CENTRE OF DOCUMENTATION, RESEARCH AND EXPERIMENTATION ON ACCIDENTAL WATER POLLUTION
715, Rue Alain Colas, CS 41836 - 29218 BREST CEDEX 2, FRANCE
Tel: +33 (0)2 98 33 10 10 – Fax: +33 (0)2 98 44 91 38
Email: contact@cedre.fr - Web: www.cedre.fr

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Contents

• Spills

Bunker fuel spill due to a container ship collision: Feihe, NYK Themis and Hammonia Thracium (Singapore Strait)
Late afternoon on 29th January 2014, a collision occurred 3 km off Jurong Island (Singapore Strait) between the Hong Kong-flagged chemical tanker *Lime Galaxy* and the Chinese container ship *Feihe*. One of the *Feihe*'s bunker tanks sustained damage following the collision, releasing around 210 m^3 of bunker fuel. Some ten hours later, in the early hours of the following morning and shortly after the Maritime and Port Authority of Singapore (MPA) had initiated the emergency response at sea, a second collision occurred nearby, this time off Marina South, between the barge *AZ Fuzhou*, which was being towed, and the Panama-flagged container ship *NYK Themis*. One of the bunker tanks of the *NYK Themis* released almost 400 m^3 of IFO 120. Following these two spills, containment and recovery operations were carried out at sea, coordinated by MPA, and according to the authority involved up to 40 vessels (specialised and non-specialised), 2 skimmers, 2 Harbour Buster systems for containment in strong current, over 1,000 m of floating boom and a total of around 400 responders from MPA and specialised contractors (OSROs). Meanwhile, aerial surveys conducted by MPA reported that no slicks remained at sea by 3rd February (i.e. 5 and 4 days post-spill), leading to the demobilisation of all the vessels. On the shoreline, clean-up operations were required on a few sections of beaches on two islands (St. John and Kusu) located a few kilometres south of Singapore, under the joint supervision of Sentosa Development Corporation (an agency of the Ministry Of Trade and Industry), the National Environment Agency, the National Parks Board and Singapore Land Authority. Investigations into the causes of these two independent incidents, at first unknown, attributed both the spills to a "lack of situational awareness". These two collisions were followed by a third, near Sebarok Island on 10th February, between Panama-flagged chemical tanker *Zoey* and Liberian container ship *Hammonia Thracium* (the first of which was entering and the second leaving the Port of Singapore). One of the container ship's bunker tanks sustained damaged, resulting in the release of 80 m^3 of IFO 380 at sea. MPA was immediately notified and mobilised 4 patrol craft to conduct surveys and supervise spill response operations at sea, implemented using the resources of the contracted OSROs. Once again, the incident was reported to have been caused by a lack of situational awareness of the bridge teams, despite warnings of the traffic situation issued by the Port Operations Control Centre. In May 2014, the MPA formed a Safety Review Committee (SRC) to examine the system of navigational safety in Singapore Port waters and Singapore Strait in light of these three incidents. It appears that the bridge teams did not make appropriate use of the means at their disposal to foresee and avoid collisions (Automatic Identification System -AIS, Automatic Radar Plotting Aid -ARPA, Electronic Chart Display and Information System -ECDIS, etc.). Furthermore, the SRC did not identify any significant correlation between the occurrence of incidents and growth in vessel movements in the Singapore Strait or port waters[1].

Collisions in South Korea: GS Caltex Corp and Captain Vangelis
On 31st January, a collision occurred between the Singapore-registered VLCC[2] *Wu Yi San* and a jetty at the loading terminal of a GS Caltex refinery, in the South Korean port of Yeosu (South Jeolla Province), damaging a pipeline and causing a spill of an estimated 160 m^3 of crude oil into the water. The incident took place as the oil tanker was manoeuvring in preparation to unload its cargo (278,600 tonnes of Forties North Sea crude oil). No leaks were observed from the vessel. The spill mainly consisted of the volume contained in the damaged section of pipeline[3]. Spill response operations were conducted on the water by the Korea Coast Guard (KCG) for several days. According to a press release from Korea's Prime Minister, KCG mobilised considerable resources, including up to 5 planes 3 days post-spill (in particular for surveillance), several kilometres

[1] The number of incidents reported for the previous few years averaged about 0.012 and 0.016 per 1,000 vessel movements in the port waters and Singapore Strait respectively, according the the SRC.

[2] *Very Large Crude Carrier*

[3] According to Caltex, the 100 metre section of pipeline between the valve and the leak point represented a volume of approximately 130 m^3.

of floating boom, and no less than 200 vessels (unspecified types and dimensions).

At this stage, sheen had spread across the sea surface up to 10 km from the jetty.

Relatively fluid fresh oil began to wash up on the shore the day after the incident, affecting port structures (quays and riprap) and beaches near Yeosu.

Around 1,000 people, including many volunteers supervised by personnel from government agencies and the army, equipped with PPE, were involved in removal and clean-up operations (mainly by hand, using sorbents). These operations were expected to last around 2 weeks according to KCG (which announced that 80% of the oiled shoreline had been cleaned by 3rd February).

An investigation[4] into the causes of this incident (believed to be due to a manoeuvring/piloting error) was commissioned by KCG.

Two weeks after the incident, on 15th February, the Liberian bulk carrier *Captain Vangelis L* (88,420 GT) collided with the oil tanker *Green Plus*, during bunkering manoeuvres south of the Port of Busan. An estimated 240 m^3 of IFO 380 was released from a breach (20x30 cm) in the hull of the bulk carrier.

According to the Korea Coast Guard (KCG), which immediately organised response operations at sea, the leak (which was under control within 3 hours) caused 800 m to 200 m slicks of fuel oil to form.

Trails and slicks of fresh IFO 380 following the collision of *Captain Vangelis L* (source: vesselfinder.com)

The resources deployed at sea escalated (up to 70 vessels, including OSRVs[5], according to KCG), both for dispersant spraying operations by vessels and for mechanical recovery (mobilisation of sweeping arms and skimmers). A task force was specially set up by the Korean authorities to oversee the response, in particular comprising representatives of the Ministry of Oceans and Fisheries (MOF), KCG and the Korea Environment Management Corporation (KOEM), acting together with the polluter (whose insurer called out ITOPF to provide on-site technical expertise).

Although the efficiency of operations at sea was initially hampered by the prevailing sea and weather conditions according to KCG, it nevertheless announced the recovery of 80% of the fuel oil after 3 days and the demobilisation of resources at sea 10 days after the spill. During this period, the spill mainly drifted at sea and in the end only affected the South Korean shoreline to a limited extent.

This incident raised the issue of transboundary pollution: slicks were observed in the coastal waters of the Japanese island of Tsushima by the Japanese Coast Guard (JCG) while the Korea Coast Guard (KCG) was unable to implement full surveys due to air space restriction/control measures. Oil therefore washed up on the north coast of Tsushima around a fortnight after the collision[6].

According to KCG, the collision was caused during an attempt to steer between vessels in rough seas.

Marine diesel spill in coastal waters: sinking of the Luno (Pyrénées-Atlantiques, France)

Shortly after 10 am on 5th February 2014, the Maritime Rescue Coordination Centre CROSS Etel was alerted to the hazardous situation of the *Luno*, a relatively small, Spanish-flagged bulk carrier (100 m long; 4635 GT). The vessel had suffered a black-out 400 metres from the Adour channel (Pyrénées-Atlantiques). With no engine power and travelling unladen (the *Luno* was travelling with only ballast water onboard and was bound for the port of Bayonne to load a cargo of steel balls), the powerless bulk carrier attempted in vain to find a stable mooring, and drifted uncontrollably towards the shore, driven by westerly winds and heavy seas caused by Storm Petra. The vessel rapidly hit the Cavaliers breakwater (Anglet), on the south bank of the Adour river mouth. Under the action of increasingly strong waves and adverse weather conditions, the ship broke in two.

4 The final conclusions of which are not available in our information sources.

5 Oil Spill Response Vessel

6 Where manual clean-up operations were already in progress following a collision in the coastal waters of Tsushima on 11th January, between the Panamax bulk carrier *Ligari* (75,500 GT, carrying 66,000 tonnes of corn) and the tanker *DL Sunflower*. Damage was caused to a fuel tank of the *Ligari*, leading to a minor bunker fuel spill.

