are generally referred to as dilbit in everyday usage. The variability in the chemical composition of these natural bitumens as well as the diluents used (composition and proportion) results in a wide range of compositions and therefore of behaviours, which remain very difficult to predict.

In the event of a spill, like with most crude oils, the majority of dilbits will tend to spread rapidly and form a floating slick at the water surface. Conventional recovery techniques (skimmers, sorbents) can therefore be considered. However, for this type of product, the lightest share (diluent) will evaporate, leaving a highly viscous, heavy substance, which is liable to sink within the first few days following the spill. The deployment strategies for the spill response techniques will therefore need to be defined very rapidly as soon as the spill occurs.

OSRL Technical Forum on chemical dispersion (Fort Lauderdale, US)

From 12th to 14th November 2014, a technical workshop entitled "Understanding Dispersants in Oil Spill Response" was organised by what was formerly Clean Caribbean & Americas (CCA), a response company working in the Caribbean funded by the oil industry which merged in 2013 with its British counterpart OSRL (Oil Spill Response Limited).

This forum was attended by around 90 representatives of the public (US government agencies) and private (oil industry and response companies) sectors, mainly based in America (North, Central and Southern America). The aims were (i) to present chemical dispersants and their usage, in particular to propose and discuss the principles geared towards optimising decision-making in this field and (ii) to give OSRL the opportunity to promote its skills and capacities in this field (a visit of OSRL's response base in Fort Lauderdale was proposed following the forum).

Upon invitation by OSRL, Cedre gave a presentation on recent progress in the revision in progress of the IMO guide, including recomendations in terms of net environmental benefit analysis (NEBA).

Overall, the presentations addressed the use of dispersants from a relatively favourable angle, and the workshop focused largely on the integration of the NEBA approach in the decision-making process. In this respect, we note a North American approach which relies heavily on models, with a current tendency to attempt to include sublethal effects, in other words an attempt to determine the persistence of medium/long term effects. Another general observation was that the discussions suggested that the use of NEBA (and the conclusion, at specialised workshops, of pre-established consensuses between the different parties involved in spill response) is currently considered indispensable in contingency planning.

In the US more specifically, we note the following points:

- from the experience of the Deepwater Horizon disaster, the emergence of an overall strategy to determine response options and surface response equipment according to the distance from the upwelling oil: (i) within the immediate viscinity of the upwelling oil: mechanical recovery, (ii) downwind of this zone: in situ burning, (iii) between the coast and this zone: dispersant application, (iv) inshore: mechanical recovery (second row).
- In addition to the rules on implementation and usage, established prior to the Deepwater Horizon blowout for the regions IV and VI (including the south-western states of the Gulf of Mexico), rules on subsea dispersant injection are currently under development (RRT6 subsea dispersant use authorization process) and are to be published in the near future.

A methodology and a description of the resources required for subsea dispersant injection as a response method for offshore well blowouts have been drafted. The equipment and tactics were defined as part of the Subsea Well Response Project. OSRL now offers services in this field through its new dedicated subsea division, SWIS (Subsea Well Intervention Services): http://swis-oilspillresponse.com/index.php/node/10000.

Finally, a certain number of documents and practical tools developed in the US to support dispersant operations at different levels (e.g. decision-making, efficiency assessment, etc.) were mentioned during the forum, including:

- A complementary document alongside the SMART protocol[20], comprising a certain number of recommendations for environmental monitoring to be implemented alongside 'atypical" dispersion operations (i.e. large-scale – in the case of subsea blowouts with dispersant application at depths of over 300 m or requiring surface dispersion for over 96 hours).
- The updated version of the Dispersant Mission Planner (see LTML 31 & 32), or DMP2, a software programme available on the NOAA website which includes an EDAC (Effective Daily Application Capacities) mode for rapidly assessing the daily dispersant application capacity according to the circumstances (plane type, distance between spill and airport, slick dimensions, etc.). We also note that the Spill Tools software (see LTML 31 & 32) designed to compare the expected results of the different response options, previously available on the NOAA website, can now only be downloaded as part of the ROC software (Response Option Calculator) available from the website of the US-based firm Genwest.

• Impact

Exxon Valdez spill and shoreline impacts: feedback 25 years on

Twenty-five years after the *Exxon Valdez* spill (Alaska, 1989), the NOAA Office of Response and Restoration (OR&R) published a review entitled 'Twenty-Five Years After the Exxon Valdez Oil Spill'. This report presents an overview of the accident and summarises NOAA's involvement in the multi-agency response to the spill, but above all it provides interesting feedback relating to the lessons learnt in terms of the environmental impacts caused by this event – still considered as one of the most disastrous events on the North American shores.

