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• Spills

Spill of bituminous coal at a sensitive site (*Finacia 32* barge, Java, Indonesia)

On 1st September 2015, the non-motorised barge *Finacia 32*, carrying 7,520 tonnes of bituminous coal[1], ran aground on the Ujung Kutonas peninsula, in the south-west of Java (Indonesia), where it capsized and spilt its cargo in stormy conditions.

The incident occurred within Ujung Kulon National Park, a UNESCO World Heritage Site. Thick deposits of coal covered vast areas of shoreline and had to be removed because of the park's special status and due to the risks of environmental contamination by leaching.

***Left**: View of the* Finacia 32 *barge, capsized on the shoreline;* ***Right**: section of the shoreline covered with a thick layer of coal (Source: ITOPF)*

As these operations were being carried out, the spilt cargo was being remobilised due to strong waves and currents in the weeks following the incident. The coal thus rapidly spread along a stretch of shoreline over 1 km long (half of which was submerged in subtidal areas under up to 4 m of water), with some of it becoming buried in or mixed with sandy sediment.

***Left**: Manually recovering the coal and storing it in bags;* ***Centre**: transferring bags to the primary storage site using small two-wheeled vehicles;* ***Right**: View of the primary storage site, a month and a half after the incident. The coal was to be evacuated in bulk bags by small trucks (Source: ITOPF)*

Part of the coal was recovered manually, initially by the barge owner's personnel then under the coordination of a local company commissioned by the shipowner, who also mobilised ITOPF to provide technical expertise, and involved local inhabitants who received payment. During this phase, we note that the collected coal was transferred from the clean-up sites to two successive storage sites, respectively located 2-3 km and 7 km from the clean-up site. Due to limited access to the clean-up area, the recovered coal was transferred in bags to the first site by small two-wheeled vehicles, then by small trucks to the second. We also note that the bulk bags were covered with tarpaulins to prevent potential risks of leaching (as well as self-combustion) of the coal due to rainfall.

Fuel oil and diesel leak in coastal waters: the *Flinterstar* bulk carrier incident (Belgium)

On 6th October 2015, the LNG carrier *Al Oraiq* collided with the cargo vessel *Flinterstar* off Zeebrugge (Belgian territorial waters) in a very busy shipping area, at the crossroads of the North Sea traffic separation schemes and the access channels to the ports of Zeebrugge and Antwerp. While the LNG carrier was able to enter the port of Zeebrugge for inspection, the damaged bulk carrier grounded and sank on a shallow sand bank (-10 m) 5.3 nautical miles from the coast.

[1] bituminous coal, also known as steam coal, is used as fuel to produce electricity

The Flinterstar *stranded on a sand bar following the collision on 6th October 2015 (source: http://www.mil.be/)*

It was carrying 3,000 tonnes of steel and contained around 430 tonnes of heavy fuel oil (IFO 380) and 115 tonnes of diesel in its bunker tanks.

The 11 crew members and the pilot were rapidly evacuated and Belgium triggered its national contingency plan for the North Sea, with an exclusion zone set up around the wreck for shipping safety. The spill was monitored and assessed by aerial and satellite surveillance, sampling and drift and behaviour forecasting using the Belgian model OSERIT[2].

From the very beginning of the incident up until the end of recovery operations on the water and oil removal operations from the vessel's bunker tanks, which lasted a month, a continuous leak of a mixture of heavy fuel oil and diesel could be seen, whose intensity and appearance varied (sheen and/or streaks) according to the hydroclimatic conditions and the gradual breakdown of the wreck's structure. Based on aerial surveys and the results of recovery and pumping operations, it was estimated that around 200 tonnes of fuel (at least half of which was IFO 380) had been released into the environment.

The possibility of chemical dispersion was rejected from the outset due to the shallow depths in the area, which would not have be conducive to rapid dilution of the dispersed droplets, bearing in mind that this was a fishing area. The chosen strategy was mechanical recovery, which was rapidly implemented to reduce the quantity of oil liable to reach the coast, which comprised sensitive sites (from, inter alia, an environmental point of view).

The specialised vessel Arca *recovering floating oil at sea (Source: Belgian Environment DG)*

Initial attempts to contain and recover the slicks by trawling booms and deploying skimmers proved to be of limited efficiency due to the rough conditions, currents and the relatively high level of spreading of the diesel and heavy fuel oil mixture.

The Belgian authorities then requested help from the Netherlands, which mobilised the oil spill response vessel *Arca* (fitted with 2 sweeping arms, a separator and a storage capacity (1,000 m^3) and the dredger *Interballast I*, soon joined by the workboat *Hebo-Cat 7*[3] (both these vessels were equipped with sweeping arms).

In total, at least 50 m^3 of oil (after water separation) was recovered on the water by these vessels, which remained mobilised under the coordination of the authorities until the end of lightering operations, for which specialised companies (Multraship and Smit Salvage) were contracted by the operator and mobilised their own resources.

These lightering operations were hampered by strong tidal currents which impeded the work of the divers and had to be suspended several times due to adverse sea and weather conditions. Pumping operations were completed three weeks after the incident (resulting in the removal of 400 m^3 of oil from the vessel, of which 350 m^3 were put back on the market after settling).

*Dutch oil spill response vessels on standby (*Interballast I *and* Hebo-Cat 7*) during oil removal operations by Multraship vessels (Source: Belgian Environment DG)*

In France, the maritime authority for the Channel and North Sea mobilised aircraft and vessels for surveillance (sampling/response). The *VN Sapeur* and the patrol vessel *Pluvier* were kept on site until the end of oil removal operations with CEPPOL experts on board.

Given the navigational hazard the wreck represented, it had to be removed. As the shipowner of the *Flinterstar* had taken steps to abandon the wreck, the Belgian authorities sought judicial intervention.

[2] 'Oil Spill Evaluation and Response Integrated Tool', a 3D model developed by the Management Unit of the North Sea Mathematical Models (MUMM), a department under the auspices of the Royal Belgian Institute of Natural Sciences.
[3] belonging to *Hebo Maritiemservice.*

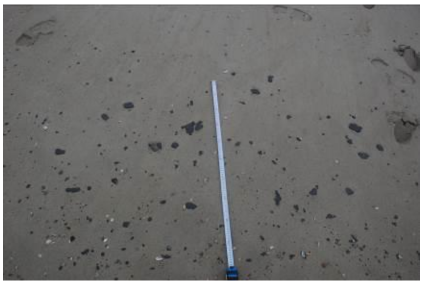
On 22nd February 2016, the shipowner was ordered to remove the wreck which, in between times, had broken in two.

A major wreck removal operation was prepared by a consortium of 4 salvage companies (Scaldis SMC, Dredging International, Herbosch-Kiere and Jan De Nul), and lasted throughout the following summer: the two sections of the wreck were removed from the water in turn and transported by sea to the port of Gand, where they were delivered, together with the cargo of metal parts, to a scrapyard approved for metal recovery and recycling.

27/06/2016: The vessel Rambiz *and its two cranes, lifting the bow section of the Flinterstar (Source: Scaldis/DEME Group)*

The incident area was declared "free of all debris in compliance with the criteria defined by the authorities" following side scan sonar surveys carried out in September 2016.

In compliance with forecasts by drift models, produced daily by the Belgian authorities and Météo-France (MOTHY model), very limited quantities of micro-tarballs washed up at a few sites along the shoreline. With the changes in wind direction and the ebb and flow of the tides, the shores of the Netherlands (Walcheren Peninsula) and Belgium were hit (light deposits along a 4-km stretch between Ostend and Knokke-Le-Zoute, triggering manual recovery operations), as well as the northern coast of France (a few hundred metres of beaches affected in mid-October by sparsely scattered micro-tarballs in the Dunkirk and Oye-Plage area)[4]. As a preventive measure, a sand wall was built to protect the Zwin nature reserve (Belgium and the Netherlands). In France, the authorities launched systematic surveys of the coastline from Gravelines to the Belgian border (Bray-Dunes) which did not reveal any further strandings.



Tarballs (1 to 5 cm) stranded on Blankenberge beach (Belgium) (Source: Belgian Environment DG)

Cedre was called upon by MUMM (Belgium)[5] to perform analyses to characterise fuel samples and by the French authorities to confirm the similarity between the tarballs collected on the French coastline and the bunker fuel from the *Flinterstar*.

The preventive provisions for caring for any oiled birds fortunately proved unnecessary. Few oiled birds were reported, thanks to favourable weather conditions and to the fact that the greatest bird populations were still further north along the Dutch coastline.