Operations were rapidly implemented to evacuate and ensure the safety of the personnel onboard the stern section (11 crew members and 1 pilot from the port of Bayonne), with support from an Air Force Puma helicopter and its crew. The personnel were airlifted to safety at around 1:30 pm.

06/02/2014: Bow section of the Luno on Cavaliers beach (left) and bridge grounded at the end of the Cavaliers breakwater after breaking away from the stern section (right). No pollution was visible on the water or the foreshore (Source: Cedre)

At 11:30 am, the Departmental Operational Centre (COD) was activated following a decision by the Pyrénées-Atlantiques authorities (Pau), and an Operational Command Post (PCO) comprising representatives of the relevant departments and parties involved in the crisis management was set up at the La Barre lifeguard station (municipality of Anglet, which activated its contingency plan). The departmental Polmar plan was activated just before midday in order to respond to any pollution generated.

The Polmar interdepartmental storage and response centre (CISIP) in Verdon was placed on alert, as was the Regional Directorate for the Environment, Planning and Housing (DREAL) and the Interregional Directorate for the South-Atlantic Sea (DIRMSA) within a reinforced Zonal Operational Centre (COZ). The Polmar correspondents within the Departmental Directorates for Territories and the Sea for the Pyrénées-Atlantiques and Landes areas (DDTM 64 and 40) were also activated.

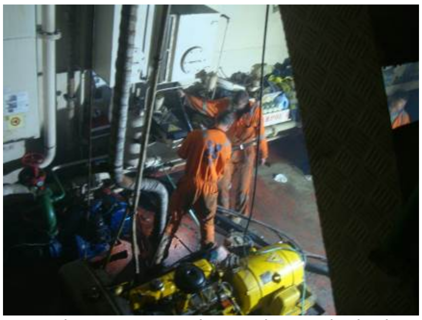
The maritime authority for the Atlantic rapidly sent maritime experts to identify the technical solutions required to manage the risks posed by the wreck: a team from the French Navy's Centre of Practical Expertise in Pollution Response (CEPPOL) thus arrived on site at around 6 pm. A team from the Dutch firm SMIT Salvage, contracted by the *Luno*'s P&I Club, arrived on site late afternoon. The Pyrénées-Atlantiques authorities called for assistance from Cedre to implement surveys within the vicinity of the spill location and, where necessary, to provide advice on the use of shoreline clean-up techniques.

In terms of oil spill risks, the shipowner indicated that at the time of the incident, the ship's bunker tanks contained 120 m^3 of marine diesel, of which approximately 25 m^3 was thought to remain in the stern section and 80 m^3 in the bow section. Although it was not possible to check whether the tanks remained intact, a strong odour could be detected at La Barre beach from around midday, indicating a spill, of an unknown quantity, of fuel. No pollution was visually detected on the beaches near to the wreck at this stage, which can be explained by the extremely rough sea conditions and the type of oil (diesel tends to rapidly spread and dissipate/break down).

During the night, the stern section – lodged on the end of the Cavaliers breakwater – in turn broke into two parts, which continued to break up, instantly releasing the fuel contained in the bunker tanks. The bow section, partially buried in the sand of Cavaliers beach, gradually became stabilised, but showed a 30° list although no leaks had yet been observed.

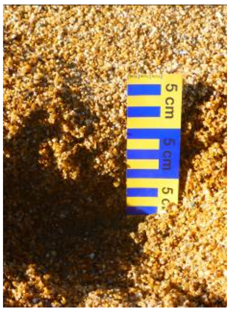
The following day, the priorities established by the departmental authorities required the shipowner to present an action plan to eliminate the pollution risk, primarily by pumping the fuel out of the tanks in the bow section:

- SMIT Salvage was contracted to inspect the structure (jointly with representatives of CEPPOL and *Les Abeilles*) prior to pumping.
- Given the wreck's list and movements caused by the swell, this operation required major preparation work in terms of access and deployment onboard of personnel and pumping equipment (mobilisation of a ladder/platform provided by the fire brigade; safety measures, installation of hand rails, lighting, floor space, etc., access routes within the wreck). All the hydraulic power packs and tanker trucks were positioned on the breakwater.



Preparing SMIT pumping equipment in the bow section of the Luno (Source: CEPPOL)

- On 7th February, an attempt to remove the bunker tank's cover plate – immediately replaced – was suspended due to a risk of an uncontrolled release inside the vessel. The following day, a hot tapping operation was carried out, successfully removing all the remaining diesel the same day[7].



Shoreline surveys conducted on 6th and 7th February between Cavaliers beach in Anglet, to the south, and the beaches in the Tarnos area, on the north bank of the Adour river (including a site where debris and litter, and therefore potentially oil, tend to accumulate) reported no visible traces of oil (sheen, oily film, etc.) on the sand, infrastructures (Cavaliers breakwater), or on debris at the high water mark.

*Surveys indicating no visible shoreline pollution in Anglet on 06/2/2015: sand (15 cm surface layer) (**left**); boulders of the Cavaliers breakwater (**right**) (source: Cedre)*

These observations confirmed the site's high natural self-cleaning potential, given the prevailing sea and weather conditions on site, but also the quantity (20 tonnes) and type (marine diesel) of pollutant spilt from the stern section of the *Luno*. The implementation of shoreline clean-up operations therefore did not appear necessary.

On 11th February, a wreck removal action plan was put forward to the State services and the City of Anglet by the shipowner and his P&I Club. This plan was validated and consisted in cutting up the different sections of the *Luno* on site. A call for proposals was published and the contract was awarded to Svitzer (cutting with a thermal lance)[8] and Koole (waste management) on 3rd March.

Operations began on 17th March and lasted 2 months: in total 1,244 tonnes of metal[9] were cut up on site and transported by land (daily trips by dump trucks) in containers to appropriate treatment sites (including *Aciéries de l'Atlantique* in the Landes area, and *Arcelor Mittal* sites in the Spanish Basque Country). Part of the mooring chain, caught on the breakwater, could not be removed and the anchor was not found. In addition, around twenty parts of the stern section, below the surface in the area around Cavaliers breakwater, were retrieved and hauled onto the beach. This operation involved detection (sonar, dives, etc.), sand removal and the installation of hauling equipment (by the amphibious vehicle Salamandre and with support from divers).

The last section (80 tonnes) of the *Luno* was removed on 15th June, and the wreck removal site was closed down on the 20th, prior to site checks to ensure no dangerous debris was remaining. The site was finally reopened and the ban on navigation and water sports was lifted on 30th June.

On 21st May 2015, the Spanish maritime accident investigation commission CIAIM (*Comisión de Investigación de Accidentes e Incidentes Marítimos*) published the investigation report[10] into the cause of the incident, which is reported to have been generated by air in the engine's cooling system.

For further information:
Cedre Report EPI.14.01/3104.

Spill of unknown origin and shoreline pollution (Brittany, Pays de la Loire and Poitou-Charentes, February 2014)

On 6th February 2014, Cedre was alerted by DDTM 85 (Vendée) as to the presence of tarballs washing up on the shores of Sables d'Olonne. Similar reports were then made by DREAL 56 (Morbihan) in Quiberon, Belle-Île and Plouharnel. In turn the Inter-ministerial Operational Crisis Management Centre (COGIC) reported identical observations in Le Croisic (Loire-Atlantique).

Notifications of such observations lasted around a fortnight, until around 18th February, with the phenomenon spreading southwards (the islands of Oléron and Ré being the southern limit), and covered a 300 km stretch of coastline across 4 departments: Morbihan, Loire-Atlantique, Vendée, and Charente-Maritime.

Upon request by the State services, Cedre was called upon to conduct surveys and take samples

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7 Meanwhile, personnel from the Adour navy base and CEPPOL unloaded a total of 1.5 tonnes of canned paint.

8 This technique was chosen over the use of shears (as was for instance the case for the *TK Bremen*) as it generates less scrap metal debris (and less noise).

9 (Including around 600 tonnes for the bow section and over 300 for the bridge).

10 http://www.fomento.gob.es/NR/rdonlyres/E80098A3-ADFD-470B-B8E6-68FCFE4E8F6A/130876/IC_2014_34_LUNO_ENGLISH_WEB.pdf

from 7th February in the Morbihan and Loire-Atlantique areas in order to (i) determine the extent and type of pollution and (ii) advise local authorities (municipalities, etc.), fire brigades and State services on recovery and waste storage techniques.

