APRIL 2023 #44

Information Bulletin

Centre for Documentation, Research and Experimentation on Accidental Water Pollution

FEATURE
Emergency response

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Shoreline clean-up site in Sri Lanka

Contents

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715, rue Alain Colas
CS 41836 - 29218 BREST Cedex 2 - FRANCE
Tel.+ 33 (0)2 98 33 10 10
www.cedre.fr

Publication Manager: Nicolas Tamic
Editor-in-chief: Marion Lavenir
Formatting & Graphic Design: Camille Laot
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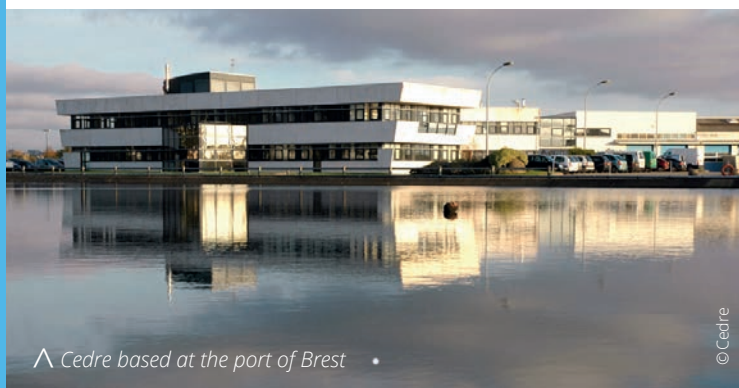
Centre of Documentation, Research and Experimentation on Accidental Water Pollution

715, rue Alain Colas - CS 41836 - 29218 BREST Cedex 2 - FRANCE
Tel.: +33 (0)2 98 33 10 10
contact@cedre.fr - www.cedre.fr



Cedre based at the port of Brest

EDITORIAL

As climate change ramps up floods, cyclones and wildfires, so it aggravates the risk of pollution from industrial fires, explosions, oil and chemical spills and sewage leaks. In the devastating monsoon floods in Pakistan this year, for example, oil fields were inundated, while flooding in Gambia raised serious concerns of oil contamination of drinking water sources. The projected increase in the number of climate disasters by 40% per year globally by 2030 has, therefore, sobering implications on future pollution hazards.

In parallel, growing conflicts are witnessing large-scale targeting of high-risk industrial and energy facilities, releasing toxic chemicals and radioactive substances that threaten human lives, water resources and ecosystems.

Over the past thirty years, UNEP has assisted countries respond and recover from the environmental impacts of disasters and conflicts. Such responses have been done in partnership with the UNEP/OCHA Joint Environment Unit which coordinates international emergency response to acute environmental risks. Under this mechanism, experts can be immediately deployed within 48 hours to help assess and contain immediate pollution impacts. Furthermore, UNEP's Disasters and Conflicts Branch supports crisis-affected countries in designing and implementing remedial solutions and reinforcing national capacities, over the short to medium term.

Strengthening partnerships with internationally recognized centers of excellence like Cedre is critical to enhancing global response capacity to the growing incidence of disasters and conflicts and helping build a more resilient future. UNEP appreciates the support received from Cedre, which has deployed experts with the support of the European Union on multiple environmental emergency missions.

I personally was privileged to work first-hand with Cedre experts in Sri Lanka in 2021 to support the government address the fallout from the *X-Press Pearl* maritime disaster. This was a complex incident triggered by hazardous chemicals catching fire, the largest plastics spill on record and an impeding risk of oil pollution. And at the time of writing, Cedre experts are taking part in a UNEP/OCHA mission to advise the government of Mauritius in overseeing the salvage of a grounded fishing vessel in a highly significant environmental area. I would also like to take this opportunity to recognize the important research that Cedre is conducting in developing pollution clean-up solutions using bioremediation.

In early 2023, the UN plans to oversee a major operation to salvage the *FSO Safer* supertanker off Yemen's Red Sea coast to prevent a major oil spill which risks worsening an already dire humanitarian crisis. We hope that this salvage will proceed without incident but are also comforted in the knowledge that we can count on partners like Cedre to assist should the need arise.

I'm honored to introduce this issue of the Cedre Information Bulletin focusing on pollution related interventions and wish you an interesting read and a great start to 2023. ■

Hassan Partow,
Head a.i., Response and Recovery Unit
Disasters and Conflicts Branch
United Nations Environment Programme

Emergency response at Cedre

Monthly meeting of Cedre's duty team

In the event of a spill, Cedre provides assistance from its headquarters in Brest and in the field. Cedre's duty team brings together all the organisation's departments and draws upon all its skills. The team is available 24/7. Cedre can also dispatch technical advisers to the site, where they may be posted at incident command centres, site command posts or directly at clean-up sites.

By Anne Le Roux,
Emergency Response Coordinator, Cedre.

Article 2 of Cedre's states stipulates that one of its missions is to "provide technical advice and assistance to the authorities in charge of responding to accidental pollution in fresh or marine waters, notably within the framework of the French Prime Minister's circular of 12 October 1978 on the preparation of local contingency plans (POLMAR Plan)".

Since the creation of Cedre, a team has thus been tasked with running a 24-hour hotline, notably in order to assist the French authorities. Over time, this activity has evolved (see Bulletin n°37) with, in particular, the creation of a specialised team in 1993.

Today, the team is composed of 8 engineers and scientists from Cedre's different departments and one coordinator. Each member of the team brings their own skills as well as the experience and know-how of their department. It is supported by an assistant and two GIS specialists (who are also in charge of improving the modelling tools). Cedre's management team provides second-line support, required in particular to make the call to deploy one or more technical advisers in the field, but also to manage relations with the press and the authorities. Finally, Cedre's laboratory plays a fundamental role in response, particularly by carrying out emergency analyses and studies on pollutants.

The team handles an average of 100 to 150 cases per year (real spills, pollution risk situations, exercises, natural phenomena) although this figure was considerably higher in 2022. More than half of the enquiries received are from the French public sector (Navy, MRCC, prefectures, town halls, fire brigade, etc.).

Cedre is also mobilised by foreign authorities with which it has an agreement in place, such as the Maritime and Port Authority of Singapore, but also the European Union though the MAR-ICE Network.


© Cedre

ABOUT MAR-ICE

The European Maritime Safety Agency (EMSA), the European Chemical Industry Council (Cefic) and the Centre of Documentation, Research and Experimentation on Accidental Water Pollution (Cedre) have amended their three-party Cooperation Agreement to extend the MAR-ICE service until the end of 2027.

After 15 years of cooperation, the MAR-ICE network, which provides support to European Union Member States and the coastal states of the European Free Trade Association (EFTA), in responding to maritime accidents involving chemicals or hazardous and noxious substances (HNS), will continue to rapidly provide information and expert advice on chemical substances in the event of maritime pollution at different levels.

Cedre has been the operational point of contact for this service ever since its creation in 2008.

This network, created through a Memorandum of Understanding (MoU) between Cedre, the European Maritime Safety Agency (EMSA) and the European Chemical Industry Council (Cefic), provides EU Member States and the coastal states of the European Free Trade Association (EFTA), as well as coastal EU Candidate Countries, with a single contact point (Cedre) in case of a chemical emergency (spill or pollution risk) in their maritime waters. The duty team can also be called upon by private companies (oil industry, shipping industry, insurance sector, etc.) with which Cedre has signed assistance agreements.

The majority of enquiries still concerns oil (around half of the calls), even though the share of hazardous substances is significant (between a quarter and a third). The remainder concerns non-hazardous substances, or doubts over the observation of natural phenomena (algae, plankton, pollen, peat, etc.).

The team manages about ten on-site call-outs each year, again, with a wide variety of cases. This could be, for instance, a half-day mission to identify deposits of "an egg yolk-like substance" on the beach of a neighbouring municipality and provide recommendations for collection. At the other end of the spectrum, in the event of a major spill affecting the French coastline, a rota is organised in the field with many of Cedre's engineers, often working in pairs, generally on a fortnightly basis. Such missions can stretch over several months.