The two monitoring programmes carried out the first week after the incident then in late October (PAH concentrations in fish, benthic fauna and sediment) did not reveal any increase in the level of PAHs following the incident.

For further information:

Anon., 2016. The *Flinterstar* Incident. OTSOPA 16/8/Info.1 document presented by Belgium at the Meeting of the Bonn Agreement Working Group on Operational, Technical and Scientific Questions concerning Counter Pollution Activities (OTSOPA), held at Scheveningen, The Netherlands, 24-26 May 2016. 11 pp.

Leak of low persistence diesel in a port (barge *Nijptangh*, Cherbourg)

At around 6 am on 15th October 2015, the Belgian-registered marine work barge *Nijptangh* was carrying out dredging work when it struck the bottom in Cherbourg roadstead, releasing an estimated 40 to 60 m^3 of marine diesel into the port from a damaged fuel tank.

4 Around the same time, fishing gear (nets, dredges) used by shrimp boats working off Dunkirk/Oye-Plage was reported to have been oiled.

5 Throughout the incident, advice and information was regularly exchanged between Cedre and the Belgian stakeholders in charge of crisis management (in particular MUMM and Environment DG), who were also involved in revising this article, for which we are very grateful.

15/10, 3 hours post-spill: Aerial view of the diesel leak from the barge Nijptangh (near the small "Port des Flamands") (Source: French Navy)

The emergency response mobilised the naval fire-fighters at Cherbourg naval base (personnel and fireboat) and an operational centre was activated mid-morning at the Manche Prefecture (Saint Lô).

The naval base rapidly provided 2 tugs, containment booms and pumping equipment, and a French Navy EC225 helicopter carried out several overflights of the area to monitor the spread and evolution of the spill. The port authority contacted Cedre's duty officer to notify them and request on-site assistance to advise the services in charge of the spill response.

One of the main actions consisted in assessing the risk of further leakage from the source. With this as a backdrop, the clearance divers for the Manche area provided support by carrying out initial inspections of the hull of the *Nijptangh*. Based on these inspections of the structure in addition to observations carried out on the water, it appeared that the leak had stopped: the barge was towed into dock the same day, before the fuel was pumped out of its tanks by a local company.

Containment booms around the *Nijptangh*, in dock for fuel removal (Source: Cedre)

In terms of spill response, actions to protect nearby sensitive sites proved necessary, in particular boom deployment (lined with a row of sorbent booms) around a salmon farm adjacent to the incident site, and the preventive closure of water intakes at the sea discovery centre, Cité de la Mer.

Floating booms deployed by the French Navy to protect the floating cages at the fish farm (Source: Cedre)

To prevent health risks, temporary fish bans and shipping bans in the affected area were issued.

On the water, the weather conditions and properties of the oil, which was relatively light, caused the oil to spread extensively, making it difficult to concentrate and contain it, and ultimately preventing mechanical recovery. Collection operations on the water therefore proved inappropriate, and the low persistence of marine diesel implied a high short term natural dissipation potential of the majority of the oil spilt, due to the local hydrodynamics. This scenario was backed by forecasts (high evaporation and dispersion within 24 hours) produced by the weathering model used by Cedre and was confirmed by aerial observations throughout the day, which revealed that the wide spread of the floating oil led to the presence of a metallic and rainbow film.

The following day, the oil dissipated thanks to choppy conditions (50 to 80 cm) and relatively strong winds (20 to 26 knots), but also to the renewal of the water mass in Cherbourg's outer roadstead due to tidal movements. Aerial surveys carried out in the morning confirmed that no sheen was present at the water surface and surveys were also conducted from the military police boat VSMP HEAUME, during which no floating oil was observed visually. Finally, on-foot surveys carried out jointly by Cedre and the port authority only revealed light, discontinuous traces of sheen in a few places, which were being dispersed naturally and therefore did not require any response actions.

Shoreline pollution following an oil tanker grounding (*Nadezhda*, Sakhalin Oblast, Russia)

In late November 2015, the oil tanker *Nadezhda* (1,137 DWT) suffered an accident near the Port of Nevelsk (Sakhalin Oblast, in the Russian Far East), grounding on a shoal in a storm. The ship's structure was damaged, releasing an unspecified proportion of the 786 tonnes of oil (heavy fuel oil and diesel) it was carrying into the coastal waters.

No response at sea was possible due to the adverse sea and weather conditions, and the spill rapidly hit the shoreline, leading the Russian Ministry of Emergency Situations to set up and coordinate clean-up operations. The information available, although sparse and rather vague, indicated that over one hundred responders were involved in shoreline clean-up operations and spill control at the source (transfer of the remainder of the cargo into the tanks of other vessels, and laying of approximately 150 m of booms against the hull of the damaged oil tanker). Two days after the incident, the Russian authorities stated in the press that 1.5 km of shoreline had been cleaned (of the 3.5 km oiled), with a total of over 100 m^3 of oiled sediment collected at that stage, and announced that 2 further weeks of operations were scheduled to complete the response.

Contamination of infrastructures with heavy fuel oil (*City* incident, Port of Sakata, Japan)

On 10th January the cargo ship *City* ran aground in the Japanese Port of Sakata (Yamagata Prefecture, Sea of Japan). Shortly after the structure had broken, the ship released around 120 tonnes of IFO 180 (as well as diesel and lubricants) which, under the influence of the waves and currents, spread through the port waters, oiling many infrastructures, river banks and rice paddy irrigation channels.

On-shore response was implemented with on-site assistance from the technical expert (ITOPF) appointed by the *City*'s P&I Club. According to ITOPF, the clean-up operations were hampered by the winter temperatures and the abundant snow cover. During the 6-week response, various techniques were implemented including recovery/scooping of the floating oil (viscous and relatively congealed) using nets, manual recovery of stranded oil using sorbents (pads, mats and mop) and scraping of the thickest coatings on hard surfaces (port infrastructures, concrete walls) prior to pressure washing.

Loss of a cargo of coal in coastal waters (*New Mykonos*, Faux Cap, Madagascar)

On 29th January 2016, the Panama-flagged bulk carrier *New Mykonos* was travelling from Richards Bay (South Africa) to India with a cargo of 160,000 tonnes of coal when it ran aground on a sand bar around 8 km from the coast of Faux Cap, in the region of Androy (southern tip of Madagascar).

In the weeks following the incident, salvage operations were envisaged to refloat and tow the vessel. The shipowner thus contracted 2 companies (including SMIT Salvage) to survey the structure and assess the salvage options, working in tandem with the Madagascan authorities (in particular OLEP, the organisation in charge of response to marine oil spills, under the Ministry of environment, ecology, the sea and forests). Two tugs based in South Africa were subsequently mobilised (*Mermaid Vanquish* and *Raptor*), as well as the Malta-registered oil tanker *Anuket Topaz* to which the contents of the bunker tanks – which remained intact – of the *New Mykonos* were to be transferred.

More than a month after the incident, the vessel still remained grounded, due to ongoing adverse weather conditions in the area which prevented salvage operations. Meanwhile, leaks of powdered coal, regularly observed, indicated that the cargo had started to escape. In mid-March, the 2,500 tonnes of bunker fuel were pumped out of the vessel (and the hydraulic circuits purged), thus eliminating at least the risk of a fuel spill.

However the structure, which had suffered leaks and was almost entirely immersed in 25 metre-deep waters, broke in two in early April due to the mechanical stress exerted by the swell. The broken vessel released its cargo and the State of Madagascar stated in the press that it was pursuing negotiations with the shipowner and his representatives for the removal of the coal and the wreck (the outcome of these negotiations remains unknown to us).

Grounding of a container ship and pollution of an exposed shoreline environment (*TS Taipei*, Taiwan)

On 10th March 2016, during a storm, the container ship *TS Taipei*, suffering engine failure, ran aground around 300 metres off the coast of Shimen, in the north of New Taipei (Taiwan), in the East China Sea. The 21 crew members were evacuated to safety the same day by helicopters belonging to the Taiwan National Airborne Services Corps (a tragic helicopter accident in which 2 responders were killed occurred during these rescue operations).

The wreck could not be towed and was very exposed to wave action, causing it to be deformed and damaged against the rocks. One of the priorities was therefore to remove the bunker fuel to mitigate the imminent risk of shoreline oil pollution, and to prepare to subsequently remove the vessel (the operator TS Lines tasked the specialised companies Resolve Marine and Nippon Salvage with assessing the possible options and implementing these operations). The quantity of fuel transported at the time of the incident was estimated at around 410 m^3 of IFO 380 and 50 m^3 of marine diesel. The sea and weather conditions considerably slowed down the pumping operations carried out using equipment belonging to Nippon Salvage.