As a general rule, the pollution took the form of scattered balls of viscous fuel oil, or sometimes patties up to 40 cm in diameter.

09/02/14, Le Croisic (Loire-Atlantique): Accumulations of tarballs and patties on a beach (Source: Cedre)

16/02/14, Hoedic (Morbihan): Manual recovery operations implemented by the fire brigade (Source: Cedre)

08/02/14, Piriac-sur-mer (Loire-Atlantique): primary storage of collected waste in a lined skip (Source: Cedre)

In the Morbihan area, one of the most heavily affected areas, 90 tonnes of oiled waste was collected, including a large amount of emulsion, representing 30 m^3 after settling. The quantities of oil recovered in the other areas are not known to us, as the pollution was more scattered and the collection of oiled waste was sometimes not very selective due to the large amount of oiled litter. Although an accurate estimation cannot be given, the quantity of oil collected is reckoned to be between 50 and 90 m^3.

The analysis of around 20 samples in Cedre's laboratory also suggested that this was a heavy fuel oil (viscosity of over 500 centistokes) obtained by catalytic cracking. The oil was believed to have been at sea for a relatively short period of time (5 to 10 days) and no analogy was able to be made with past major spills in the area (*Erika*, *Prestige*) or with potential spill sources (known wrecks). Also, given the homogeneity of the substance recovered, the possibility of the pollution having been caused by illegal discharge of oily waste (slops, bilge or sludge) proved unlikely.

In a bid to provide information on the probable source of this pollution, Cedre called upon Météo France for drift backcasting (using the MOTHY model) from various points and presumed dates of oiling, between Belle Île and île d'Oléron. The numerical data obtained enabled plausible scenarios to be identified as to the origin (location and time) of the spill(s), based on which further direct drift simulations were implemented. Through this approach, a possible hypothesis, although unverifiable and based on many unknowns (for instance the exact dates of oilings), emerged, which was that of a relatively brief release – lasting no more than a few hours – from a ship travelling southwards either from Ushant traffic separation scheme or from a port in southern Brittany towards Cape Finisterre or a port on the north coast of Spain.

For further information:
Cedre Report EPI.14.04/4134.

Heavy fuel oil spill and coastal sensitivities: Kirby Inland Marine Barge 27706 (Texas City, US)

On 22nd March 2015, in Houston Canal (Texas City, US), the oil barge *Kirby 27706*, pushed by a tugboat and carrying 3,500 m^3 of IFO 380, collided with the cargo ship *Summer Wind*.

One of the starboard tanks was damaged and rapidly released the 640 m^3 of fuel oil it contained in a narrow and particularly busy shipping channel between the Gulf of Mexico and the oil facilities of south-east Texas (Galveston, Houston).

The emergency response was coordinated by a Unified Command (UC, comprised of representatives of the competent agencies[11], as well as the responsible party and many private spill response contractors). Given the close proximity to the coast (around 1 nautical mile), the at sea response strategy was centred around containment and mechanical recovery operations. Meanwhile, the barge operator organised the towing of the barge and removal of its cargo (completed by the evening on the day after the collision).

Heavy fuel oil spill from a damaged barge in Houston Ship Channel (22nd March 2014, Texas, US) (Source: USCG)

One of the main issues relating to the at sea response[12] was to reopen the Houston Ship Channel and the Intracoastal Waterway – which had immediately been closed to traffic – as soon as possible. Despite the use of helicopters for aerial observation, the guidance of response vessels towards the oil slicks was tricky, according to TGLO[13], due to the changing currents in and around the channel, combined with adverse atmospheric conditions at times (reduced visibility due to fog). The National Oceanic and Atmospheric Administration (NOAA) was thus called upon to model the drift and weathering of the fuel oil.

The spill, which occurred close to the coast, rapidly hit the shoreline, calling for major protection efforts including laying floating booms and sorbents (in particular sorbent booms and mops) at various sites[14] in Galveston Bay. The areas most immediately and significantly affected by shoreline pollution were those where the shipping channel meets the Gulf of Mexico, mainly consisting of beaches (Pelican Island, Big Reef) and riprap making up Texas City Dike (originally built to regulate sediment transport in Galveston Bay).

On the day after the incident, the US Coast Guard announced the deployment of a total of 20 km of floating boom on the water, for recovery and site protection, as well as the availability of a further 60 km (and another 6 km ordered).

*D_{+1}: Mop sorbents used to protect and clean up riprap on Texas City Dike (**left**); accumulations of heavy fuel oil along the high tide mark on shores close to the spill (Big Reef) (Source: NOAA).*

In areas close to the collision, no floating pollution was reported more than 3 to 4 days after the spill. Scattered oilings (tarballs, oil patties, etc.) were reported on Matagorda Island, some 200 km from the spill location, implying that the oil had drifted down the Texan coast in a south-westerly direction for 5 days. The island, a 60 km-long uninhabited sand bank, is classed as part of Aransas National Wildlife Refuge and is home to 19 state or federally listed threatened or endangered species, some of which were breeding at the time of the spill (birds and reptiles in particular).

[11] In particular U.S. Coast Guard, Texas General Land Office, Kirby Inland Marine Inc., Texas City Office of Emergency Management, Galveston City Office of Emergency Management, Galveston County Office of Emergency Management, U.S. Fish & Wildlife, Texas Parks and Wildlife, and Center for Toxicology and Environmental Health.

[12] which mobilised 27 vessels and over 380 responders at sea.

[13] Texas General Land Office, a member of the UC

[14] Where surveys were soon carried out, according to the specific recommendations of an Area Contingency Plan (Site Specific Surveys).

Shoreline surveys[15] and wildlife collection were carried out, with very limited site access and traffic (only accessible by helicopter or shallow-draught boats, almost no roads...).


D+5: Localised deposits of emulsified heavy fuel oil on the beaches of Matagorda Island (Source: USCG/Unified Response)


D+6: Laying floating boom for shoreline protection (Matagorda Island) (Source: USCG/Unified Response)


*D+7: Shoreline survey on Matagorda Island using light-duty vehicles (**left**); D+8: manual collection of sand (**right**) (Source: USCG/Unified Response)*

The island was divided into twelve 5 km stretches, on half of which oil had come ashore, and 3 of which were considered "heavily oiled" by the UC.

According to TGLO, the combined mobilisation of over 1,300 responders and vast quantities of equipment (around 100 dump trucks, 20 heavy vehicles, over 200 light-duty vehicles, 4 barges for transport/unloading, etc.) resulted, after 30 days of recovery operations (mainly manual, with mechanical support), in the removal of no less than 2,500 tonnes (5.5 million pounds) of oiled sand and debris.

In terms of environmental impacts, the NOAA National Marine Fisheries Service reported on 31st March that 21 dead dolphins and 4 turtles (2 dead and 2 alive) had stranded. Most of these animals were found in Galveston Bay and were not visibly oiled. Necropsies were carried out to determine whether these deaths had been caused by the spill[16]. By this same date, and with similar uncertainty as to the cause, around 200 dead birds had been collected (150 in Galveston Bay, over 30 in the Matagorda area).

Oiled wildlife rescue and rehabilitation centres were set up in the Galveston and Matagorda areas, while a Natural Resource Damage Assessment (NRDA) procedure was launched to determine whether or not there was a link between these dead animals and the spill.

Finally, we note the economic impact of this spill, which required the main shipping route between the Gulf of Mexico and the oil and chemical facilities in the Galveston-Houston area (representing a tenth of the United States' refining capacity) to be closed to traffic for 3 days. Furthermore, as the shipping channel was gradually reopened to traffic, the hulls of many vessels moored nearby had to be cleaned (by pressure washing, at 3 decontamination stations: Pelican Cut, Galveston and Bolivar).

In June 2015, the National Transportation Safety Board (NTSB) in charge of investigating the causes of the collision concluded that the captain of the tugboat pushing the barge had made an initial error, causing the barge to cross in front of the bulk carrier, which was unable to avoid hitting the barge.

For further information:
http://coastguardnews.com/?s=texas+city+y+response
http://response.restoration.noaa.gov/texas-city-y-oil-spill
http://www.glo.texas.gov/what-we-do/caring-for-the-coast/_publications/responder-june-2014.pdf
http://www.ntsb.gov/news/events/Documents/2015_Houston_BMG_DCA14FM008_Abstract.pdf

15 Using the Shoreline Cleanup Assessment Technique (SCAT), now implemented virtually systematically in North America
16 We do not have information on ultimate conclusions of this investigation.