Cedre is also regularly involved in UNEP/OCHA expert missions abroad via the ERCC (see article on pages 12 and 13).

When a major incident occurs, Cedre reorganises its work. Each department focuses its activity on assisting the authorities by providing experts on the various issues to the command centres and clean-up sites, by carrying out studies and experiments specific to the pollutants in question, or by providing logistical support to the experts deployed on site. Cedre also runs (from its headquarters in Brest) the drift committee set up by the French authorities in the case of long-lasting response operations at sea (see Bulletin #43).

Whatever the extent of the incident, the duty engineer based in Brest is available to provide Cedre's on-site engineers with technical support. To fulfil this specific role, Cedre's engineers and scientists, regardless of their initial specialisation, are tutored by the team members and GIS specialists. In addition to response techniques and strategies, duty officers must have a solid knowledge of numerous databases, the modelling of product behaviour, French and international regulations relating to accidental water pollution, the list of the laboratory's analytical capabilities and many other notions. They must be capable of working in both French and English.

Regular training and exercises are essential to keep the team's skills up to standard.

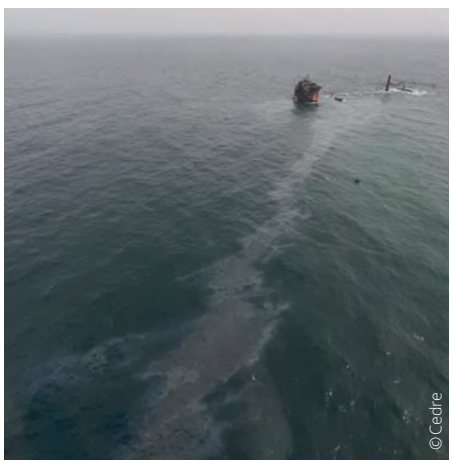
Sinking of the *X-Press Pearl*

Burnt plastic pellets washed up on a beach in Sri Lanka

By Stéphane Le Floch, Research Department Manager and Camille Lacroix, Aquatic Litter Monitoring and Studies Department Manager, Cedre.

On 17 June 2021, the Singapore-flagged container ship *X-Press Pearl* which had been commissioned less than 6 months previously, was carrying 1,486 containers when it sank some 9 nautical miles off Colombo, executive and judicial capital of Sri Lanka, following a series of misunderstandings and imposed decisions. The investigation is currently in progress, however sufficient information is available to establish the timeline of events.

On 11 May 2021, the ship's captain reported a leaking container of nitric acid on board to the Hamad Port Authority in Qatar. The port denied permission to unload the leaking container. On 15 May, the ship requested assistance from Hazira Port in India, which also denied permission to discharge the container, forcing the vessel to continue its journey. On 20 May, Sri Lanka received a distress call from the crew reporting that an uncontrollable blaze had broken out on board. A series of explosions followed and, on 25 May, the ship was completely ablaze. Despite assistance from the Indian Navy and the Sri Lanka Navy, the fire could not be extinguished, as the flames were fanned by strong winds, and the ship began to sink. On 12 June, the Emergency Response Coordination Centre (ERCC) of the Directorate-General for European Civil Protection and Humanitarian Aid Operations (ECHO) responded positively to a request for international assistance made by the Government of Sri Lanka, and a team of European marine pollution experts was set up (2 French engineers from Cedre and 1 Italian from Ispra). The mission team, activated by the United Nations Environment Programme/Office for the Coordination of Humanitarian Affairs (UNEP/OCHA), arrived at the scene on 16 June[1]. On 17 June, the wreck was completely stabilised at a depth of about twenty metres, with the superstructure emerging.

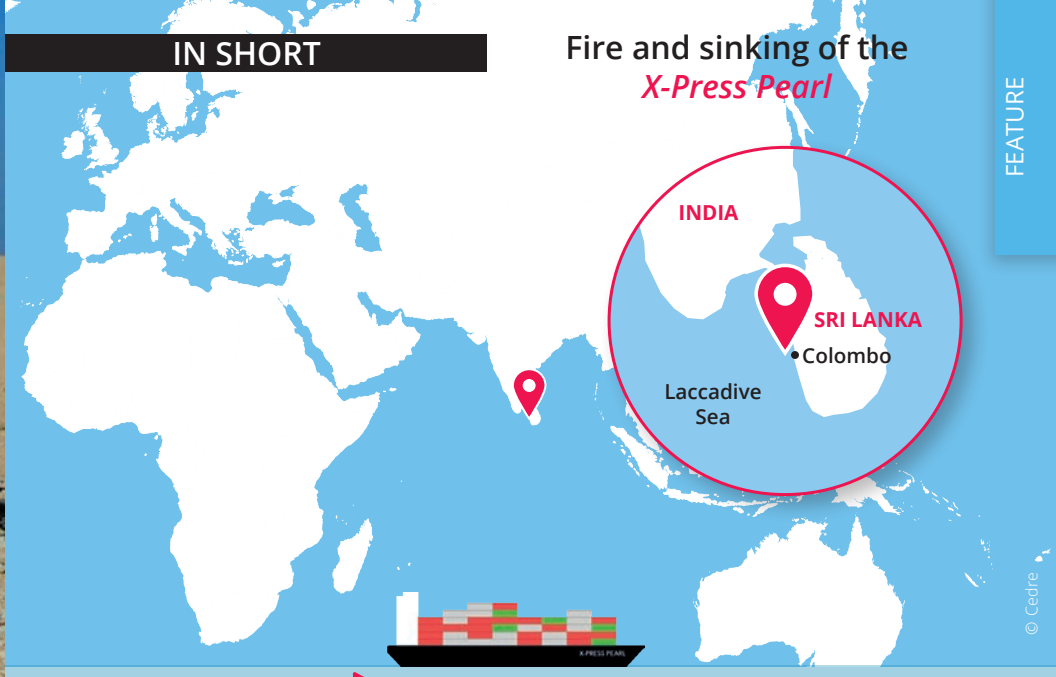


20 days after the X-Press Pearl *began to sink, it continued to leak bunker fuel at sea*

The *X-Press Pearl* was now considered to be a polluting wreck as it held onboard containers with a wide variety of chemicals and bags of plastic pellets, as well as bunker fuel (255 m^3 of heavy fuel oil) and various lubricants (52 m^3)[2].

IN SHORT

Fire and sinking of the *X-Press Pearl*



X-Press Pearl container ship

Date built: 2021
Flag: Singapore
Owner: X-Press Feeders
Capacity: 2,756 TEU (twenty-foot equivalent units)
Draught: 11.5 m
Length: 186 m
Width: 34 m

Quantity transported:
- 255 m^3 of bunker fuel
- 11,000 tonnes of plastic pellets
- 81 containers carrying dangerous goods including 25 tonnes of nitric acid, 1,040 tonnes of caustic soda and 210 tonnes of methanol

In terms of air pollution, the Sri Lankan authorities had to take very quick action as the prevailing sea and weather conditions were driving the thick black smoke generated by the fire towards the coast, and more precisely towards the capital, Colombo[3]. The city's inhabitants were exposed to these fumes for more than ten days. The country's National Building Research Organisation (NBRO) was then asked to set up an air quality monitoring protocol including in situ gas measurements (VOCs, CO_2, CO, NO_x, SO_x) and air sampling to check for the presence of soot particles from the ship's fire. While it is not yet possible to draw conclusions about the gas levels measured, correlations would appear to exist between peaks in particulate matter and the presence of the cloud over Colombo.

The United Nations experts rapidly identified three potential sources of marine pollution: the oil still on board, the containers of chemicals, and the containers of plastic pellets.