These operations could only be implemented on six days during the fortnight following the incident, when a breach opened up in the structure of the *TS Taipei*, causing water to flood into several bunker tanks and part of the fuel to leak out into the coastal waters.

View of the structure of the TS Taipei, with a vertical breach on 25/03/2016; Heavy fuel oil washed up on the rocky foreshores some 300 m from the wreck (Source: Taiwan Environmental Protection Agency)

On 25th March, these leaks of heavy fuel oil visible from the cracked wreck caused the almost immediate oiling of a 2-km stretch of the nearby shoreline, followed by the contamination, to varying degrees, of 20 to 25 km of coastline over the following weeks.

The risk of the vessel breaking up further made it even more necessary and urgent to perform pumping operations to remove the fuel remaining in the ship's bunker tanks. The Taiwan Environmental Protection Agency (TEPA) estimated that 250 tonnes potentially remained onboard, and also reported the presence of 35 tonnes of lubricants and 617 containers[6] (of which only a few fell overboard and were washed up on the shore).

The proximity of the wreck to the shoreline and the sea state made operations at sea difficult if not inadvisable. In situ oil recovery operations were therefore mainly carried out on the shoreline, with mainly manual recovery (using lightweight tools or sorbents) of the stranded fuel and oiled debris, present in rather large quantities (mainly derived from fishing gear).

According to ITOPF, mobilised by the operator's representatives, underwater agitation of contaminated sand and surfwashing operations were carried out with recovery using sorbent mops. Heavy fuel deposited on hard substrates called for flushing operations, completed with high pressure washing.

Shoreline clean-up was completed after 2 months (10th May). According to TEPA, nearly 130 tonnes of contaminated solids and 60 m^3 of oil were recovered near and on the shore (including both floating fuel oil and strandings on the foreshore). The quantities removed from the tanks of the vessel were estimated at 295 m^3 of IFO 380 and 24 m^3 of marine diesel. During these operations, floating booms were deployed to protect the water intakes at a nuclear power plant near to the incident site.

After the cargo on the deck and in the holds had been removed by cranes, the stern and bow sections of the *TS Taipei* were towed away respectively in late July and early August (SMIT Salvage) to be dismantled.

Late March: Aerial view of the wreck of the TS Taipei and the nearby exposed shoreline where clean-up operations were being conducted (Source: Taiwan Environmental Protection Agency)

River spill: preventing spread to coastal waters (Iplom SpA refinery, Genoa)

On 17th April 2016, in Italy, a crude oil spill occurred at the Iplom SpA refinery in Busalla (a municipality of the Metropolitan City of Genoa). The spill reached the Polcevera stream and, downstream, the waters of Multedo oil terminal (Port of Genoa, Liguria).

The spill was triggered by an explosion, of undisclosed origin, which caused a crack to appear in a pipe at the refinery, as the cargo of an oil tanker was being unloaded. While several estimations reported in the press indicated a relatively high quantity spilt, somewhere around the 500 m^3 mark,

[6] Onboard, 9 containers held dangerous substances including, according to the Indonesian authorities, 22 tonnes of potassium perchlorate, 20 tonnes of toluene, 20 tonnes of fats, 9 tonnes of "corrosive liquids", 6 tonnes of "flammable lubricants" and 12 tonnes of epoxy paint. According to our sources, they were successfully recovered without any spillage.

information on the spill response was sparse rather vague. Nevertheless, the threat of the spill spreading to inshore waters and further out to sea rapidly triggered the activation of the Ramogepol plan[7]: an 8-km long slick was spotted off Albenga (south-west of the spill location, towards the Monegasque and French waters) by an Italian Coast Guard plane.

View from a Hawk Owl *surveillance device deployed by Castalia: rows of booms across the Polcevera which feeds into the port of Genoa (Source: Castalia Consorzio Stabile S.C.p.A.)*

In Genoa, measures were taken to attempt to restrict the spread of the spill in the port waters and beyond them into the Gulf; successive rows of booms were laid across the watercourse close to the source of the spill as well as in the port to attempt to contain and recover the oil. In the estuary of the Polcevera, filter dams (bunds with pipes through them) were also built, but collapsed during the night of 22nd to 23rd April under the effect of currents and heavy rainfall.

At sea, around ten specialised vessels were at work, under the coordination of the Italian Coast Guard, for recovery operations (the results of which are not specified) which lasted at least up to 7 days after the incident.

On the French side of the border, the oil spill response vessel *Jason* chartered by the French Navy was on standby in Nice, to provide support, if required, to the Italian authorities or if the slicks were to reach waters under French jurisdiction. The Italian authorities rapidly declared the spill to be "under control", contained near to Genoa. This statement concurred with observations made on 23rd April by French Navy *Falcon 50*, upon request by the maritime authorities in Toulon, which did not detect any pollution in French waters. These observations also corroborated the drift forecast models, according to which the spill was not expected to cross the border into French waters.

The measures taken to contain and recover the oil upstream of where the river flows into the port waters, along heavily reinforced, or even channelled, sections of banks, with low ecological sensitivity, appear to have restricted the environmental impacts. A few scattered oilings were reported near to the mouth of the Polcevera (roadstead/port of Genoa) by ISPRA (*Istituto Superiore per la Protezione e la Ricerca Ambientale*) staff. A few oiled birds were reported by the Ligurian branch of the LIPU (*Lega italiana protezione uccelli*). The low number of birds affected would appear to be thanks to the fact that, according to our sources of information, no functional area for birds was affected by the spill.

According to various press articles, 4 workers at the refinery, questioned by the Italian authorities, provided conflicting reports on the condition of the pipe which caused the spill, with some considering it to be "satisfactory" while for others it displayed "20 critical points".

Crude oil spill from a subsea pipeline (Shell Offshore Inc. US)

On 12th May 2016, at the Glider offshore oil field some 160 km off Port Fourchon (Louisiana, US), a leak occurred for an unspecified reason from a 6-inch pipe between a production well and the Brutus platform, operated by Shell Offshore Inc. The incident caused a spill of around 340 m^3 of crude oil of unspecified density into the Gulf of Mexico.

The surface pollution was initially surveyed by a helicopter belonging to the operator, with the observation of sheen stretching across an area 20 km long by 3 km wide. Bands of true colour were also visible and the oil company notified the authorities of the spill on the same day. It contracted 2 specialised companies (Marine Spill Response Corporation and Clean Gulf Associates) to implement response operations at sea as soon as possible. Five vessels were mobilised and fitted out with mechanical containment and recovery equipment, in accordance with the strategy prioritised by the US Coast Guard (USCG) in cooperation with Shell Offshore.

[7] Marine spill response plan established in 1993 under the RAMOGE Agreement between France, Italy and Monaco.

Aerial view of 3 vessels carrying out mechanical containment/recovery operations at sea on 14th May 2016 (Source: USCG/Marine Safety Unit Morgan City)

The operator also contracted the necessary equipment and personnel required to conduct further aerial surveys.

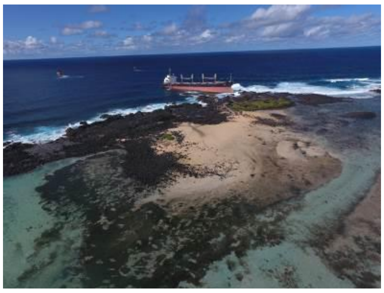
The USCG requested support from NOAA[8], in particular in terms of the behaviour and drift of the oil, as well as the environmental resources at risk. The modelling results confirmed that the product would spread rapidly and forecast that the oil would drift westwards, without an immediate risk of it reaching the coastline.

The operations were stopped 4 days after the spill, by which point no layers thick enough to be recovered remained. A total of 320 m^3 of a water/oil mixture was reported to have been recovered.

The resulting rapid mobilisation of offshore response equipment and personnel (over 130 responders, from both public and private spheres) for what ultimately proved to be a medium-sized spill can be set against the importance perceived by the operator of communication in order to prevent the emergence of unfounded rumours of loss of well pressure control (in fact production was rapidly suspended, thus stopping the leak) in a context overshadowed by the *Deepwater Horizon* disaster.

Grounded bulk carrier: an exposed coastline contaminated (*Benita*, Mauritius)

On 17th June, the Liberian bulk carrier *Benita* grounded on the shores of Le Bouchon, in the South of Mauritius (Indian Ocean), following a dispute between crew members[9] working in the machine room which ultimately led to the engine unexpectedly stopping. The 44,000 DWT vessel, travelling in ballast, had onboard 145 tonnes of bunker fuel and 30 tonnes of marine diesel.