• Past spills

Shen Neng 1 incident (2010): lawsuit seeking compensation for environmental damages
In May 2015, the Australian Government announced that it had filed a lawsuit against the owner of the bulk carrier *Shen Neng 1* to recover damages, apparently due and unpaid, following the grounding of the *Shen Neng 1* on 3rd April 2010 on Douglas Shoal (which comes under the Great Barrier Reef Marine Park Authority (GBRMPA), near the port of Gladstone, Queensland) (see LTML 29&30). An enquiry by the Australian Transport Safety Bureau (ATSB) indicated that the incident had been caused by a human error due to the chief mate's level of fatigue, which meant that he had failed to correctly amend the ship's route. The ship, carrying 65,000 tonnes of coal, released a limited quantity of bunker fuel from a punctured tank. However the main concern was less the effects of this spill and more the impacts potentially induced by the grounding: GBRMPA considered this incident to have caused "the largest known direct impact on a coral reef by a ship grounding". Between 11 and 12 hectares of the Great Barrier Reef was damaged and the ship was suspected of having left anti-fouling paint residues on the reef, generating a long term chemical risk (the removal of these residues is the first priority identified by GBRMPA). Following various unsuccessful attempts to obtain compensation from the owner for the environmental damage caused, Australia filed a lawsuit, due to commence in April 2016 in the Federal Court in Brisbane, to seek the funds required to clean up and remediate the damaged reef or, failing that, to have an order issued to the owner to implement these actions.

• Illegal discharge

Cases of operational discharge of oil declining in the Baltic Sea

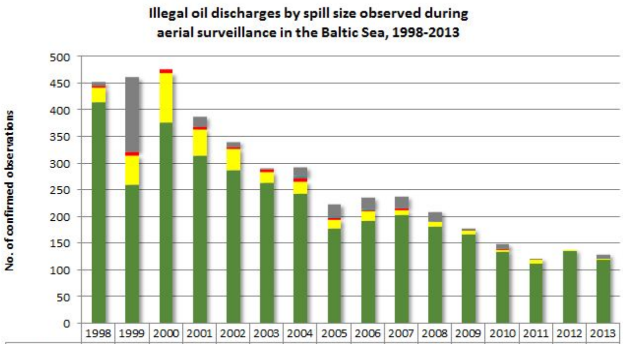
In 2014, the Helsinki Commission (HELCOM) published a new report analysing the evolution of cases of illegal discharge in the Baltic Sea detected by aerial surveillance carried out by the 9 contracting countries.

The report presents a review of 2013 which primarily indicates a slight decrease, by about 15%, in the number of flight hours[17] in the HELCOM area.

Despite interannual variation in surveillance efforts, HELCOM confirmed in 2014 the trend, ongoing since the late 1990s, towards a decrease in the number and volume of illegal discharges of oil detected.

In 2013, 130 confirmed mineral oil spills were thus reported in the Baltic Sea, based on a total of 4317 flight hours.

With the vast majority of these spills representing less than 100 litres, this was the lowest estimated total volume recorded so far (11 m^3).



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
unknown	7	138	0	19	9	2	17	23	21	21	18	2	9	2	0	7
> 100 m3	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0
10-100 m3	3	8	6	5	4	6	8	4	2	4	0	1	2	0	0	0
1-10 m3	28	54	93	50	40	20	22	16	18	9	10	7	2	7	2	2
< 1 m3	414	261	377	314	288	264	244	179	194	204	182	168	136	113	137	121

(Source: HELCOM)

More significantly, we note the overall decrease in the Pollution per Flight Hour (PF) index over the last 2 decades, despite constantly increasing vessel traffic. In terms of the future outlook, the report indicates the need to further increase night flights (but also to equip aircraft with specialised detection equipment) which represented 15% of flight hours in 2013. The contribution of the CleanSeaNet (CSN) satellite surveillance service, provided by the European Maritime Safety Agency (EMSA), was also mentioned, having reported over 100 possible detections in the Baltic

[17] In particular in Sweden and Germany, countries which remain nevertheless the greatest contributors in terms of flight hours.

Sea in 2013, of which 60% were checked by aircraft and 7% confirmed.

For further information:
http://helcom.fi/Lists/Publications/HELCOM%20report%20on%20Illegal%20discharges%20observed%20during%20aerial%20surveillance%20in%202013.pdf

• Response preparedness

EMSA: new recovery equipment for the Black Sea

In spring 2014, the European Maritime Safety Agency (EMSA) announced that the *Enterprise* (a supply vessel chartered by EMSA and based in Varna, Black Sea) had been equipped with a Weir Boom 180[18]. This recovery system is comprised of a 300 m recovery boom composed of 4 chambers, forming a weir, and the oil recovery chamber is fitted with 3 deck-mounted vane pumps operated by an ATEX power pack, given that this vessel is liable to be required to respond to major surface spills (e.g. tanker accidents), but also potential offshore well blow-outs (and therefore to recover slicks of fresh crude oil).

For further informtion on the EMSA oil spill response vessels:
http://www.maritime-executive.com/article/EMSA-Ups-Oil-Spill-Equipment-in-Bulgaria--2014-03-16/
http://www.emsa.europa.eu/oil-recovery-vessels.html

• Decision support

Multi-model platform for the Mediterranean region: European project MEDESS-4MS

The MEDESS-4MS project, which was completed at the end of January 2015 after 3 years of development work, was co-funded by ERDF under the MED Programme, a transnational programme of European territorial cooperation. The project focused on improving oil spill risk prevention in the Mediterranean Sea by developing forecasting and decision support systems.

The aim was to integrate various existing oil slick drift models (MOTHY, Medslik, Poseidon) within an operational platform supplied with input data by existing sources of various environmental data: metocean forecasts (GMES/MCS, national organisations, etc.), vessel and spill surveillance at sea (AIS, VTMIS, EMSA-CSN, etc.), sensitivity atlases, spill response equipment data, information on past incidents, etc.

In short, MEDESS-4MS offers a decision support system via a user interface hosted on a web portal, providing interactive access to 3 types of scenarios: real-time (automatic simulations triggered by spills detected on satellite images); delayed mode (offline simulations of past spills, including backtracking); emergency management mode (real-time simulations performed by users).

Designed to meet the requirements of European and non-European agencies (such as EMSA and REMPEC), the platform also aims to contribute to contingency planning and the implementation of European Directive 2005/35/EC (on the identification of ship-source pollution). Since project completion, REMPEC communicated about this project during the spill response exercise and connected regional conference held in May 2015 in Zarziz (Tunisia), initiated by MOIG (Mediterranean Oil Industry Group) and certain national and private oil companies (ETAP, Ecumed, etc.) (see http://www.moig.org/).

For further information:
http://www.medess4ms.eu/ (project website)
http://medess-dss.bo.ingv.it/joomla_medess/index.php/en/ (page providing access to the system)

[18] Manufactured by the UK-based firm Vikoma.

• Recovery

New modular skimmer: Lamor Minimax 25 or LMM 25

The Finnish company Lamor, world leader in brush skimmers, is offering a new skimmer with a modular design, on two accounts, known as MM 25.

Firstly, the basic module can be fitted with oleophilic brushes, discs or a drum. These modules are hydraulically operated and easily interchangeable.

Secondly, up to 4 basic modules can be joined together, with a single pumping unit, to provide higher recovery rates (25 m^3/h for a single module, 100 m^3/h for a quadruple system).

The basic module weighs around 20 kg, is compact (l x w x h = 85 cm x 85 cm x 46 cm) and can therefore be easily deployed. It can also be easily assembled and disassembled without any specialised tools.
According to the manufacturer, this oleophilic skimmer has undergone full tests at Ohmsett testing facilities, which apparently confirmed its efficiency both on light and highly viscous oil.
It can be connected to a vacuum system or a suction pump and, with a draught of less than 13 cm, is suitable for use at coastal and port sites, as well as in inland waters (rivers, lakes, etc.).