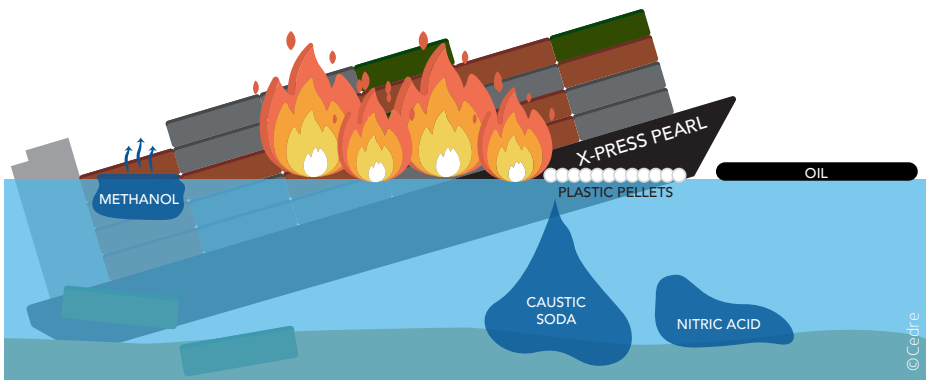
Concerns were raised very early on over marine pollution due to the bunker fuel (Intermediate Fuel Oil 380 or IFO 380) and lubricants, given that, as soon as the wreck was stabilised on the seabed, a continuous black leak appeared above the wreck and stretched out towards the shoreline. The leak was detected during an aerial survey by helicopter and subsequently on satellite photos provided by CLS*, leading the UN team to organise a boat surveillance trip to collect samples. Analyses performed by Cedre's laboratory confirmed that the pollutant was IFO 380 and therefore that, despite the violent blaze, the fuel oil had not burnt off. This point argued in favour of the implementation of response at the water surface, i.e. containment and recovery, to prevent the oil from entering the water column as far as possible and thereby reducing pollution by PAHs* and limiting the risk of seafood contamination (fish and shellfish).

The complexity of assessing the risks and impacts of chemical pollution was exacerbated by the wide variety of products carried and listed in the ship's cargo manifest. Almost all the possible theoretical behaviours of chemicals identified in the Standard European Behaviour Classification (SEBC) were found, i.e. Sinkers (S), Dissolvers (D), Floaters (F) and Evaporators (E)[4]. However, the detailed analysis of these behaviours quickly revealed the duality of certain substances, such as methanol which, despite being completely soluble, has the specificity of being able to evaporate from the water, possibly forming a toxic and flammable gas cloud, or nitric acid and caustic soda, which will initially sink in the water column before gradually dissolving. This behaviour entails a high toxicity risk for benthic species. The UN team assessed the intensity of these different fates in order to propose the most appropriate response strategies, and also to accurately assess the environmental impact of the incident. The possibility of using underwater

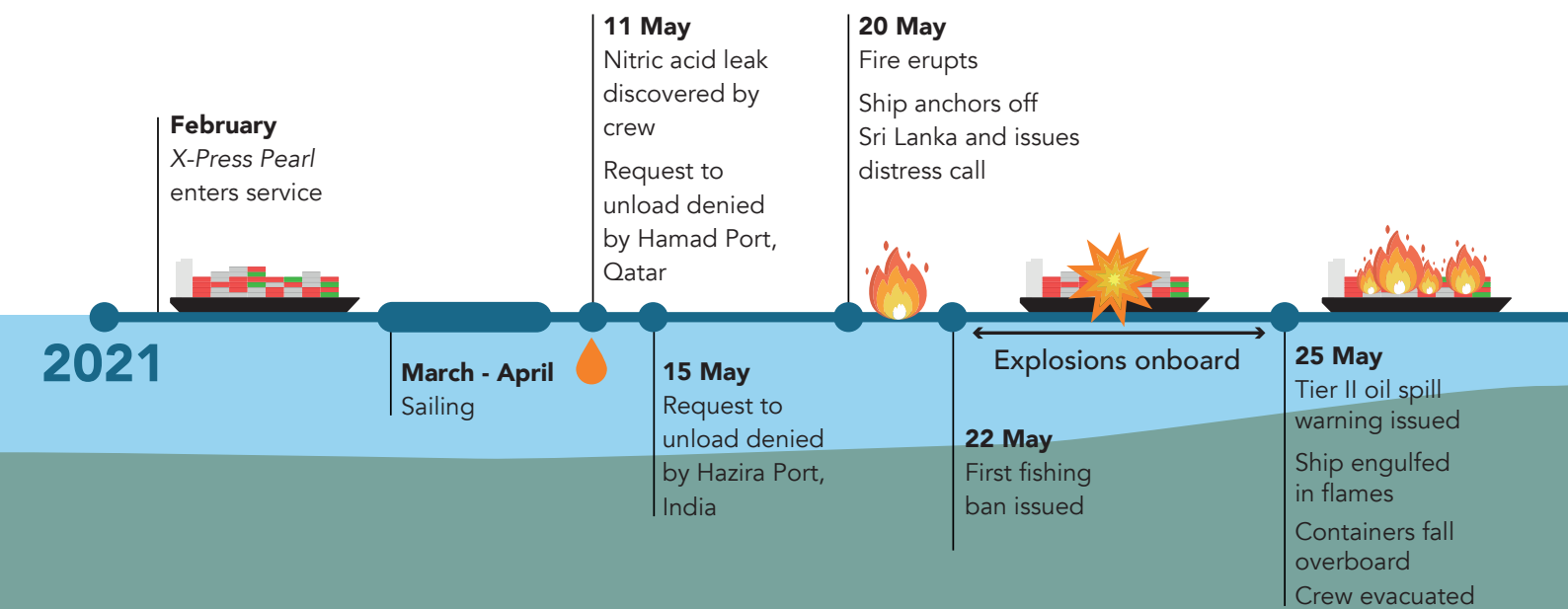
drones to search for containers scattered across the seabed and to map the impacted area was therefore discussed. The issue of the toxicity of the molecules (PFAS*) present in fire-fighting foams was also raised, as these compounds are particularly persistent and bioaccumulable, and their toxicity is recognised.

One third of the cargo of the *X-Press Pearl* was composed of plastics. The vessel was carrying 11,000 tonnes of plastic pellets, mainly polyethylene beads with a diameter of 3 to 5 mm. These plastic pellets were transported either in bulk containers or in 25 kg bags, i.e. bags each containing one million pellets. During the fire, while a share of the pellets burned, several containers burst open releasing their cargo into the marine environment, leading to vast quantities being washed up on the Sri Lankan coastline. Mixtures of intact pellets, melted and agglomerated pellets, and burnt plastic pieces were found along more than 700 km of coastline. The largest quantities were recorded on the shore nearest to where the ship sank, in an area with strong hydrodynamics, which resulted in a share of the pellets being buried in the sand. This phenomenon greatly increased the complexity of cleaning operations, posing technical challenges for clean-up operators. Given the limited knowledge of the management of this type of pollutant, various techniques had to be devised, tested and specially adapted on site, such as sweeping, vacuuming, sieving, sink-float separation or screening. Despite the major efforts made by the Sri Lankan authorities to mobilise human resources and collection equipment, many questions remained unanswered, not least the much-debated "How clean is clean?", or indeed what to do with the plastic pellets recovered. Could they be recycled? More than one year after the ship sank, shoreline clean-up operations are still underway and are proving to be particularly fastidious, time-consuming and costly. In autumn 2021, the Sri Lankan authorities announced that 33,000-plus person-days had been worked for the clean-up process.