The Benita *bulk carrier grounded on the reef of the Bouchon lagoon (Source: Five Oceans Salvage)*

The sensitivity of this site, both in ecological terms (reef surrounding a lagoon; proximity to a marine reserve also a RAMSAR site) and socio-economic terms (proximity to fish farm; upcoming local festivities; popularity with tourists), made debunkering a key priority. To do so, the shipowner contracted the Greek company Five Oceans Salvage (FOS, with a branch in Mauritius), whose experts undertook dives to inspect the condition of the *Benita*. They discovered several cracks in the vessel's cargo tanks, causing them to take on water, but the stranded bulk carrier appeared stable, despite 4 to 8 m high waves breaking on the reef.

A Mauritius Police helicopter bringing the equipment required for fuel removal operations (Source: Five Oceans Salvage)

Preparations for pumping operations (including additional equipment being brought onboard by Mauritian police helicopters) began the day after the incident, as part of a salvage plan which ultimately aimed to refloat the ship and tow it away. The fuel was removed and stored in IBC[10] containers (capacity of 1 m^3) placed on the deck. These tanks were removed by helicopter and landed ashore before transferring their contents to road tankers to be taken to a local refinery[11]. During these operations, which had to be suspended a number of times due to adverse weather conditions, the *Ionian Sea*, owned by FOS and based in Port Louis, remained on-site, with a towline attached to the bulk carrier to prevent excessive movement and provide constant tension.

Meanwhile, from the first few days following the incident, oil leaks were observed and oil washed up on the shoreline near to the ship, probably due to the rough conditions rendering ineffective the

[8] National Oceanic and Atmospheric Administration
[9] In relation to a medical issue, according to the London P&I Club.
[10] Intermediate Bulk Container
[11] Virgin Oil refinery in Montagne-Blanche (Mauritius).

containment booms laid as protective measures (in the lagoon and apparently around the vessel). According to the first statements by the National Coast Guard (NCG), the substance reaching the shore was oily water (bilge, machine room) and not bunker oil[12]. Later, other sources announced a spill of 10 to 15 tonnes of bunker fuel due to the grounding, then a further 10 tonnes in July during salvage operations.

Clean-up operations were organised both on the shoreline and in the lagoon, under the supervision of the Mauritian Ministry of Environment, with support from the NCG and the mobilisation, by the P&I Club, of equipment and personnel from a specialised contractor (Swire Emergency Response) and technical expertise provided by ITOPF.

In addition to skimmers and pumps, these operations included the use of manual recovery techniques for floating oil (bailers) and stranded oil (lightweight tools, scrapers, brushes, sorbents, etc.) as well as low pressure flushing. These operations took place during and after debunkering and refloating operations on the *Benita*[13].

Shoreline clean-up operations involved over thirty responders, including volunteers (paid fishermen), and were hampered by difficulties in transporting equipment across the lagoon and its installation in very exposed areas which were difficult to access (barrier reef)[14], as well as by the need to use non-aggressive techniques due to the site's sensitivity (ruling out the use of washing agents and hot water or pressure washing).

Operations to remove the fuel and lubricants from the vessel were completed (235 cubitainers removed) in the first half of July, leading to the preparatory phase to refloat and tow the vessel on 23rd July.

Six days later, the *Benita* was under tow to an Indian scrapyard when it sank 170 km off Mauritius in waters 4,000 metres deep, following initial flooding of the stern. According to FOS, no signs of pollution were visible at the surface in the hours after the ship sank.

Twelve days after the incident, it was reported in the press that the P&I Club had so far spent 6 million Mauritian rupees (approximately €161K) on lightering operations (still ongoing at the time, and including the personnel and logistical resources onboard the ship, pumping operations and the management of the recovered oil). The cost of using the Mauritian Police helicopters represented a large share of this sum. Furthermore, a rate of 5.5 million Mauritian rupees a day (around €147K a day) was also quoted for the mobilisation of the experts and technicians required to refloat the ship.

Finally, we note the use of remote controlled devices, reported by FOS, for various aspects of the response: a drone for shoreline surveys and a ROV to inspect the ship for structural damage as part of salvage operations. It is interesting to note that approvals had to be obtained from communication and aviation authorities to operate the drone.

• Past spills

Feedback from the shoreline pollution of Refugio State Beach (May 2015, US)

In spring 2016, two reports offering feedback from the Plains All American Pipeline 901 spill (in 2015, polluting the shores of the Californian county of Santa Barbara, US)[15] were published concurrently.

One gives the perspective of the Office of Spill Prevention and Response (OSPR) under the California Department of Fish and Wildlife, while the other gives that of the US Coast Guard (USCG). These two organisations acted respectively as State and Federal On-Scene Coordinator, within the Unified Command, the classic emergency response set-up used in the US[16].

The response actions implemented are described in these reports and recommendations are made. The reports cover many points, some more original than others. We note the following points of

[12] Contrary to various reports in the press, indicating that photos and videos posted on social media showed apparently relatively thick, viscous layers of oil resembling bunker fuel.

[13] It took over 25,000 hours to complete these phases according to FOS.

[14] Access to a small islet (*Ilot Brocus*) which is part of the barrier reef would have required a platform to be built, calling for the installation of several tonnes of scaffolding brought by numerous helicopter trips.

[15] See LTML n°41

[16] which also included representatives of the responsible party, the local authorities - county, city, tribes, etc. - and other relevant federal or state agencies, such as the U.S. Environmental Protection Agency

interest:

- In terms of the response organisation:
    - The success of operations was considered to be largely thanks to good cooperation between the different partners (public and private), which was particularly necessary given the mobilisation of large numbers of people and logistical resources (up to 1400 responders at the height of the response).
    - Health measures were immediately implemented (closure of fisheries, monitoring of the environment and seafood), allowing activities to be resumed as early as possible (limited impact on uses).
    - The good communication with non-governmental organizations (NGOs) was highlighted. In relation to this aspect, it is recommended that an increased effort be made to involve local authorities and NGOs in spill preparedness, by providing information and pre-training on response strategies.
    - On a more specifically US note, the successful inclusion of tribal authorities was highlighted, with training/awareness-raising actions, participation in clean-up and monitoring operations, in particular of culturally sensitive sectors for Native Americans (notion of 'Cultural Monitors').
    - Recommendations were also made in relation to the optimisation of (i) volunteer application management and, where relevant, (i) their integration in the response (in particular in terms of their supervision by OSPR personnel).
    - The need to develop a computerised data management system for SCAT data was also recognised.
    - Many requests from scientific organisations, who saw this real spill situation as an opportunity to conduct research or field testing, were received by the response authorities (as well as by the responsible party). As feedback, recommendations were made on the development of a protocol for evaluating and vetting these requests, which varied in their degree of relevance (some were considered of interest for operations, such as sensor tests, while others were considered to already be covered, such as by the NRDA for impact study proposals), by the US Coast Guard Research and Development Center, if necessary with support from ad hoc partners (agencies, universities, etc.).
- In terms of technical aspects:
    - The influx of technical proposals from third parties (service providers, manufacturers, equipment distributors, etc.) called for the involvement of Applied Response Technology (ART) Technical Specialists (THSP), to assess the potential relevance and efficiency of the proposed response methods. Nearly 40 proposals were evaluated, 2 of which were considered to be of interest (see following point). While this concept was greatly developed and tested during the *Deepwater Horizon* spill in 2010, following this more recent incident it was recommended that groups of ART THSPs be defined within Regional Response Teams (RRTs) that do not already have such specialists or, failing that, mechanisms should be implemented to facilitate the provision of this expertise from other RRTs. Based on existing cases, the definition of an accepted methodology for in situ vetting of alternative technologies was also recommended.
    - The topography of the site, in particular the point of discharge to the ocean, raised certain technical challenges requiring the use of specific equipment. The crude oil had run down a nearly vertical cliff face, characterised by potentially erodible, porous, fractured sandstone with coastal scrub and dense vegetation. The cliff face was heavily oiled and was located in an ecologically and culturally sensitive area. Therefore, while clean-up operations were necessary, both environmental impacts and responder safety hazards had to be kept to a strict minimum. The bulk of the oil and very oiled rocks and soil were removed, relatively selectively, by a spider excavator (an all-terrain excavator with articulated legs), which provided a safe method for working on this steep, hazardous slope. Replacement cobble, of similar composition, appearance and dimensions to the original substrate, was used (following approval by the California Coastal Commission). A second alternative technique used was the application of dry ice to oiled surfaces using ice-blasting power washers (the oil was recovered at the foot of the cliff), a technique deemed both efficient and to limit the erosion of treated surfaces.