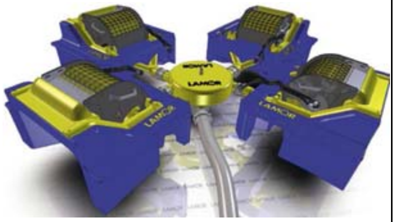


Photo and diagrams of the LMM 25 (Source: Lamor.com)

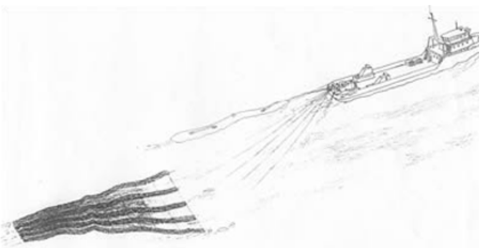
For further information:
http://www.lamor.com/en/2013/07/maximize-your-efficiency-with-the-new-modular-lamor-minimax-25-skimmer/

A new lease of life for the Force 7 offshore rope mop skimmer

Developed in the late 1970s by UK-based firms Oil Recovery International and Star Oil Recovery and marketed by OPEC (http://www.opec.co.uk/), the oleophilic rope mop skimmer Force 7 was given a new lease of life though a project bearing the same name (FORCE7, see www.cordis.europa.eu/result/rcn/141725_en.html), which was awarded €1 million funding by a European research support programme (FP7-BSG-SME – 2012-1 – Research for SMEs).

Launched in March 2013 and led by the Italian firm D'APPOLONIA SPA, this 2-year project mainly involved British (Edwards Diving Services Ltd and LKL TEC Ltd), Spanish (Polisilk sa) and Italian (Extreme Materials srl) SMEs, as well as OPEC and the Belgian Textile Competence Centre, Centexbel.

The general concept of the equipment remained the same as that of the equipment that Cedre had the chance to see deployed on the water during a demonstration in 1979, then in 1982 for a deployment trial (without oil) carried out in Plymouth from a French Navy vessel: a mop of oleophilic material, at the time 5 pairs of oleophilic ropes woven together, was towed at low speed behind a tug or supply vessel and held open either with a paravane (initial version) or an outrigger (new version).

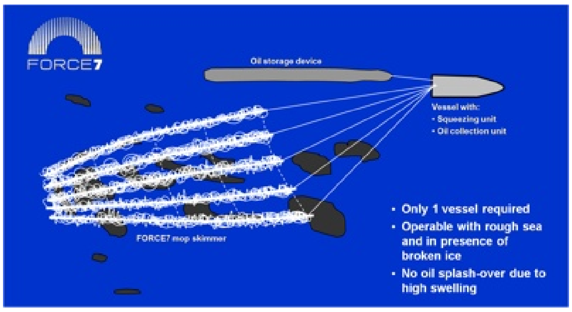


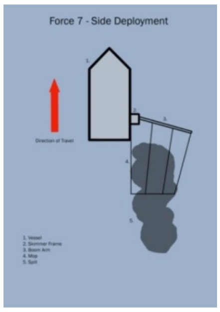
This mop is deployed from a wringer unit reel which is used to periodically squeeze the oil out of the mops while hauling them onboard.

Above and below: initial version of the Force 7 (source: www.opec.co.uk)



Drawing upon the skills of the SMEs involved in this project, the main amendment to the system resides in the type and design of the oleophilic materials used. The 5 pairs of strands of polypropylene fibres, 75 cm wide, have been replaced with 4 multilayer bands designed to promote the recovery and retrieval of heavy oil, while also being efficient on light oils.



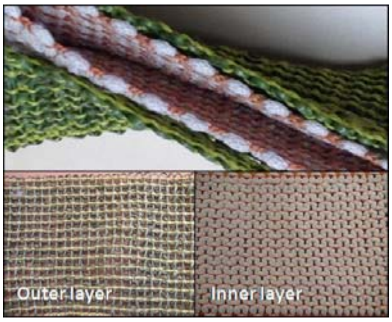


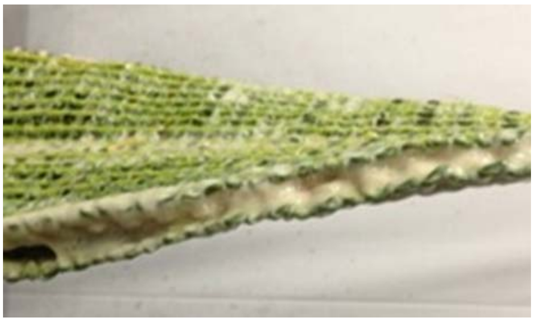

Above and left: new version of the Force 7 (source: www.force7.eu/)

The small-scale trials conducted have shown that the textile structure is capable of recovering 2 times its own weight in oil, with over 90% efficiency (i.e. 90% oil in the mixture recovered).

On 26th February 2015, a large-scale trial was conducted in Cardiff Bay, confirming that the system performed well at various towing speeds, up to 5 knots.

The advantage highlighted by the system's designers is, like for the initial system, its capacity to respond in rough sea conditions (hence the name Force 7), thanks to its deployment by a single vessel and the movement of the oleophilic textile in sync with the water's movements.





Left: textile developed through the Force 7 project

For further information: www.force7.eu

• Conferences

International Oil Spill Conference 2014

The 2014 International Oil Spill Conference (IOSC) was held in Savannah (Georgia, USA) from 5th to 7th May. Over 2,500 participants attended this triennial event consisting of many conferences, a trade exhibition with around 175 stands run by equipment manufacturers, service providers, etc., as well as a spill response equipment demonstration on the Savannah River.

CONFERENCES

IOSC 2014 comprised 45 thematic sessions, organised into 5 parallel agendas, with a total of over 180 presentations. Many of these presentations focused on spill response planning and preparedness, for the majority in a specifically North American context. In addition, we note the relatively predominant place held by: the **Arctic** theme, through projects recently completed or currently in progress supported by the oil industry (for instance API or OGP Joint Industry Projects) and references to exercises/tests conducted upon the initiative of public and private bodies (e.g. Arctic Shield in the US); **chemical dispersion** (with sessions devoted to subsea injection), far more widely addressed than in situ burning (ISB), to which relatively few references were made (in contrast with the previous edition[19], admittedly the first post-Macondo conference) and than mechanical recovery.

In terms of **oil industry initiatives**, IOSC 2014 coincided with the launch of the new version of the ARPEL (Regional Association of Oil, Gas and Biofuels Sector Companies in Latin America and the Caribbean) Oil Spill Response Planning and Readiness Assessment Manual and more specifically the RETOS tool (version 2.0, whose development was supported by IOSC), a tool designed to enable users – from industry, government, etc. – to assess their level of oil spill response planning and readiness.

A session on "Cutting Edge Techniques and Research" provided Cedre with the opportunity to present the results of the European Hoverspill project[20] (devoted to designing a hovercraft for response at difficult access sites; see LTEI n°20), alongside a project partner (Turbylec) who detailed the development of the associated oil/water separation system[21]. Cedre also presented a number of posters focusing on the tools developed as part of its current projects, in particular the burn test bench and the European project POSOW in which it is a partner. From this very dense programme, we have selected the following points (in a non-exhaustive review) to note:

Subsea application of chemical dispersants:

- As an upshot of the Deepwater Horizon blow-out, the issue of measuring the efficiency of dispersant injection into plumes of erupting crude oil was addressed during a presentation[22] outlining the limits of surface application methods: (i) measuring droplet size using a Laser In-Situ Scattering Transmissometer (LISST), mainly applicable in dilute mixtures free of gases; (ii) taking fluorometry measurements in the water column, which do not provide information on droplet size (and therefore on the capacity to rise through the water column or to coalesce). The results of work carried out on various scales at experimental facilities (Sintef and Ohmsett) indicate a high potential for the monitoring of a dispersed plume using acoustic imagery, which could be used to measure the average oil droplet size and to differentiate these bubbles from gas bubbles (whose acoustic resonance is different). According to the results obtained, the attenuation of the signal – reflecting the percentage of dispersed droplets of a given size (< 70 µm) – constitutes a relevant indicator of the efficiency of subsea dispersion.
- Tim Nedwed (ExxonMobil) provided a review of the situation in terms of research initiated by the American Petroleum Institute (API) on different themes ranging from dispersion efficiency measurements to its expected impacts, also addressing the question of modelling[23]. The question of application procedures was raised, with a comparison of the efficiency of prior injection (premix) and injection downstream of the release. Attention was also drawn to the need expressed by industry to develop numerical models to estimate, beyond the initial size of the droplets formed in various application conditions, their long term fate (dissipation, coalescence) in the water mass (issue also identified by Cedre, based on the results of injection experiments carried out at its facilities for the OGP-IPIECA project). A presentation by Sintef[24] also focused on this issue, indicating notably that premix injection was considered to be more efficient (a conclusion which concurs with studies on this issue performed at Cedre in the