The impact of this incident on the local population and on the environment has not yet been fully assessed, but an initial assessment points to major socio-economic losses for the population and extensive damage to the environment. The introduction of fishing bans and no-go zones triggered substantial financial losses within the fishing community and the tourism sector, which had already been badly hit by the COVID pandemic. This incident could also be responsible for high mortality among marine organisms, both fish and mammals, due in particular to exposure to chemicals. Several animals, including turtles and dolphins, were found washed up on the beaches with burn marks that could have been caused by acid and/or soda. Necropsies have also shown that the stomachs and gills of some dead fish contained plastic pellets. The Sri Lankan authorities will need to explain the impact of this incident on the marine ecosystem to the local population and will have to prove to the insurers that the mortality observed is a direct consequence of this incident. The environmental impact of spills of chemicals and plastic pellets at sea is not always easily estimated, hence the need for infrastructures that can reproduce this type of exposure in order to obtain factual data to help decision-makers to opt for the most appropriate response strategy.



Fate of main substances spilt at sea



Separating sand and pellets by sink-float separation

In early February 2023, Sri Lanka's Marine Environment Protection Authority (MEPA) announced that salvage operations were coming to a close. The Shanghai Salvage company, based in China, is finalising the removal of the second and final section of the wreck and is recovering all the debris and containers remaining on the seabed. More than a year and a half on from the incident, response operations at sea are now completed. On the shoreline, plastic pellets are still being found.

Over and above the direct consequences on the Sri Lankan population and environment, the sinking of the *X-Press Pearl* could have international repercussions. A number of issues have emerged that must be discussed, namely:

- the obligation for ports handling hazardous containers to provide assistance in the case of a dangerous situation;
- the integration of the issue of plastic pellets into international conventions;
- the need for pre-established protocols for setting up environmental monitoring programmes following a major incident.

An exponentially increasing number of substances are being transported across our seas and oceans. It is therefore essential to consider the environmental impact in order to keep it to a minimum, even in the event of a major incident. ■

Members of the UN mission surveying the shoreline affected by the pollution

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SAY WHAT ?

***CLS**

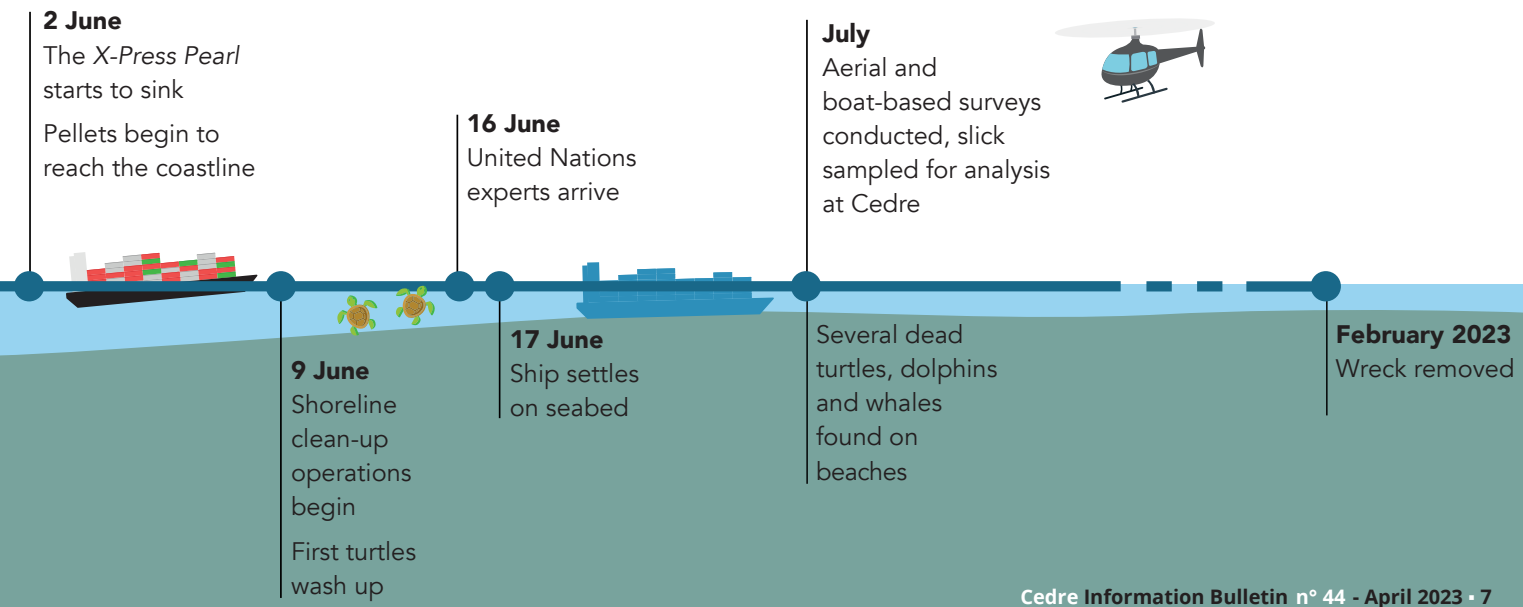
Collecte Localisation Satellites. CLS, a subsidiary of CNES and CNP, is an international company specialising in providing Earth observation and monitoring solutions.

***PAHs**

Polycyclic aromatic hydrocarbons

***PFAS**

Per- and polyfluoroalkyl substances



River pollution following a deliberate discharge of waste oil

On 6 May 2022, a deliberate discharge of waste oil into the rainwater drainage network of the town of Lamorlaye (Oise department) caused the pollution of two small rivers, the Vieille Thève and the Thève, the latter a tributary of the Oise river, resulting in approximately 7 km of waterways being contaminated.

By Florence Poncet, Engineer in the Research Department, Cedre.

Map of the area, comprising 3 towns, 2 departments and 2 regions. The Prefecture of the Oise department conducted and coordinated the response operations

In this sector located near the vast Chantilly forest, the banks of the rivers concerned are mostly bordered by sprawling wooded areas and privately owned marshland, offering very limited access. Indeed, this is possible via only three roads where these rivers are crossed by bridges and two tracks that are mostly unsuitable for vehicles, which complicated the survey missions and the response operations.

The Fire and Rescue Services (SDIS) of the Oise and the Val-d'Oise departments implemented the initial emergency measures, which involved installing booms at the few accessible points and notably immediately upstream of the confluence with the Oise river. The installation of these booms before the waste oil reached this point in the river, together with subsequent regular pumping of the accumulated oil, made it possible to effectively contain the pollution and prevent it from spreading into the Oise.

The initial surveys conducted by the Fire and Rescue Services identified the presence of oil trapped along the rivers in logjams (obstacles formed by accumulations of branches and plant debris in the riverbeds), presenting a risk of release of the oil in the event of storm-related flooding.

Ten days after the incident, Cedre was mandated by the Prefecture of the Oise department to conduct a full survey of the rivers in order to assess the situation and to recommend the necessary clean-up operations to be implemented in addition to the booms.

These surveys identified 46 points of floating oil accumulation, temporarily blocked by the logjams, and including around ten patches measuring between 1 and 4 m^2. The mapping of these accumulation points, with associated GPS coordinates, by the Oise Fire and Rescue Service facilitated their geolocation by the emergency response company, as well as the monitoring of the progress of the clean-up operations by the authorities.

Draining using screens (water/oil separation) and recovery of the oil, emulsified due to storms and the increased water level and flow, to reduce the volume of waste

It was also noted that oil had remained in the minor bed of the Thève, the level of which was fairly low at that time. There had therefore been no oiling of the banks and their vegetation, with the exception of slight black traces left by the passage of the oil on leaves, roots or tree trunks, but which did not require any intervention.

Boom and sorbents installed by the Oise fire brigade at the bridge on the D909 road

Finally, it was considered urgent to conduct the clean-up operations before the booms installed by the Fire and Rescue Services (floating booms, custom-made straw and wire mesh barriers, and sorbent booms) could be rendered ineffective in the event of a rapid rise in the water level and increased currents following the storms that had been forecast in the area.

To this end, the company Séché Urgences Interventions was requisitioned by the Prefecture of the Oise department for the recovery and disposal of the oil and oiled plant debris.

Manual scooping of the oil

The clean-up operations lasted one week and were conducted under the command of the Director of the Oise Fire and Rescue Service with the assistance of Cedre.