- The distance[17] between the offshore oil recovery sites and port facilities which could be (i) accessed by oil recovery vessels and (ii) used to offload the recovered oil-water mixture compromised the efficiency of the response. This led to considerable downtime (five hour one-way transit), although the transfer of other light equipment (e.g. for decontamination and boom repair) was minimised by mobilising a work barge assigned within the spill area. The lack of a temporary storage facility for at-sea lightering of the recovered oil-water mixture was clearly identified as a limit for at-sea recovery, and therefore as an improvement opportunity for future incidents.
- Difficulties were also generated by the nearby presence of natural seep, in particular in terms of site inspection (determining whether endpoint criteria had been achieved by the responsible party). Among the recommendations made in this respect, we note that it was suggested that the Unified Command should task the Environmental Unit with developing a sampling plan to produce analytic results in order to determine whether the oil has properties that allow it to be distinguished from natural seep.

These documents also offer a comprehensive review of the efforts deployed and results obtained (quantities recovered, wildlife impacts etc.), to supplement/amend certain previous data.

For further information:

Calif. Dept. of Fish & Wildlife/OSPR, 2016. *Refugio Oil Spill, Response Evaluation Report: Summary & Recommendations from the Office of Spill Prevention and Response*, 75 pp.

USCG sector Los Angeles-Long Beach, 2016. *Refugio Beach Oil Spill, Santa Barbara County, California; Federal On-Scene Coordinator's After Action Report*, 47 pp.

Oleg Naydenov **incident: debunkering operations completed**

In mid-November 2015, the Spanish National Plan for Maritime Safety and Rescue was lifted, after bunker fuel removal operations had been completed and the risks generated by the wreck of the *Oleg Naydenov* had been mitigated. This 136-m Russian trawler sank in mid-April 2015 in waters 2,700 m deep, over 20 km south of Gran Canaria, after being towed out to sea on orders from the Spanish authorities after a fire broke out onboard a few days earlier (in the port of Las Palmas de Gran Canaria)[18].

On 26th November 2015, SASEMAR[19] announced that operations on the wreck had been completed (sealing breaches and removing bunker fuel) by the contractor Ardent (and Oceaneering International for the use of ROVs) and that the state of environmental emergency had consequently been lifted.

In terms of operations at sea, 528 m^3 of oil was recovered, including both recovery from the surface and from the bunker tanks, i.e. around a third of the volume initially estimated to be onboard the vessel when it sank.

Installing the fuel removal equipment on the Oleg Naydenov *(Source: Ardentia Marine)*

As a reminder, the port authorities justified the decision to tow the trawler on fire out to sea based on the safety of other vessels berthed in the port of Las Palmas, as well as on the mitigation of the risk of oiling for port facilities and of affecting the neighbouring desalination plant (on which the drinking water supply of hundreds of thousands of inhabitants depends).

[17] In this case, over 70 km
[18] See LTML n°41
[19] *Sociedad de Salvamento y Seguridad Marítima*

• Review of spills having occurred worldwide in 2015

Oil and HNS spills, all origins (Cedre analysis)

• Volumes spilt

In 2015, Cedre identified 26 spills involving volumes equal to or greater than 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 in ports, around 20% inshore and approximately 10% in estuaries (Fig. 1).

The number of incidents recorded in 2015 is close to the annual median of 29 incidents for the previous decade (2004-2013). The total quantity of oil and other hazardous substances spilt, around 13,500 tonnes, is far lower than the median estimated using the same method for the previous 10-year period (around 30,500 tonnes), ranking the 2015 total among the lowest estimates since 2004 (Fig. 3).

Overall, the significant spills in 2015 have a median quantity of around 45 tonnes.

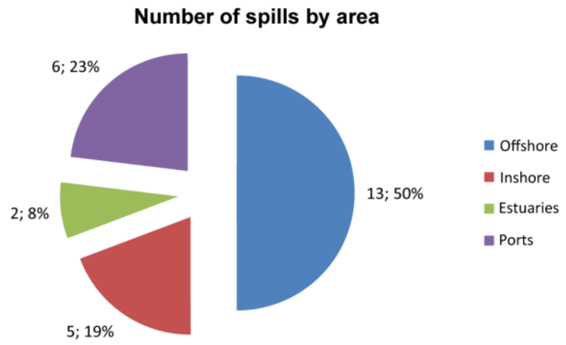


Figure 1

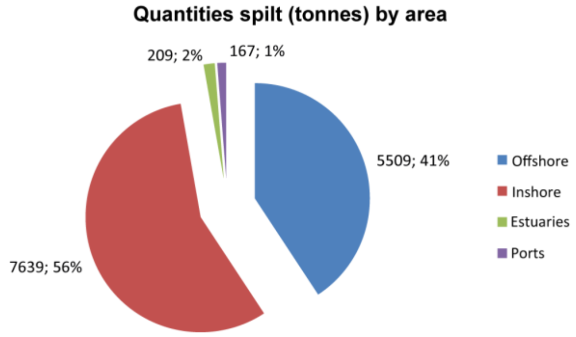


Figure 2

The quantities spilt in 2015 were mainly (just under 60%) released into inshore waters (Fig. 2), with the majority of this volume being due to the loss of a barge which ran aground in September in Indonesia (Java)[20].

The second largest share (around 40%) of the quantities spilt was in marine waters, largely due to the collision between the oil tanker *Alyarmouk* and a bulk carrier off Singapore in January[21].

Ports and estuaries were affected by relatively low quantities in 2015.

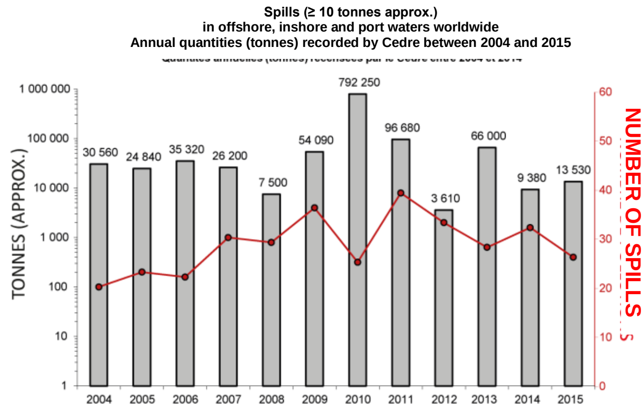


Figure 3

[20] *Finacia 32* incident with the loss of its cargo of coal. See above

[21] See LTML n°41

• Spill locations

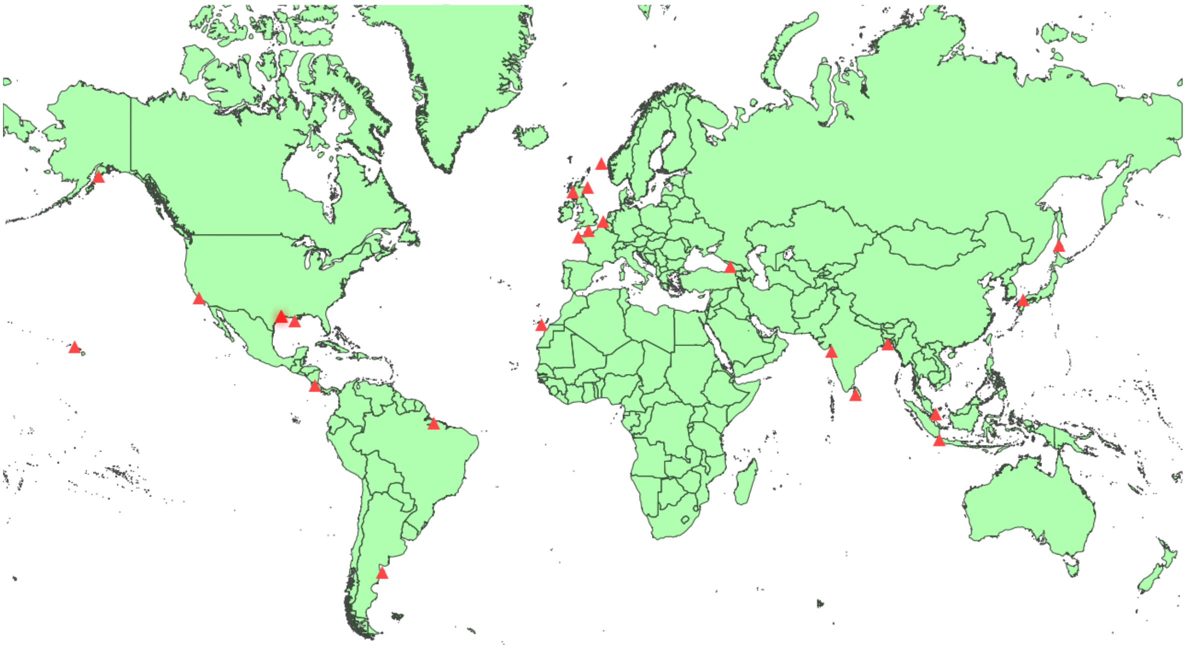


Figure 4 *Location of the main oil and HNS spills (≥10 t.) offshore and inshore in 2015 recorded by Cedre*