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[19] See LTML n°33
[20] The *Hoverspill* Consortium, 2014. Hoverspill: a new amphibious vehicle for responding in difficult-to-access sites. International Oil Spill Conference Proceedings 2014: 649-659 (doi:http://dx.doi.org/10.7901/2169-3358-2014.1.649).
[21] Maj G., 2014. Turbylec: Development and experimental validation of an innovative centrifugal oil-water separator. International Oil Spill Conference Proceedings 2014: Pages 634-648 (doi:http://dx.doi.org/10.7901/2169-3358-2014.1.634).
[22] Panetta, McElhone, Winfield & Cartwright, 2014. Ultrasonic Scattering Measurements of Dispersed Oil Droplets in the Presence of Gas. International Oil Spill Conference Proceedings pp. 266-282.
[23] Nedwed, 2014. Overview of the American Petroleum Institute (API) Joint Industry Task Force Subsea Dispersant Injection Project. International Oil Spill Conference Proceedings pp. 252-265.
[24] Brandvik, Johansen, & Farooq, 2014. Subsea Release of Oil & Gas – A Downscaled Laboratory Study Focused on Initial Droplet Formation and the Effect of Dispersant Injection. International Oil Spill Conference Proceedings: pp. 283-298.

experimentation column).

- Shell presented a detailed review[25] of the progress of research programmes funded by members of API designed to gain knowledge of the toxicity and fate (persistence or biodegradation) of chemically dispersed oil (and dispersants) in deep water. Further research opportunities were also identified, notably the need for methods to effectively monitor chemical dispersant constituents at low concentrations (such a method only currently exists for DOSS, one of the surfactants found in Corexit 9500). A consensus appears to be emerging in terms of the design of toxicity tests, in order that they may give greater consideration to pressure and temperature in deep ocean environments (as this influences the bioavailability of molecules via their dissolution, etc.). The need to assess the sensitivity of model deepwater organisms to oil, in relation to that, which is far better known, of coastal/shoreline species was also highlighted.
- Concerning more operational aspects, a presentation[26] also highlighted the need to define tools (forms, etc.), through close collaboration between industry and the relevant US agencies, to ensure that approval is rapidly granted (or denied) for subsea dispersant use in an emergency. To do so, API (API D3 JITF) has worked towards developing an approval request procedure from US EPA Regional Response Teams (RRTs), based on industry feedback and recommendations in terms of efficiency, equipment, procedures, etc.

Response to non-floating oil spills (heavy fuel oils and bitumen):

- Among presentations on contingency planning (risk identification, necessary equipment, organisation, training, etc.) in North America, in connection with the transport of crude oils extracted from Canadian tar sands, we note a presentation[27] relating to the marine environment, focusing on the development of a numerical model (VDROP) to simulate the short term fate of a (surface) spill of diluted bitumen (dilbit) under the action of waves. Supported by experimental measurements (carried out in the DFO wave tank in Canada), this work suggests that droplets form relatively quickly from a dilbit spill in the presence of waves. This work concludes that it is possible to model this process and lays the foundations for further studies on the applicability (efficiency, window of opportunity, etc.) of chemical dispersion in the event of a marine spill of such non-conventional substances (Ed. Note: only the first 20 minutes post-spill are currently modelled; it would be interesting to examine whether there is a point at which natural dissipation under wave action becomes limited (possibly causing the heavy fraction of diluted bitumen to become submerged)).
- We note an interesting case, although in inland waters, presented by US EPA[28], relating to the question of response to a dilbit spill in Kalamazoo River in July 2010 (see LTEI n°15).

Preparing to assess environmental impacts and damages:

- Cefas presented[29] recent developments in the British project PREMIAM (Pollution Response in Emergencies Marine Impact Assessment and Monitoring), consisting in the development of a methodology known as the Monitoring Preparedness Assessment Score (MPAS). Designed to be as objective as possible, this methodology takes the form of a questionnaire intended to generate a score for local, regional or national authorities indicating their level of preparedness and their capacity to implement an ecological impact assessment in the event of a major spill. The matrix is divided into 8 principles (available expertise, logistics, funding,

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[25] Broje, Gala, Nedwed & Twomey, 2014. A Consensus on the State of the Knowledge and Research Recommendations on the Fate and Effects of Deep Water Releases of Oil, Dispersants and Dispersed Oil. International Oil Spill Conference Proceedings) pp. 225-237.

[26] Coelho, Drieu, Staves, Twomey & Walker, 2014. A Collaborative Effort to Define the Application, Approval, and Monitoring Process for Subsea Dispersant Use. International Oil Spill Conference Proceedings pp. 238-251.

[27] Zhao, Torlapati, King, Robinson, Boufadel & Lee, 2014. A numerical model to simulate the droplet formation process resulting from the release of diluted bitumen products in marine environment. International Oil Spill Conference Proceedings pp. 449-462

[28] Dollhopf, Fitzpatrick, Kimble, Capone, Graan, Zelt & Johnson, 2014. Response to Heavy, Non-Floating Oil Spilled in a Great Lakes River Environment: A Multiple-Lines-Of-Evidence Approach for Submerged Oil Assessment and Recovery. International Oil Spill Conference Proceedings pp. 434-448.

[29] Kirby, Gioia & Law, 2014. The Principles of Effective Post-spill Environmental Monitoring and their Application to Preparedness Assessment. International Oil Spill Conference Proceedings pp. 572-587.

coordination, etc.) and aims to identify which aspects could be improved.

- Another presentation[30] focused on the development of a tool to predict the amounts of natural resource damage settlements following oil spills – an exercise performed in the US based on the Natural Resource Damage Assessment (NRDA) procedure. A consultant economist, in collaboration with a university laboratory, built a statistical model to predict these amounts (based on a multiple-regression analysis of 86 past cases, in order to identify the main factors influencing the determination of these amounts). This tool, considering damages as losses of economic services due to environmental impacts, is perceived as potentially useful to the stakeholders usually involved in this NRDA approach (public bodies, responsible parties, etc.), which, we remind readers, is fundamentally a method of reaching a consensus, if not always a scientifically robust approach. This methodology is therefore developed within an exclusively American context, but nevertheless provides insight into the recurrent question of the economic assessment of ecological damages.

Spill response in the Arctic environment: R&D, preparedness, response strategies…

- A presentation[31] provided an overview of the Arctic Oil Spill Response Technology Joint Industry Programme (JIP), launched in January 2012 and funded by 9 oil companies[32]. This programme aims to improve knowledge in terms of response strategies, to promote the development and assessment of response equipment designed to overcome a certain number of recurrent difficulties in the Arctic environment (oil detection in/under the ice, containment/recovery, etc.), as well as to obtain data in order to better assess/predict potential environmental impacts. A review was provided of the progress made by the 6 technical working groups (TWGs), devoted to: dispersants, environmental effects, in situ burning, mechanical recovery, trajectory modelling in ice and remote sensing. An up-to-date review is available on the project website http://www.arcticresponsetechnology.org/. The issues addressed by the Arctic Oil Spill Response Technology JIP highlighted during the conference focused on:
    - The expected feasibility and benefits of **dispersion**, addressed through a presentation by Sintef[33] about modelling the fate of dispersed oil under ice, to ultimately assess the potential (i) to coalesce (i.e. form new slicks) or inversely (ii) to stabilise in the form of an emulsion or as dispersed droplets (i.e. available for biodegradation). This conference presented the conclusions drawn from the first phase of this project (an integral part of the Arctic Oil Spill Response Technology JIP), which consists in a literature review (the full report is available at http://www.arcticresponsetechnology.org/wp-content/uploads/2014/02/Report-1.4-Fate-of-Dispersed-Oil-under-Ice.pdf) aimed at identifying existing gaps in the data required to develop and validate such a model (subsequent project phases).
    - equipment for **oil detection and mapping**, under/in ice and/or in low visibility, notably with a presentation by Chevron (available on the JIP website). A report reviewing existing technologies and assessments, prior to the implementation of comparative tests in 2014 at CRREL[34] of the equipment considered to be the most promising (task coordinated by the Prince William Sound Oil Spill Recovery Institute, OSRI), then field tests scheduled for 2015.
    - **ISB**, with a presentation by SL Ross (again as part of the Arctic Oil Spill Response Technology JIP) covering the points detailed in the state of knowledge reports available on the JIP website and which conclude that there is "a considerable body of scientific and engineering knowledge on ISB" in the Arctic. According to the authors (which include Elastec and Spiltec), ISB in the Arctic is a "safe and effective" strategy