Custom-made barrier (wire mesh/straw) built by the Val-d'Oise fire brigade upstream of the confluence with the Oise

Emergency response strategy and protocol recommended by Cedre:

- Leave the boom system in place to prevent pollution of the Oise river and to recover the inevitable small releases generated by the clean-up operations.
- Begin priority recovery operations on the main accumulations as soon as possible (as systematic progression starting upstream would not enable the recovery of the greatest accumulations before the arrival of the stormy weather).
- Factor in the sensitive nature of the natural environment by organising the clean-up operations in small teams, by protecting the banks in the work areas to avoid any contamination during recovery of the waste oil and oiled branches, and by positioning sorbent booms downstream of these areas.
- Perform manual recovery (scooping), working either along the riverbanks or in the riverbed.
- Ensure evacuation of the collected waste by carrying it to the access points, and exceptionally with the use of a quad bike.

By the end of these clean-up operations, 24 m^3 of a mixture of water and oil (in unknown proportions) had been pumped out and 2.5 to 3 tonnes of oiled matter and oil removed from the river during the work on the logjams. ■

Before/after clean-up at an accumulation point

Oil traces on the Moselle river

EDF's Cattenom power plant requests Cedre's assistance

On 20 February 2022, the Cattenom nuclear power plant was informed of the presence of suspicious traces on the Moselle river, downstream of the site. The plant's teams immediately conducted checks which showed that these traces were caused by oil coming from the non-nuclear part of the facilities. The absence of radioactivity was thus quickly confirmed. The Prefecture and the French Nuclear Safety Authority immediately notified the border authorities, and subsequently kept them informed of the management of this incident as it unfolded. As soon as the plant's teams became aware of the presence of traces of oil in the Moselle, they worked in conjunction with the Moselle Fire and Rescue Service (SDIS) to install a floating boom and conduct pumping and clean-up operations.

By François Robein, EDF.

The cause was related to work on the site's fire control circuit, which triggered the automatic start-up of the sprinkler system for the monophase units of the discharge transformers. The unintentional spraying resulted in an estimated 220 m³ of fire water being discharged into one of the site's oil separators. During treatment, a faulty detector allowed oily water to leak into the Moselle until the operator permanently isolated this connection.

The Moselle, with the cooling towers of the Cattenom nuclear power plant in the background

Continuation of the in-depth investigations

On 22 February, Cattenom power plant contacted Cedre and began a visual survey of the Moselle by drone. On 24 February, Cedre's engineer conducted on-foot and boat surveys of the Moselle from the location of the discharge to the town of Sierck-les-Bains. On 25 February, Cedre submitted its report comprising its findings on the impact of the incident as well as some recommendations. The investigations conducted confirmed the absence of any impact on local flora and fauna due to the biodegradable nature of the product and the minute quantities released. No additional clean-up operations were therefore necessary on the riverbanks.

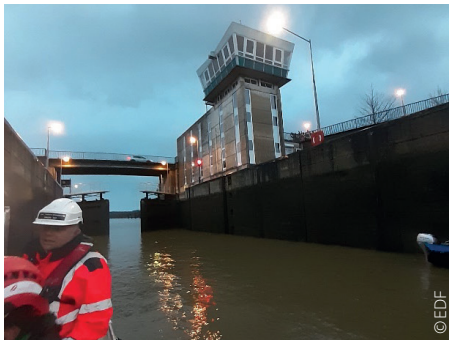
Mobilisation by the power plant of its duty service teams to coordinate the management of the incident in conjunction with the public authorities

No fish mortality was noted. For many years now, the power plant has tasked an independent laboratory with the regulatory monitoring of the condition of the Moselle downstream of the site. An additional study was requested following this incident. The comparison of the 2021 and 2022 studies showed no significant changes.

Containment of the oil residues and assessment at the boom installed at the site's discharge station

As after each incident, the Cattenom power plant established feedback designed to improve its organisation and prevent such an event from happening again:

- the operating mode of the circuits around the oil separators has been altered to enhance safety;
- the reliability of the sheen detectors has been improved;
- the site is now equipped with all the means necessary to deal with HCH (hexachlorocyclohexane, a persistent organic pollutant);
- standard procedures now include immediately contacting a pollution clean-up contractor and Cedre when a problem is detected. ■



Departure of the survey by boat on the Moselle downstream from the site, with the Séché teams

Offshore wind

Response preparedness

While the offshore sector remains largely dominated by the oil and gas industry, the development of offshore wind farms has been steadily increasing over the past twenty years.

The installation and operation of these offshore wind farms thus generate a growing risk of accidental water pollution, a risk that needs to be studied in order to determine the potential impacts on humans, the environment, property and facilities.

Against this backdrop, and on the basis of preliminary risk studies, it now appears essential for all of the private or public actors working in ports, offshore wind farms and the surrounding areas to be fully prepared to prevent spills and propose an effective and appropriate response framework.

This preparedness must be coherent with this sector of activity while complying with a set of principles already approved in other areas of the offshore industry historically active in pollution response.

Wind turbine blades at the Saint-Nazaire logistics hub

Wind farm

These principles can be summarised as:

- the prevention and reduction of pollution at the source;
- the establishment of an organisation and the procedures necessary to deal with different levels of pollution;
- the preparation of appropriate response strategies, techniques and equipment;
- the training of both operators and decision-makers, the mobilisation of experts, and the continuous improvement of stakeholders' know-how through exercises to validate their response capacities and improve their effectiveness.

Finally, the preparedness and response frameworks defined by private stakeholders must be able to be implemented in conjunction with the existing ORSEC and ORSEC/POLMAR-Terre contingency plans for oil pollution at sea and along the French coastline. In this respect, and in order to monitor the evolution of the issues and requests related to these new marine technologies, the authorities must further develop the legislative framework through the drafting of new texts (e.g. the instruction drawn up by the General Secretariat for the Sea authorising bunkering operations at sea).

Thanks to its experience in the oil and gas industry, notably, Cedre has been working alongside stakeholders in the offshore wind industry since 2019 to contribute to the adaptation and improvement of their systems and their human and material resources mobilised in the event of a water pollution incident. This is evidenced by our recent studies, reviews, training courses and agreements with the authorities and industrial firms within this sector. ■

By Pierre Parenthoine,
Engineer in the Studies and Training Department, Cedre.

The EU's Marine Pollution Response

Under the Union Civil Protection Mechanism

Disasters causing marine pollution are a major concern for the EU. Therefore, the EU supports countries and maritime regions to be prepared and respond to incidents at sea quickly and effectively. The EU contributes to strong and long-standing regional cooperation against marine pollution in its role of a Contracting Party to the regional sea conventions: HELCOM, BONN Agreement, Lisbon Agreement and Barcelona Convention, and as an observer to the Bucharest Convention.

By Till Steinkamp and Gian Marco Desogus, ERCC Echo.

Marine pollution emergencies fall under the Union Civil Protection Mechanism (UCPM) which is the EU's primary tool when a country's own response capabilities are overwhelmed. The support offered to countries under the UCPM focusses primarily on protection of people, but also covers the environment and property, and it can be activated against all kinds of natural and man-made disasters, including marine pollution, occurring inside or outside the Union.

All EU Member States and UCPM Participating States as well as EU Neighbouring countries may receive co-funding for marine pollution-related prevention and preparedness actions, including full-scale exercises. When it comes to maritime incidents, UCPM facilitates coordination of and transportation of assistance to the affected country anywhere in the world. It does so via its operational hub – the Emergency Response Coordination Centre (ERCC) – which is greatly supported with services offered by the European Maritime Safety Agency (EMSA).