• Incidents leading to spills

The most frequently identified incidents in 2015 were due to **breaches or ruptures** in various structures:

- Nearly a quarter of these incidents were associated with vessel **strandings** and **groundings**, which represented 23% of incidents (Fig. 5). While ships striking the bottom only represented a small proportion of the total volume spilt in 2015, strandings accounted for the majority of this volume, representing nearly a 60% share (Fig. 6). The most significant spills, in terms of quantity, in this category occurred in Asia following strandings, in Indonesia (case of the non-motorised barge *Finacia 32*)[22] and in Bangladesh (case of the small bulk carrier *Jabalenoor*)[23].
- **Ship collisions** (with other ships or structures) also represented around 23% of incidents, and constituted the second largest share of the total volume spilt in 2015 (38%, largely due to collisions between ships; Fig. 6). We note the collision involving the oil tanker *Alyarmouk* in the Strait of Singapore in January[24], the collision which ruptured tanks onboard a chemical tanker (*Carla Maersk*) in March near Galveston Bay (Texas, US) and finally, in Europe, the *Flinterstar* incident[25] off Zeebrugge.
- **Loss of integrity** of various structures, most often pipelines or pipes within oil facilities, represented approximately 20% of incidents in 2015, but only around 1% of the overall quantity spilt, due to the generally low to moderate quantities involved (around 10 to 20 m^3, with the exception of one 50 m^3 spill in 2015).
- Spill related to **ships sinking at sea or wrecks** accounted for 12% of incidents and represented a minimal share (3%) of the total volume spilt in 2015 (the largest quantity recorded was that spilt following the sinking of the tug *Nalani*, a few kilometres off Oahu, Hawaii, in January)[26].

[22] See above
[23] See LTML n°41
[24] See LTML n°41
[25] See above
[26] The *Nalani* began to take on water during a test phase at sea due to a hatch cover not being replaced following maintenance work. According to the US NSTB, the incident was due to the decision leave without ensuring proper watertight integrity prior to the trials (the water intake was aggravated by low freeboard at the stern). Loaded with around 290 m^3 of diesel at the time of the accident, the tug sank in over 650 m of water, with the contents of its fuel tanks, and was declared a constructive total loss.

None of the other types of incidents stood out in the 2015 analysis, either in terms of frequency or of their share in the overall total (Fig. 5 and 6)[27]. No information on the incident having caused the spill was found in 15% of the cases listed.

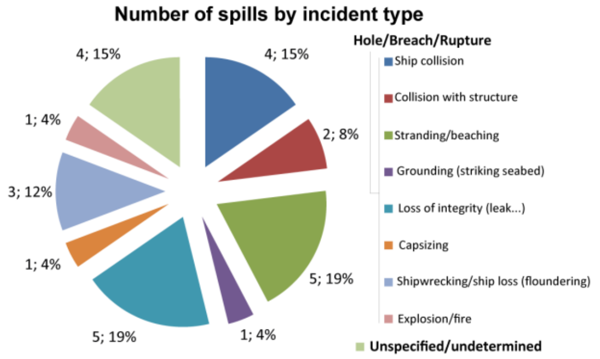


Figure 5

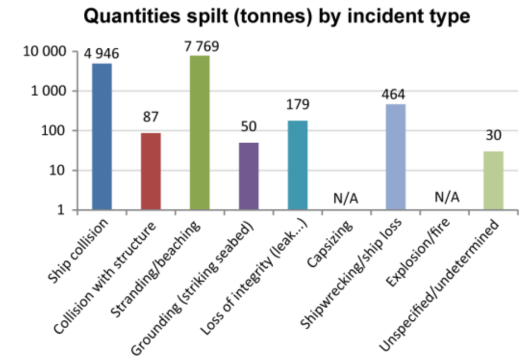


Figure 6

• Spill causes

Analysis of the causes of the spills recorded shows that in around two thirds of cases, the cause was **undetermined or unspecified** (Fig. 7). Not only is this category more prevalent, it also by far the main contributor (>90%) to the total quantity spilt (Fig. 8). We note however that the majority of this share is due to the collision of the oil tanker *Alyarmouk*[28] and the stranding of the bulk carrier *Finacia 32* (see above), incidents whose causes were not divulged in our information sources.

This lack of information therefore hinders the analysis of the main causes of significant spills. We nevertheless note the frequency of **technical failures** (around 20%, half of which were due to the **defectiveness/dilapidation** of facilities), followed by incidents caused by **human failure** (12% of cases, Fig. 7). It is however difficult to determine the share of these causes among the total volume spilt given the lack of accurate data in terms of quantities.

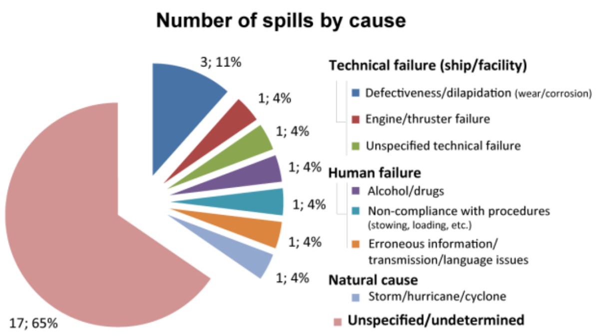


Figure 7

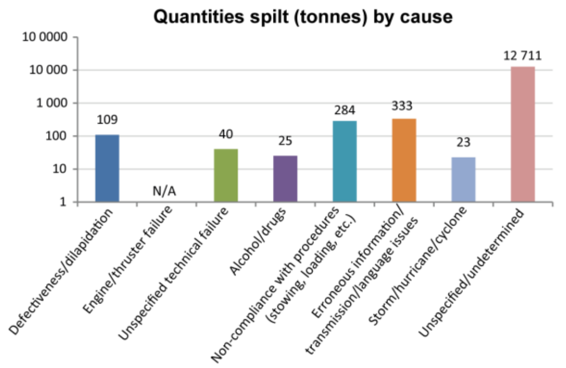


Figure 8

• Substances spilt

The vast majority of spills (over 90% of occurrences in 2015) involved oil. In this category, the most commonly spilt products were **light refined oil products** (34%), followed by **unspecified oil** (15%), **heavy/intermediate refined products** (unspecified IFO grades or <380) and **heavy refined products** (IFO≥380). These are followed by **crude oils of unspecified density** and, alongside oil products, 2 occurrences in the **coal derivatives** category[29] (Fig. 9).

[27] A statement to be taken more as an indication than an affirmation, given the patchy nature of the information available, in particular in terms of the volumes involved.
[28] See LTML n°41
[29] One case involving coal and the other coal tar.

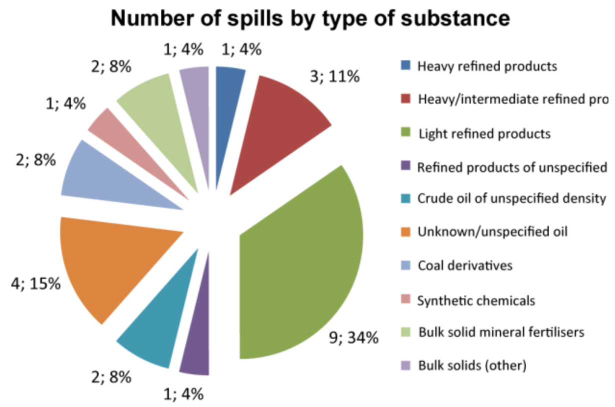


Figure 9

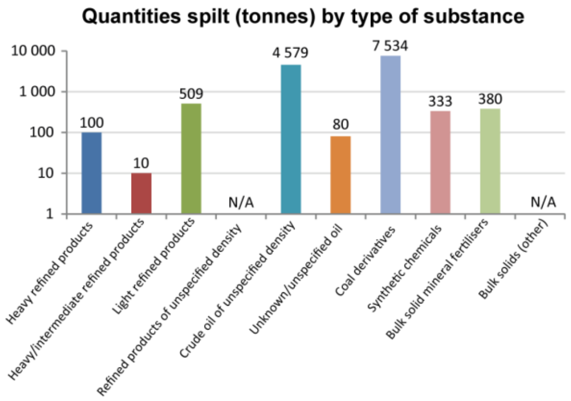


Figure 10

In terms of the quantities spilt, we note the major share of **coal derivatives** in the 2015 total (Fig. 10), mainly due to the cargo of coal released from the *Finacia 32,* a barge which ran aground on the Indonesian coast in September 2015 (see above).