[30] Dunford & Lynes, 2014. Predicting natural resource damages from oil spills in the United States. International Oil Spill Conference Proceedings pp. 588-603.
[31] Mullin, 2014. Advancing Oil Spill Response in Arctic Conditions: The Arctic Oil Spill Response Technology - Joint Industry Programme. International Oil Spill Conference Proceedings pp. 960-971.
[32] BP, Chevron, ConocoPhillips, Eni, ExxonMobil, North Caspian Operating Company, Shell, Statoil, and Total
[33] Beegle-Krause, McPhee, Simmons, Daae & Reed, 2014. The Fate of Dispersed Oil Under Ice: Results of JIP Phase 1 Program. International Oil Spill Conference Proceedings pp. 949-959.
[34] US Army Cold Regions Research and Engineering Laboratory.

whose "benefits far outweigh the potential detrimental effects" – an opinion which went largely unchallenged at the conference (e.g. no questions from the audience on the fate/degradation/potential impact of residues in the water or air). The potential benefits of chemical herding agents to overcome technical difficulties relating to oil containment by floating booms in ice-affected waters were also addressed.

- A presentation[35] was devoted to shoreline response in the Arctic, providing a detailed review which highlighted a certain number of particularities of cold regions (morpho-sediment types, freeze-thaw cycles, etc.), and how the constraints (available logistics, windows of opportunity, etc.) dictate clean-up priorities, recommendations and techniques which are significantly different from those known in "normal" environments. The complex issue of waste management and evacuation in these remote regions was also emphasised (meaning that the choice of techniques which produce as little waste as possible is an important criterion).
- mechanical recovery was addressed during a presentation by the US Coast Guard[36] which reviewed a series of in situ assessments of detection and mechanical recovery equipment, in particular those coordinated by the US Coast Guard Research & Development Center (RDC) since 2010 on the Great Lakes and more recently in Alaska (large-scale Arctic Shield 2012 and 2013 operations[37]). The presentation and the related paper provide an overview of the existing gaps and needs in terms of techniques, as well as operational and logistics issues encountered during equipment tests in real conditions. The contribution of assessments at sea towards identifying improvement opportunities for many of the resources tested was generally considered undeniable.

Shoreline response: benefits and future prospects for the SCAT procedure

- A session was entirely devoted to the Shoreline Cleanup and Assessment Technique (SCAT), part of which focused on improvement opportunities in terms of its preparation[38], in particular through the development of training/awareness-raising tools focusing on its integration in the incident command system (ICS) during major spills. It appears that the procedure, now well established in spill response, has considerably evolved (the Macondo blow-out is a recent illustration), and has become increasingly complex over the past 10 years or so, due to a growing range of issues and considerations (in the NRDA for instance). Consequently, this procedure requires the involvement of specialised personnel (training requirements are highlighted) and generates constraints and requirements at all levels: collection (in the field), banking, summarising, analysis and presentation of large quantities of data (and often at a high rate during an emergency). These changes and prerequisites for the SCAT method were presented by NOAA[39], prior to feedback[40] from the implementation of the SCAT procedure, on an unprecedented scale (and complexity), following the Deepwater Horizon spill: 3-year duration, approximately 1,800 km of shoreline surveyed (just under half of which was shoreline marshes). This presentation showed how the results collected in the formalised framework of the SCAT procedure enabled relatively accurate monitoring (i) of the multiannual evolution of this large-scale spill (extent, location, intensity; delayed oilings due to remobilisation of initially buried accumulations, etc.) and (ii) of the related clean-up operations (e.g. transitions between types of techniques, based on various operational sectors and types/degrees of pollution, etc.). We note that, despite having being undoubtedly successful for the Macondo spill, and thus having been supported and reinforced (development of additional tools, procedures, etc.), the SCAT procedure must, according to the speaker, remain flexible and adaptable.

[35] Owens, 2014. Shoreline planning and response in ice-dominated environments. International Oil Spill Conference Proceedings pp. 1186-1199
[36] Hansen, 2014. Responding to Oil Spills in Ice. International Oil Spill Conference Proceedings pp. 1200-1214
[37] See LTML n°36
[38] Parker, Clark, Martin, Pilkey-Jarvis & MacDonald, 2014. New Tools for the SCAT Program: An Innovative Approach to Assimilating Newer Responders into the Shoreline Cleanup Assessment Technique Program. International Oil Spill Conference Proceedings pp. 1298-1314.
[39] Tarpley, Michel, Zengel, Rutherford, Childs & Csulak, 2014. Best Practices for Shoreline Cleanup and Assessment Technique (SCAT) from Recent Incidents. International Oil Spill Conference Proceedings pp. 1281-1297
[40] Michel, Nixon, Holton, White, Zengel, Csulak, Rutherford & Childs, 2014. Three Years of Shoreline Cleanup Assessment Technique (SCAT) for the Deepwater Horizon Oil Spill, Gulf of Mexico, USA. International Oil Spill Conference Proceedings, pp. 1251-1266

Long term ecological impact assessments following the Macondo/Deepwater Horizon (DWH) disaster

- The Coastal Waters Consortium (CWC), coordinated by a number of Louisiana Universities under the Gulf of Mexico Research Initiative (GoMRI), provided an overview[41] of the progress of its impact assessment work, following the DWH spill, on coastal systems in the Barataria Bay area (Louisiana), which had also suffered various disturbances, due to tropical storms and hurricanes as well as to water management and development work in the Mississippi Delta. A large number of results were presented, whose interpretation requires confirmation for some at this stage. Among the many points raised, we note:
  - the relatively healthy state of the plant biomass of shoreline marshes 4 years post-spill, despite interpretations of satellite images which suggest a reduction in plant cover at marsh edges (statistically more exposed to oil).
  - that the fluctuations recorded in oyster populations in the Mississippi estuary since 2010 have been connected with environmental fluctuations other than the pollution (salinity, interspecies relationships, etc.).
  - that fluctuations in the diversity of bacterial communities have been observed between oiled and unoiled stations, however these fluctuations are smaller that those related to freshwater diversions in shoreline marshes.
  - that, in coastal waters, the influence of the flow rate of the Mississippi and related factors (salinity, nutrients, organic inputs, etc.) appears to be a more influential variable than any effect of the DWH spill on the criteria mentioned during the session (phytoplankton, hypoxia phenomena).
- A session was entirely devoted to the long term impacts of the DWH spill. In terms of shoreline marshes in particular, we note a comparative study of the effects of various treatments (clean-up techniques, in some cases followed by restoration measures) 3 years post-spill, presented by NOAA[42]. According to these results, mechanised cutting and scraping on sites with persistent oil proved significantly beneficial to site restoration (vegetation and invertebrate fauna), as long as they were followed by replanting. An additional presentation (not available on the IOSC website) by NOAA recommended, in light of 3 years of post-DWH monitoring, the use of manual methods in such shoreline marshes, with mechanical methods being set aside for more heavily affected sites with persistent oil, bearing in mind that these techniques should ideally be followed by restoration actions to accelerate recolonisation by vegetation (in particular at marsh edges where erosion occurs).