On a practical level, this framework allows the EU to get operationally involved and provide support and coordination ranging from detailed satellite images, to vessels, specialised equipment and deployment of dedicated expert teams. Three practical examples of previous response to marine pollution under the UCPM are:

Plastic pellets on a beach in Sri Lanka

- A massive tsunami damaging an oil refinery and causing an oil spill of 950 000 litres at the coast of Peru in January 2022. After the call for support from Peru, the UN requested environmental experts through UCPM in the fields of incident handling, contingency planning, marine chemistry and environmental emergencies. As a response, four oil spill and environmental experts from France (Cedre personnel), Italy and Spain joined a UNEP/OCHA Joint Environment Unit (JEU) team between 25 January and 9 February 2022. The experts provided technical advice and identified the immediate priorities for action.
- A burning and eventually sinking of a cargo ship carrying hazardous chemicals as well as plastic granules and oil in Sri Lanka in June 2021. Two Cedre spill response experts from France as well as one oil spill expert from Italy were deployed to Colombo between 15 and 30 June 2021 to join the JEU team led by a UNEP team leader. The experts supported

the national authorities and provided technical advice in the following domains: effects of oil pollution on the marine environment, countermeasures on plastic pellet pollution in the sea, environmental impact of the sunken shipwreck, protection of the sea food chain, recovery strategies on sea turtle populations, risk assessment of the coastal ecosystem.

- A critical fire on a bulk carrier in Swedish waters which required assistance for large External Fire Fighting System Capacities in December 2021. Through the UCPM, Norway deployed a requested ship to support Swedish rescue teams. The bulk carrier was safely towed after 11 days of firefighting at sea. This prevented a potential major marine pollution.

The EU continues its efforts towards enhancing preparedness and response to marine pollution incidents and managing crisis on water as much as on land. Thanks to France and the expertise of CEDRE, the UCPM is able to provide invaluable support and key recommendations to countries affected by severe marine pollution emergencies in the last years. ■

Shoreline clean-up site in Sri Lanka

Aerial observation of pollution in Peru

Cooperation in the field of oil spill response training

By Sebastian Kroll, CCME – Havariekommando.

Every year, the Central Command for Maritime Emergencies (CCME) carries out numerous training courses and exercises in combating oil spills for response personnel and management staff from German coastal state environmental agencies. However, due to the lack of technical possibilities in Germany, no practical training with oil can take place. In addition, since oil spills in which the response equipment of CCME is used are extremely rare, most response personnel and managers lack the relevant experience. As major response operations in recent decades have shown, it is precisely this experience that is of great value for the further development of technology, tactics and training. CCME was therefore looking for a competent and experienced partner who would be able to provide practical training using real oil.

Cedre staff instructing CCME participants during the training course.

CCME participants deploying a suction shovel during the training course.

The technical expertise, the training programme and the training possibilities of Cedre were already well known through the cooperation in international working groups and committees. It was therefore the obvious choice to extend the cooperation with Cedre to practical training as well.

Based on the requirements of CCME, Cedre designed a special four-day "Oil Spill Management Course" with a focus on practical oil spill response under real conditions. After a theoretical overview of the general principles and strategies of oil spill response, the course goes on to cover the survey, assessment and organization of the response site, the containment and recovery of various oils on the water as well as cleaning of shores and beaches. The course is rounded off by a concluding practical exercise and a table top exercise (based on real oil spill response operations). Since the course is held in English and because there are many opportunities for exchange of experiences with the trainers, the training course also prepares the participants to some extent for international assignments.

CCME participant handling a handheld brush skimmer during the training course.

Since 2018, the "Oil Spill Management Course" has been held once or twice a year. The content is subject to constant evaluation in order to be able to react to new developments, requirements and wishes of the participants. For example, CCME has meanwhile stationed oil spill response equipment from its stock at Cedre, so that the participants can now practice with their own equipment in an even more practical way.

About CCME - Havariekommando

On January 1st, 2003 the Central Command for Maritime Emergencies (CCME) (in German: Havariekommando) commenced operations, founded in the aftermath of the sinking of the *Pallas* and the following oil spill in 1998. The CCME is a joint institution of the German Federal Government and the Federal Coastal States. It was established to set up and carry out a mutual maritime emergency management in the North Sea and in the Baltic Sea, including the exclusive economic zone (EEZ). The main tasks of CCME are human lifesaving, firefighting, pollution response and emergency towing.

The CCME is based in Cuxhaven (Northwest Germany). The Central Command for Maritime Emergencies is headed by a federal official. During daily work routine the CCME consists of about 45 employees, working in five different sections (Maritime Emergencies Reporting and Assessment Centre; Marine Pollution Control/ High Sea and Salvage Section; Marine Pollution Control/Coastal Section; Fire Fighting, Rescue and Medical Response Section; Public Relations Section).

These five sections form a "centre of competence", which deals with all questions related to maritime emergencies. In case of a "Complex Emergency Situation", the staff is alerted and called for to co-ordinate immediate action of all necessary forces under the auspices of the Federal Government and the Coastal States. Personnel from the CCME forms this "Incident command centre", which is organized in four units. The head of CCME and one person from each unit are on standby. Immediately they alert crews or response teams, contact the operation staffs of the coastal states and inform the authorities of neighbouring countries. The casualty staff leads the operation at sea and onshore, at beaches and inshore waters. As fast as possible CCME sends an on-scene-coordinator to supervise the operation on site and provide all necessary information to the casualty staff.

These arrangements under a centralised command structure allow rapid and comprehensive control of all necessary operations in major maritime emergencies. The CCME hereby utilises personal, equipment and know-how of all authorities and institutions of the federal government, the coastal states and private organizations responsible for the sea and the coastal area.

CCME staff surveying burnt out containers on board "MSC Flaminia", Wilhelmshaven, 10 September 2012.

Since its founding in 2003 CCME has successfully managed about 90 "Complex Emergency Situations", ranging from minor pollution incidents to fire on board passenger ships (*Lisco Gloria*, 2010), chemical incidents (*MSC Flaminia*, 2012; *Purple Beach*, 2015), grounding of ultra large container vessels (*CSCL Indian Ocean*, 2016) and large-scale loss of containers (*MSC Zoe*, 2019). ■

Firefighters of a Maritime Incident Response Group First Response (MIRG FR) at one of the many annual exercises.

Response and legislation in Canada

Eastern Canada Response Corporation (ECRC) (also known by its French name, La Société d'Intervention Maritime, Est du Canada -SIMEC) provides marine oil spill preparedness and response services. ECRC is government certified (Transport Canada (TC)- Marine Safety) Response Organization (RO) under the Canada Shipping Act, 2001 (CSA). ECRC's mission is to maintain a state of marine oil spill response preparedness that is consistent with legislation and capable of providing a real response at an affordable cost to its members.

By Robert Starkes, Eastern Canada Response Corporation (ECRC).

ECRC ~ SIMEC

more info

www ecrc-simec.ca

Background

In 1993, amendments were made to the CSA to strengthen Canada's marine oil spill response capability. These amendments required:

- That ships (as defined in the CSA) operating in Canadian waters south of 60° N latitude and designated oil-handling facilities located in Canada south of 60° N latitude have an arrangement with a certified response organization.
- The establishment of certified response organizations (RO).

ECRC was established in 1994 as one of four ROs set up by Canada's private sector to meet the requirements of the CSA. The other ROs include Atlantic Environmental Response Team (ALERT) based in Saint John, New Brunswick; Point Tupper Marine Services (PTMS) based in Point Tupper, Nova Scotia; and Western Canada Marine Response Corporation (WCMRC) in British Columbia.

Certification

The CSA establishes the requirements for preparedness capacity and sets rigorous response planning standards for the certification of ROs. ROs are required to submit and demonstrate to TC a comprehensive Response Plan that details how they meet the planning standards. Certification is valid for a period of three years, with TC monitoring RO capabilities on an ongoing basis through attendance at training sessions and exercises, and by conducting audits of training records and response equipment.