In terms of the response to and assessment of these effects, it is interesting to remember that the *Exxon Valdez* raised many challenges, due to the geographic remoteness of the affected sites (coastal mountain ranges), the complexity of the shoreline (rugged coast, difficult access...), the high tidal ranges, the harsh sub-polar/oceanic climate requiring operations to be stopped over the winter, etc., in conjunction with major environmental constraints relating to the relatively low level of human

[20] SMART: Special Monitoring of Applied Response Technologies

activity in the area (ecologically sensitive habitats, fisheries resources, etc.). With this as a backdrop, the report reviews the conclusions relating to the various implications of the accidents. We draw readers' attention to the conclusions relating to: (i) the viability and efficiency/benefit of various methods (in particular high pressure hot water washing, but also surfwashing or "berm relocation"), (ii) the long term fate of residual contamination in shoreline sediments and intertidal benthic populations. The latter point was also the focus of a publication by NOAA (Fukuyama et al, 2014), which indicates that:

- In addition to the spill itself, the application of aggressive response techniques, especially the use of high pressure hot water washing during the first year[21], required monitoring of intertidal benthic communities to be implemented. This 10-year monitoring programme identified significant initial impacts clearly linked to this response method which were greater than the impact caused by the oil itself. A restoration process was however visible after 2 to 3 years. The re-establishment of communities, directly or indirectly affected, was generally observed after 3 to 6 years, according to sites and the colonisation potential of benthic species (due to biological cycles in sync with the high natural forces present on such foreshores).
- The design of the monitoring programme (long term, many unoiled control sites) also meant that natural fluctuations (inter-annual, spatial) could, retrospectively, be differentiated from those due to the spill.
- Overall, this minimises, or even contradicts, certain initial predictions that, due to the extent of initial impacts, the restoration times required by sites treated with high pressure hot water would be longer than for oiled sites on which this technique was not used: ultimately, recovery occurred at about the same time for both categories of sites due to a more dynamic recolonisation phase at cleaned sites.

This report completes that published by the U.S. Geological Survey which, based on the long term monitoring of sea otter populations (including several thousand specimens found dead in the aftermath of the spill), announced a return to pre-spill levels between 2011 and 2013.

Probably due to prolonged exposure to the residual contamination of their functional shoreline habitats (for nutrition), these populations were among the slowest to recover. Almost twenty years went by before signs of population recovery began to show. In addition to the decrease in population size (based on aerial surveys), the long term analysis of sea otter carcasses showed a return to normal of the age distribution of the individuals collected (following a prevalence of prime-age individuals, compared to the youngest and oldest individuals prior to the spill and in 2013). Meanwhile, the recent results of genetic studies using genes selected as indicators of oil exposure suggest a reduction since 2008.

For further information:

- NOAA report: http://response.restoration.noaa.gov/sites/default/files/Exxon_Valdez_25YearsAfter_508_0.pdf.
- Fukuyama AK, Shigenaka G, et Coats D., 2014. Status of intertidal infaunal communities following the *Exxon Valdez* oil spill in Prince William Sound, Alaska. Mar Pollut Bull. 2014 Jul 15;84 (1-2):56-69. http://dx.doi.org/doi:10.1016/j.marpolbul.2014.05.043.
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• Wrecks

Bulk carrier *Smart*: wreck removal operations complete (South Africa)

The removal of the last section of the bulk carrier *Smart*, which sank in August 2013 on the shores of Richards Bay (South Africa) where it released its cargo of coal (see LTML n°38), was completed in September 2015. Following the removal of the front and rear sections in October 2013 and December 2014 respectively, the middle section was evacuated following complex operations due to the partial burial of the structure in the sediment and to the harsh sea and weather conditions in this region. The operations were carried out by Titan Salvage, a subsidiary of the US firm Crowley

[21] Technical choice made at the time as during the first months the oil became persistent/viscous and adhered to surfaces (weathering/emulsification, etc.)

Maritime (which recently won renown in the salvage of the wreck of the *Costa Concordia* in Italy) which now belongs to the new group Ardent, following a merger with the Danish company Svitzer (subsidiary of the AP Møller-Maersk group).
In terms of the management and the completion of these operations, the South African Maritime Safety Authority (SAMSA) commended the good cooperation between the public players (in particular SAMSA, the South African Department of Agriculture and Environmental Affairs and the Endangered Wildlife Trust) and representatives of the responsible party – the P&I Club and the salvage company contracted – which led to a satisfactory result, in compliance with the pre-defined conditions and schedule and without any legal action being required, in an ecologically sensitive environment.