The share of oil in the annual total appears to be mainly dominated by **crude oils of unspecified density**, followed by **light refined products** (white oils) and **heavy to intermediate oils**, although the lack of accurate data prevents a more detailed analysis.

Few chemical spills were recorded, with one case in the **synthetic chemicals** category (spill of approximately 330 tonnes of methyl tert-butyl ether, or MTBE, following the *Carla Maersk* in Galveston Bay, Texas, in March 2015) and two spills of **bulk solid mineral fertilisers** (potash fertiliser in the case of the bulk carrier *Jabalenoor* in Bangladesh, and ammonium nitrate fertiliser in that of a barge which sank in the coastal waters of Costa Rica)[30].

Ship-source oil spills in 2015: ITOPF statistics

The 2015 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.

Two tanker spills involving over 700 tonnes of oil were reported by ITOPF for 2015 (compared to 3 in 2013 and 1 in 2014) and 6 medium-sized spills (7-700 tonnes) also were also recorded.

According to ITOPF, the total volume of oil spilt by ships in 2015, approximately 7,000 tonnes (compared to 4,000 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

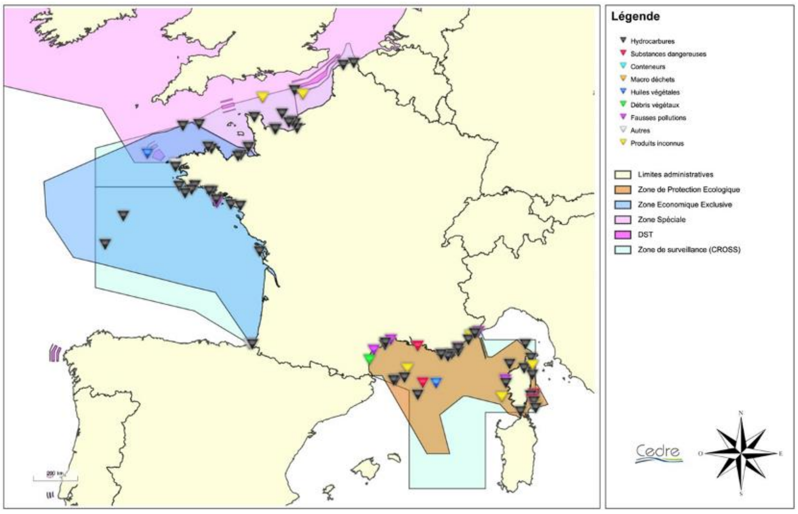
Pollution reports: analysis of 2015 POLREPs (mainland France)

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 2015 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 2015 POLREP data shows that:

30 See LTML n°41

- 239 POLREPs were submitted, 90 of which were confirmed, giving similar values to those of 2014 (237 and 96 respectively), indicating overall relative stability, following the drop during the period 2000-2012[31].
- the majority of POLREPs were once again located off the Mediterranean coast, with 53% of reports submitted. Meanwhile, the percentage of confirmed POLREPs in the Western Channel has increased since 2013.
- like in previous years, oil was by far the most frequent category of pollutant, involved in approximately 70% of POLREPs (as was also the case for the 3 previous years).
- the origin of the spill was determined for 27% of POLREPs, a percentage within the range observed for the period 2012-2014 (during which this percentage regularly increased, from 18% in 2012 to 29% in 2013 then 34% in 2014).



Location of confirmed POLREPs in 2015 in France (Source: Cedre)

In 2015, the relative share of confirmed POLREPs along the shipping routes off the coasts of the Channel and Mediterranean was lower than the share of confirmed POLREPs inshore.

It is however difficult to interpret this unusual observation as a shift in the location and hence in the source of confirmed cases of pollution, as this change could be explained by variation in surveillance pressure.

The monthly evolution in the number of confirmed reports roughly reflects that of the period 2000-2014: an increase is always visible during the summer, with peaks in particular in June and August (a peak is observed in August only in the Mediterranean, although the reason for this remains undetermined – more intensive surviellance, weather conditions or actual number of discharges). In 2015, 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 and the range of volumes for all incidents could not be determined.

For further information:
Cedre report R.16.11.C/4306 "Analyse et exploitation des POLREP en zone de surveillance française - Année 2015".

• Response preparedness

EMSA at-sea response means: fleet expanded and stockpiles established

In 2016, the European Maritime Safety Agency (EMSA) set up two oil spill response equipment stockpiles, supplementing its fleet of specialised oil spill response vessels. These stockpiles, one for the Baltic Sea (Gdansk, Poland) and the other the North Sea (Aberdeen, Scotland, UK), have been up and running since July and September 2016 respectively. The equipment can be mobilised around the clock upon request from any Member State, with an announced maximum mobilisation time of 12 hours (including preparation and loading time, equipment ready for dispatch).

EMSA also has technical support personnel available for hire to assist with the deployment of specialised equipment. The stockpiles offer equipment for mechanical containment and recovery operations at sea, with particular emphasis on concentration systems for use in strong current (Speed Sweep 1500 DESMI, NOFI Current Buster 6), storage capacities, as well as in situ burning equipment (Elastec American Fireboom), as yet a relatively uncommon strategy in European countries. The conditions and tariffs of this service (known as the Equipment Assistance Service or

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

EAS) are set out in the Incident Response Contract for Equipment (IRC-E), which is signed by the requesting party.

Summer 2016 also saw the entry into service of 2 bunkering tankers:

- *Norden*, based in Gothenburg, Sweden, where it reinforces the standby vessel network for the Southern Baltic Sea. It offers a 2,880 m^3 storage capacity and under this contract has been fitted with: two 12-m rigid sweeping arms (Lamor LSS 12) with integrated brush skimmers, two sections of self-inflating boom (Lamor Ocean Master Boom 1900) on reels, an offshore skimmer (Normar 250 TI) as well as a Simrad Argus oil slick detection system (by Norwegian group Navico).
- *Mencey*, based in Las Palmas (Canary Islands, Spain), with a 7,270 m^3 storage capacity, dispersion equipment (dispersant spray system and dispersant tanks), recovery equipment (including 2 Lamor LSS 12 rigid sweeping arm systems, a Lamor LWS 1300 weir skimmer and two 250-m sections of Lamor single point inflation boom) and a Miros oil slick detection system.

After Cyprus and Malta in 2015, EMSA set up 2 new dispersant stockpiles (3rd generation dispersant Radiagreen OSD), each comprising 200 tonnes, in Portugal and Spain.

For further information:
http://www.emsa.europa.eu/oil-spill-response/eas-inventory.html
http://www.emsa.europa.eu/oil-spill-response/oil-recovery-vessels/vessel-technical-specifications.html

Contingency planning in Bangladesh, in response to lessons learnt from recent incidents

In 2016, the Bangladesh Ministry of Environment and Forests launched the development of a national spill contingency plan for marine waters, with a proposal to establish a specific government entity tasked with supervising and coordinating crisis management, expected to be placed under the authority of the Department of Environment. It has been suggested that the Bangladesh Coast Guard would be made the operational entity.
The Government of Bangladesh has stated that this initiative was triggered by the occurrence of several recent spills, including that of the small tanker *Southern Star 7* (December 2014) and the barge *Jabalenoor* (May 2015), which led to spills at sensitive sites (protected mangroves; see LTML n°40 and 41), and which highlighted existing needs in terms of mitigating the risks of environmental damage in the Delta of Bengal which is home to the world's largest mangrove and is an international conservation concern.
Furthermore, another identified goal is to define international cooperation mechanisms for response to major spills, in particular on a regional scale through a Memorandum of Understanding established in 2010 with 4 other neighbouring coastal countries (India, Pakistan, Sri Lanka and the Maldives) from which Bangladesh hopes to gain support, recognising that its national expertise in the field is currently limited.