ROs are certified for a specified Geographic Area of Response (GAR). ECRC's GAR covers all navigable waters south of the 60th parallel of latitude for all of the provinces of Canada with the exception of the province of British Columbia, the Port of Saint John, New Brunswick, and Point Tupper, Nova Scotia. Those areas are covered by the other three ROs.

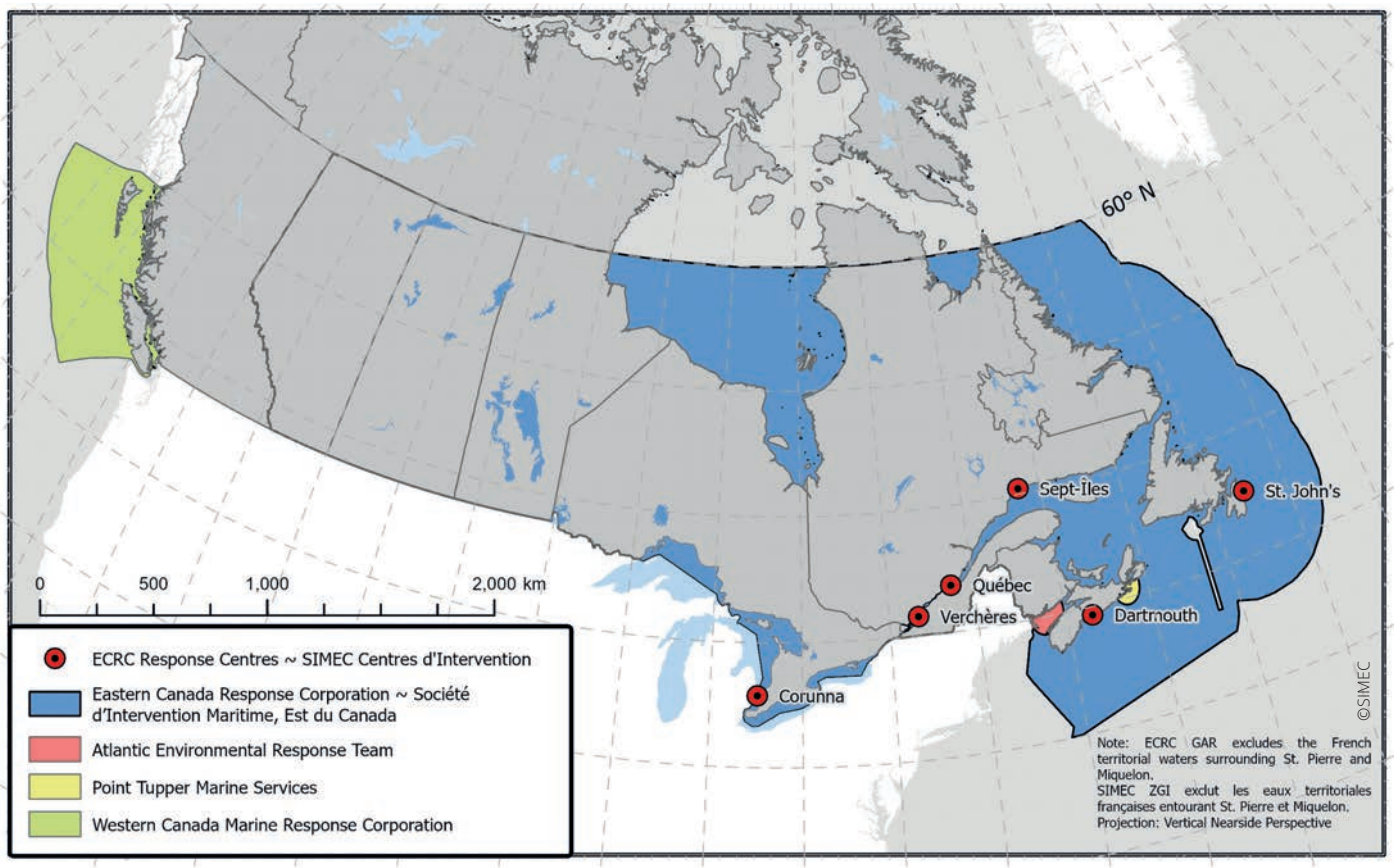
ECRC is headquartered in Ottawa and operates six staffed Response Centres in Corunna, Verchères, Québec, Sept-Îles, Dartmouth, and St. John's. ECRC has 50 full-time employees and more than 500 trained contractors and advisors who are part of the response team.

Health and safety of personnel is the number one priority for ECRC, and a comprehensive Loss Control Program is integrated into all work activities. ECRC provides ongoing training for employees and contractors, and conducts numerous exercises as required under the planning standards and in support of member preparedness activities.

Removal of heavily oiled seaweed on rip-rap shoreline

ECRC maintains a large inventory of specialized response equipment at each of its Response Centres. Most of the equipment is road or air transportable to allow for support cascading capability between Response Centres and to provide effective coverage within its GAR. A rigorous maintenance program helps ensure that equipment is ready for response.

ECRC has established contracts with spill response contractors, consultants, and specialists. ECRC has also established mutual aid support agreements with the two other ROs on Canada's east coast (ALERT – Saint John, NB, and PTMS – Point Tupper, NS) as well as WCMRC in British Columbia. ECRC is also a member of the Global Response Network, a collaboration of major international oil industry funded spill response organizations whose mission is to harness cooperation and maximize the effectiveness of oil spill response services worldwide.



Map of Canada showing the different ECRC Response Centres

Response

Should a member have a spill, they would activate ECRC through a 24-hour emergency number. ECRC's call-out process quickly mobilizes personnel and equipment to the degree necessary to respond to the incident. ECRC uses the Incident Command System as a tool for managing its spill response activities. ECRC acts under the direction of the Incident Commander to provide a plan of action, equipment, resources, and operational management to support the response effort. To date, ECRC has responded to more than 400 spills, covering a wide range of spill sizes, different operating environments, and in all seasons.

Low pressure flushing on oiled shoreline during a winter response

Preparedness

Canada has developed a capable and sustainable oil spill preparedness regime to respond to spills from ships and oil handling facilities that is based upon a rational approach to the predicted risks of oil spills. Aligned with our mission statement, ECRC has sought to provide value-added preparedness services to all of its members and has taken a leadership role in response preparedness within the community at large. The experience that ECRC has gained over the past 28 years is used to support the provision of training to its members, consulting on contingency plan development, and conducting educational workshops for clients.

High pressure-hot water cleaning on rip-rap shoreline

European civil protection exercise DOMINO 2022

A "medicane", a Mediterranean tropical-like cyclone, hits the Bouches-du-Rhône department in Southern France, triggering a chain of major industrial and maritime incidents. Stretched too thin, the French emergency response resources are unable to deal with all of the events. France thus calls on its European counterparts for assistance, with some 1,000 responders being deployed to deal with incidents both on land and at sea. This was the general scenario behind the large-scale DOMINO 2022 exercise in which Cedre participated from 15 to 19 May 2022.

By Nicolas Tamic, Deputy Director, Cedre.

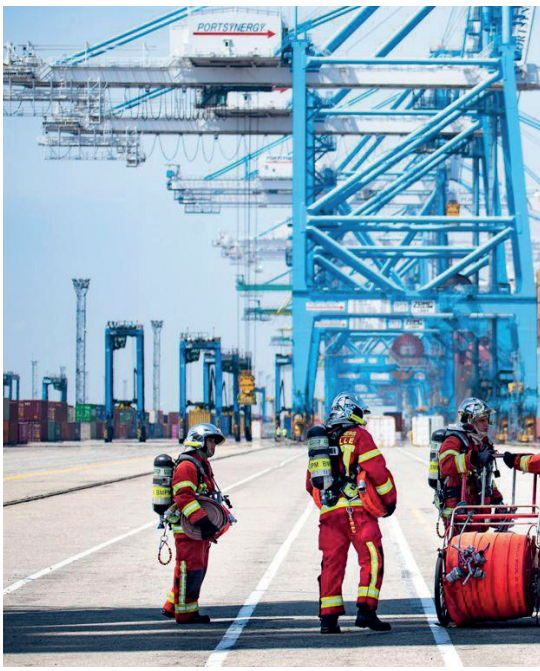
Co-financed by the European Commission, the DOMINO 2022 field exercise was led by the French Ministry of the Interior and involved the German, Austrian, Belgian and Spanish civil protection authorities as well as Entente Valabre, the centre of gravity for training in civil security, research, new technologies and prevention in the field of natural risks. The objectives of the exercise consisted in activating the European Union's Civil Protection Mechanism to integrate operational European modules while ensuring the interoperability of all of the procedures and actions in the field, and all this within a degraded operational context. The new population alert system, FR-Alert, designed to complement the standard sirens, was also tested for the first time during this exercise.