Recovery capacity assessment

At IOSC 2011, a workshop on the Effective Daily Recovery Capacity (EDRC, established in 1993 under the Oil Pollution Act 90 following the *Exxon Valdez* spill) was organised. The aim was to discuss the lessons learnt from the DWH spill in terms of the relevance of this criterion in assessing the mechanical recovery capacity for a given size of spill[43]. In 2014, a session was once again devoted to this topic. We note:

- a presentation by the Alaska Department of Environmental Conservation (ADEC)[44], which considers regulations in force in the State of Alaska in terms of approval of spill response plans submitted by various entities (industrial or public) to be unsatisfactory. An Effective Daily Recovery Capacity (skimmer, pump – assessed according to ASTM standard 2709-08) of at least 20% of that announced by the equipment manufacturers is currently considered acceptable. Within this context, ADEC recommends adding to the standardised test results by implementing assessments introducing the operational constraints most likely to be

[41] Hooper-Bui, Rabalais, Engel, Turner, McClenachan, Roberts, Overton, Justic, Strudivant, Brown & Conover, 2014. Overview of Research into the Coastal Effects of the Macondo Blowout from the Coastal Waters Consortium: A GoMRI Consortium. International Oil Spill Conference Proceedings pp. 604-617

[42] Zengel, Rutherford, Bernik, Nixon & Michel, 2014. Salt Marsh Remediation and the Deepwater Horizon Oil Spill, the Role of Planting in Vegetation and Macroinvertebrate Recovery. International Oil Spill Conference Proceedings, pp. 1985-1999

[43] Cf. LTML n°33

[44] Miller & Kotula, 2014. Alaska's approach to determining oil recovery rates and efficiencies. International Oil Spill Conference Proceedings, pp. 1749-1758.

encountered in real circumstances (strong agitation, slick spreading, presence of debris, etc.). ADEC thus promotes the use of the "Request for Assessment of Skimmer System Efficiency", in which the plan holder is asked to stipulate the equipment's conditions of use in order to best predict its capabilities.

- Genwest Systems presented[45] the potential benefits of the Response Options Calculator (ROC, see also LTML 31-32) in the assessment of the performance of various recovery systems, according to their technical specificities and configuration.
- During discussions, the importance of considering the EDRC in terms of recovery "systems" (i.e. as part of the chain of equipment required – containment, storage, transfer, guidance capacities, etc.) and not simply of pumps and skimmers was emphasised. In the same line of thinking, the US Coast Guard alluded to[46] the implementation (in collaboration with BSEE and Genwest Systems) of an approach known as the Estimated Recovery System Potential (ESRP) Calculator, developed based on lessons learnt from the DWH spill, which takes into account concentration/containment and recovery (skimmers and pumps) capacities but also storage, settling and transfer/transport towards on land facilities.

SPILL RESPONSE EQUIPMENT

According to the organisers, the exhibition attracted a record-breaking number of visitors, with a roughly equivalent number of exhibitors as during the previous IOSC. In addition to already well known equipment and manufacturers, we draw your attention to the following points which will be developed in subsequent Technical Letters on the basis of further information made available to us:

- the presentation of various aerial surveillance balloons, including Hawk Owl Aerostat developed by UK-based firm Spill Consult (and since marketed by the newly created company Owls Surveillance) as well as that proposed by the US firm Qualitech.
- among response products, the sorbent OPFLEX (from OPFLEX Environmental Technologies) was on show, in all its available forms (pads, rolls, booms, loose, etc.) on what was no doubt the exhibition's largest stand.
- very few chemical dispersant manufacturers were exhibiting this year.
- among at sea response equipment, relatively few new devices are to report. Some of the most recent equipment has been covered in previous letters (Vikoma OPRS 300 high sea skimmer, OceanEye surveillance balloon, Elastec X150 groove disc skimmer; MOS Sweeper by Egersund for recovery in strong currents for instance). We note the arrival on the market of the recovery boom ORS 1000 by US firm Ocean Systems LLC, which will be covered in a subsequent Technical Letter.

Finally, a 45-minute equipment deployment demonstration was held on the Savannah River, which placed a particular focus this year on (i) aerial observation and remote sensing equipment and (ii) real-time transmission of collected data (displayed at this event on screens placed in front of the conference centre), with:

- the deployment of compact/unmanned aerial surveillance equipment, fitted with cameras and various sensors, including:
  - an aerostat (QualiTech)
  - two Unmanned Aerial Vehicles (UAVs) by Prioria Robotics (Hex-Flyer, a small six-propeller helicopter and Maveric, a hand-launched glider).
- on the water, the mobilisation of several vessels including:
  - a Clean Gulf Associates vessel (fitted with the SECurus system) for remote sensing of slicks from vessels.
  - the new Elastec/American Marine R3S (Rapid River Response System), designed for dynamic recovery of oil slicks in shallow waters and strong currents (estuaries, rivers,

[45] Mattox, DeCola & Robertson, 2014. Estimating mechanical oil recovery with the Response Options Calculator. International Oil Spill Conference Proceedings, pp. 1759-1771

[46] Casey & Caplis, 2014. Improving Planning Standards for the Mechanical Recovery of Oil Spills on Water. International Oil Spill Conference Proceedings, pp. 1772-1783.

etc.). This system is composed of a 9-metre Kvichak MARCO recovery vessel, positioned at the apex of a V-shaped containment arrangement comprising 2 legs of lightweight solid-core boom (Optimax). The 2 legs of boom are held open by 2 BoomVane deflectors towed by a small workboat operating at low speed (approx. 1 knot). The oil recovered by the vessel is stored in a floating tank (towable bladder with a capacity of approximately 4 m^3). This system is highly reminiscent of the Rapid Deployment System by SUPSALV (U.S. Navy Supervisor of Salvage and Diving) which required 2 workboats to tow the floating booms in a pair trawling configuration.

• Research

ITOPF Award 2014: the FAMERR project

While the hazards relating to bulk chemical transport is an issue that has been identified for many years, as evidenced by the establishment of the OPRC-HNS Protocol by the International Maritime Organization (IMO), still relatively few research programmes aimed at better understanding the fate of a substance in the marine environment and its possible impact on marine flora and fauna have been carried out to date.

Based on this observation, the International Tanker Owners Pollution Federation (ITOPF) decided in 2014 to fund the FAMERR (Factors Affecting Marine Emergency and Response Research) project, put forward and led by the Centre for Environment Fisheries and Aquaculture Science (Cefas), through the 3rd Annual ITOPF R&D Award.

The aim is to characterise the fate and ecotoxicity of 2 chemicals (aniline and butyl acrylate) based on environmental variables representing different geographical regions and season. The ultimate aim is to obtain data to support decision-making in the event of a spill of these substances, chosen based on (i) the high quantities transported, (ii) their former inclusion in the European programme Arcopol+ and (iii) links to a complementary project called MERR (Marine Emergency Response Research), also led by Cefas and funded by the UK Department for Environment, Food & Rural Affairs (Defra).

In March 2015, Cefas gave a presentation on the project's progress at the Interspill conference in Amsterdam. Particular mention was made of the characterisation of the ecotoxicity of aniline on various marine species, including the amphipod *Corophium Volutator*, in different water temperature and salinity conditions, affecting the chemicals' solubility limit and therefore their bioavailability. The preliminary results of the project suggest that the ecotoxicity of the chemicals tested is effectively altered by environmental conditions, confirming the value of this effort to characterise the fate of chemicals according to water quality[47].

In addition, we note that the winner of the 4th ITOPF R&D Award, revealed in June 2015, is the University of Washington's School of Marine and Environmental Affairs, for a one-year project devoted to identifying emerging risks from marine transportation and evaluating the current state of response preparedness to face these risks.

For further information:
http://www.itopf.com/in-action/r-d-award/

• Wrecks

Entry into force of the Nairobi International Convention on the Removal of Wrecks

With its ratification by a 10th State, Denmark, on 14th April 2014, the Nairobi International Convention on the Removal of Wrecks, established by the International Maritime Organization and

[47] Consequently, simply extrapolating a toxicity value obtained for a freshwater species therefore also appears insufficient. This issue is also the background to work carried out at Cedre aiming to establish routine tests, according to the recommendations in the OSPAR Convention, to determine how hazardous a substance is for 4 marine species belonging to different trophic levels (*Corophium volutator*, *Acartia tonsa*, *Scophthalmus maximus* and *Skeletonema costatum*).

adopted on 18th May 2007, has entered into force, reinforcing the international legal framework for maritime accidents.

The convention provides Coastal States with the right to remove wrecks in their Exclusive Economic Zone (EEZ) when they constitute a hazard to navigation or to the environment, in particular where there is a risk of various pollutants being released.

This convention makes shipowners financially liable for the costs of wreck removal operations and thus requires them to take out insurance or provide other financial security to cover this risk. The convention also provides States with the right to take action against insurers to recover the costs of wreck removal operations.

In France, the law leading to the ratification of this convention was enacted on 7th July 2015.