Lessons learnt from the MSC *Flaminia* incident: operational guidelines for ships in need of assistance

In early 2016, the European Commission announced that it had finalised operational guidelines for ships in need of assistance, drafted by an expert group set up in 2013 and including representatives of Member States and private operators.
Mainly prompted by the incident involving German-registered container ship MSC *Flaminia* (July 2012)[32], this document comprises recommendations for better international coordination, covering both public and private partners, for cases such as this in which the dangers relating to an incident (here explosion/fire) onboard a vessel carrying a potentially toxic cargo (not to mention its fuel), creating a hazard for the environment and navigation, led to a two-month wait until the ship was granted access to a port in the European Union (in this case the German port of Wilhelmshaven in September 2012).
The aim of these guidelines is to supplement existing national arrangements with regard to the question of ports of refuge, with a particular focus on cases in which the incident occurs outside of national jurisdictions (international waters, like in the case of the MSC *Flaminia*) or is liable to involve decision-making by several Member States.

32 See http://wwz.cedre.fr/Nos-ressources/Accidents/Accidents/MSC-Flaminia

For further information:
http://ec.europa.eu/transport/modes/maritime/digital-services/places-of-refuge_en

• Response guidelines and recommendations

UK offshore industry initiative: OSPRAG response guidelines finalised

The Oil Spill Prevention and Response Advisory Group (OSPRAG) is a UK-based working group set up in May 2010 following the *Deepwater Horizon* disaster in the Gulf of Mexico[33]. It vocation is to identify emerging issues for the offshore oil industry. It is composed of representatives of British operators (under the umbrella of Oil & Gas UK) as well as participants from the Department of Energy & Climate Change (DECC), the Maritime & Coastguard Agency (MCA) and the Secretary of State's Representative (SOSREP) for Maritime Salvage and Intervention, together with industry-funded response companies (Oil Spill Response Ltd).

Since it was first set up, OSPRAG has produced a series of guidelines which make up an Oil Spill Response Toolkit, designed to provide information and recommendations to Oil & Gas UK operators on preparing and implementing the response measures they may be required to use in the event of a spill during their activities in the North Sea.

This series was supplemented in early 2016 with the addition of 4 new Response Implementation Guidelines (RIGs) on the following topics: Aerial Surveillance, Shoreline Response, Decanting and Waste Management. These new documents supplement the pre-existing guidelines on response operations at sea, including: At Sea Containment & Recovery, Vessel Dispersant Application, Aerial Dispersant Application and Subsea Dispersant Application.

These guidelines can be downloaded from the Oil & Gas UK website (free for its members).

For further information:
http://oilandgasuk.co.uk/product/oil-gas-uk-oil-spill-response-tool-kit/

IOGP/IPIECA: update and expansion of the Good Practice Guide Series

Since late 2015, as part of the effort to revise the IPIECA Good Practice Guide Series[34], 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 those already available. They cover the following topics:

- Economic assessment and compensation for marine oil releases (October 2015)
- Impacts of oil spills on marine ecology (November 2015) and Impacts of oil spills on shorelines (2016)
- At-sea containment and recovery (December 2015)[35]
- A guide to oiled shoreline clean-up techniques (December 2015)
- Controlled in-situ burning of spilled oil (October 2016)[36]. In relation to this issue, mention can also be made of a document released in November 2016 produced by Cedre and INERIS on the composition, characterisation and potential toxicity of burn residues in water (Preparation of an Information Document on In-Situ Burning Residues). This document draws upon a literature review and experimental data produced using equipment available at Cedre (burn test bench).
- Satellite remote sensing of oil spills at sea (December 2016).

These publications include both revised and supplemented versions of existing guides as well as entirely new documents.

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

[33] See LTML 29 & 30

[34] Which updates and replaces the 'Oil Spill Report Series' published between 1990 and 2008.

[35] In addition to an older document offering a practical approach to the issue of decanting recovered emulsions (The use of decanting during offshore oil spill recovery operations)

[36] Supplementing the technical report on the selection of ISB equipment Guidelines for the selection of in-situ burning equipment

OSRL Cold Weather Response Field Guide

The UK-registered company Oil Spill Response Ltd recently published a document relating to response in extreme cold weather, offering an overview of the operational and technical specificities of response in such climate conditions. The influence of low temperatures on the physical and chemical properties of an oil and its behaviour (weathering processes, behaviour) is addressed, based on a number of scenarios (spill in ice-covered or open water), and indications are provided in terms of the possible movements and locations of the oil in the environment.

The constraints of each response strategy and technique, on water or on ice, are also presented and, a key point, the document also briefly reviews a certain number of aspects relating to responder safety, listing the risks to which they may be exposed and the ways of mitigating these risks (equipment, protection, organisation of operations).

Finally, the guide also includes a number of technical tool sheets providing responders with information for characterising the ice (type, form, stage of development, thickness etc.) or determining the concentration of ice at the water surface, as well as the shoreline types that may be encountered (peat shorelines, permafrost, inundated low-lying tundra, etc.) and their respective sensitivity (erosion potential, oil penetration, etc.).

For further information:
https://www.oilspillresponse.com/

• Recovery

Small spills of light products and vessels of opportunity: detachable SeaHow systems

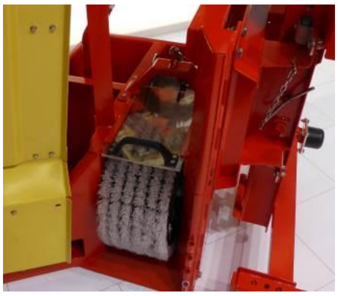
In 2015, the Finnish firm SeaHow, specialised in surveillance and maintenance services (including spill response) for inland, port and inshore waters, launched its own range of oil recovery arms for use on water. This range comprises models of suitable dimensions for use with various vessels: from systems integrated within the structure of specialised response vessels to light-weight, detachable devices, designed for small vessels of opportunity (use in ports, inland waters, estuaries, etc.).

Within this range is the MiniBagger aluminium sweeping arm which offers a sweeping width of 2.5 metres and is fitted with a polyethylene rotating brush skimmer.

This comparatively light device (weighing 106 kg in total) can be mounted on the side of a workboat (minimum of about 5 metres long) without requiring lifting equipment or specialised tools, for use in ports, watercourses, etc.

The MiniBagger sweeping arm (Source: SeaHow)

The skimmer's power unit is positioned on the deck of the workboat, as is the so-called SmartSacker sacking system, for storing the recovered oil in sacks, with a capacity of around 1 m^3, placed in an aluminium frame connected to the discharge hose.



The rotating oleophilic brush skimmer at the base of the sweeping arm (Source: Cedre)

The nameplate capacity specified by the manufacturer is 10 m^3/hour on heavy oil, on which brush skimmers are generally efficient, and 6 to 8 m^3/hour on light oil, with up to 90% oil in the recovered mixture. According to SeaHow, the system's efficiency with light oil results from its patented brush-comb design.

The MaxiBagger model is based on the same concept but in larger dimensions and is designed to be mounted on vessels over 9 m long. It has a sweeping width of 3 m and is claimed to offer recovery rates of 15 to 40 m^3/hour on light and heavy oil respectively.

According to SeaHow, its modular systems meet an emerging need for equipment capable of recovering light products, in particular with the entry into force in Northern Europe of the Sulphur

Directive, which is liable to greatly increase the use of low sulphur content fuel (including marine diesel for instance).

In late 2015, the German Central Command for Maritime Emergencies (Havariekommando) announced that it had acquired several MiniBaggers to equip up to 6 aluminium workboats (7.5 m-long Faster 650 CATs manufactured by Nordland-Hansa), in order to fill the gaps in terms of spill response equipment for use in shallow waters, either inshore or in ports/estuaries which cannot be accessed by specialised vessels.

For further information:
http://www.seahow.fi/media/liitetiedostot/seahow/minibagger.pdf
http://www.seahow.fi/media/liitetiedostot/seahow/maxibagger.pdf

• Slick drift

Météo-France model MOTHY: version 4.4

The latest version (4.4) of the MOTHY drift forecast system has been operational since summer 2016. Following the 4.3 version from April 2016, which saw the integration of new high resolution metocean forcings, these new improvements concern:

- The inclusion of changes in tack (i.e. the direction of a floating object in relation to the wind, influencing its course of movement) for targets in search & rescue (SAR) operations, at a rate of 4% random changes per hour, should improve their drift probability calculation.
- The extension of the high spatial resolution domain (10 km grid) of the global wind model ARPEGE, a domain which until now focused on France and enabled forecasts for the seas of Europe and the near Atlantic. This domain has been extended to include the Arctic sectors (Hudson Bay, Baffin Bay, Labrador Sea, Greenland Sea and Barents Sea) to the North and the Caribbean and South American sectors to the south (including the French West Indies and French Guiana). Certain sectors in the north-western Indian Ocean (Gulf of Aden, Gulf of Oman and Persian Gulf) also feature in this newly extended domain.

For further information:
http://www.meteorologie.eu.org/mothy/index-fr.html