Combined response by Marseille-Fos Port and BMPM resources in the roadstead of Fos-sur-Mer

Contacted in early summer 2021 by the European and International Relations Mission of the Directorate-General for Civil Security and Crisis Management (DGSCGC), Cedre quickly became involved in the design of the exercise, working alongside the Marseille Marine Firefighting Battalion (BMPM) and the Information Centre for the Prevention of Major Risks (Cyprès) in Martigues. The different incident scenarios gradually took shape over nine months, culminating in May in three incidents with a maritime focus.

The first scenario was organised around the Étang de Berre lagoon. It simulated the overflow of a tank in the TotalEnergies biorefinery, located above the lagoon, the bad weather conditions in the region having resulted in the failure of all of the biorefinery's preventive measures and caused a spill of vegetable oil into the lagoon. The second scenario was organised in the roadstead of Fos-sur-Mer and simulated a collision between two vessels, with part of the cargo of one of the vessels being spilt into the sea. Finally, the third scenario was organised on board a container ship docked in the Fos-sur-Mer terminal, with one of its containers transporting a chemical substance which was subject to thermal runaway resulting in a fire.

The scale of the exercise, from both a strategic and an operational/tactical perspective, as well as the significant resources to be deployed, required long-term planning organised through monthly meetings in Valabre under the aegis of the DGSCGC. At the same time, willing industrial partners and shipowners were sought to participate in this exercise, providing their facilities and crisis management teams free of charge. The Marseille-Fos Port, the EUROFOS container terminal and TotalEnergies' La Mède biorefinery immediately responded to the first requests, followed by two regional shipowners well known to Cedre: the Compagnie Fluviale de Transport and Ganaye Environnement. These shipowners provided the exercise organisers with two dummy vessels and their crews.



Deployment of a BMPM team at the EUROFOS container terminal

With regard to the spill response, several state resources were involved. These notably included CROSS MED (Maritime Rescue Coordination Centre of the Mediterranean Sea), the BMPM, the Bouches-du-Rhône Fire and Rescue Service (SDIS), the Support and Assistance Vessel (BSAA) *Pionnier* of the Maritime Prefecture of the Mediterranean Sea, CEPPOL (French Navy Centre of Practical Expertise in Pollution Response), and CAPINAV (Reinforcement Capacity for Interventions on board Vessels). Private sector responders were

City representatives, stakeholders and assessors on the shore of the Étang de Berre

Spain, Germany, Austria and Belgium were deployed at very short notice to reinforce the French resources. The maritime scenarios provided an opportunity to implement all of the European and French operational crisis management procedures. The exercise was also the opportunity for emergency response players to confirm their interoperability and perfect their response techniques, thereby demonstrating their ability to deal with extraordinary events in a coordinated manner. This European exercise proved a success, further demonstrated under real conditions in the summer of 2022 when the EU Civil Protection Mechanism was triggered to respond to the raging forest fires in the south-west of France. ■

also asked to participate. TotalEnergies' Fast Oil Spill Team (FOST) and the company EKKOPOL thus reinforced the state response mechanism, with FOST providing its teams and response resources and EKKOPOL one of its pollution clean-up vessels.

Cedre participated in the exercise by conducting its maritime phases and by deploying a team of engineers in the field to reinforce the crisis management structures. It also coordinated the activities of the drift committee responsible for issuing drift forecasts for the oil slicks at sea.

The exercise took place from 15 to 19 May 2022 in real time. Operational modules from

Coordinated installation of a boom on the Étang de Berre

Example of marine litter sampled on the shoreline of the OSPAR maritime area

An abundance of marine litter on OSPAR area shores

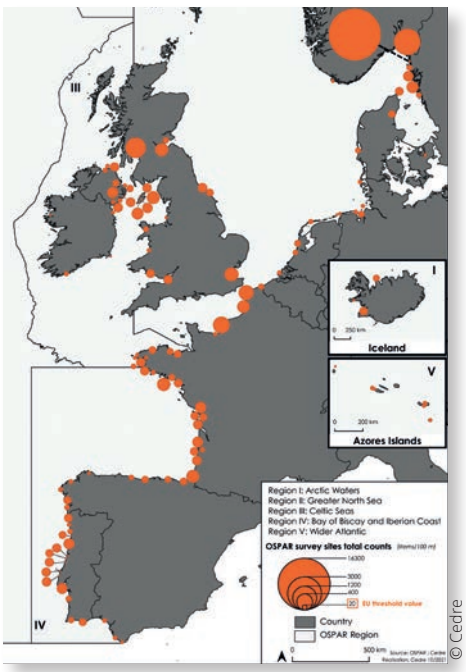
The most recent official assessment of beach litter in the OSPAR maritime area, for which Cedre is lead author, has been published[1]. This assessment confirms that the pollution of beaches by marine litter remains high and that further reduction measures are needed.

By **Camille Lacroix** and **Silvère André**, Aquatic Litter Monitoring and Studies Department, Cedre

Since 2020, Cedre has been leading the Beach Litter Expert Group in charge of implementing the beach litter monitoring programme under the OSPAR Convention[2] . Within this framework, Cedre conducted an assessment of pollution on the North-East Atlantic beaches with the support of Rijkswaterstaat (Netherlands), various experts and the OSPAR Secretariat, on behalf of the Environmental Impact of Human Activities (EIHA) Committee. This work contributed to the preparation of the Quality Status Report 2023 on the marine environment and resources in the OSPAR area.

To do so, monitoring data from 114 sites along the coastlines of 11 countries were analysed to determine the abundance, composition and evolution of beach litter over the period 2015-2020. Based on this work, a beach litter inventory was drawn up and the extent to which the strategic objectives set out by OSPAR have been achieved was assessed.

Following on from this evaluation, OSPAR adopted a new Regional Action Plan for Marine Litter for the period 2022-2030[3]. Under the North-East Atlantic Environment Strategy (2020-2030)[4] adopted by OSPAR, the contracting parties are committed to reducing single-use and maritime-related plastics in the OSPAR area by 50% by 2025 and 75% by 2030. ■



Median abundance of marine litter at OSPAR monitoring sites (2018-2020)

KEY TAKEAWAY FROM THE ASSESSMENT

The quantities of beach litter, predominantly plastics, remain high in the OSPAR Maritime Area. Over the past six years, a decrease in the abundance of total litter and plastics has been observed for the OSPAR Maritime Area and for four OSPAR Regions. To substantially reduce marine litter, current efforts must be continued and additional measures introduced.

[1] *Lacroix, C., André, S., and van Loon, W. 2022. Abundance, Composition and Trends of Beach Litter. In: OSPAR, 2023: The 2023 Quality Status Report for the North-East Atlantic. OSPAR Commission, London.*

[2] *Convention for the Protection of the Marine Environment of the North-East Atlantic.*

[3] *OSPAR's Second Regional Action Plan for the Prevention and Management of Marine Litter in the North-East Atlantic (2022 – 2030). https://www.ospar.org/documents?v=48461*

[4] *Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2030. https://www.ospar.org/site/assets/files/1200/north-east_atlantic_environement_strategy_compiled.pdf*

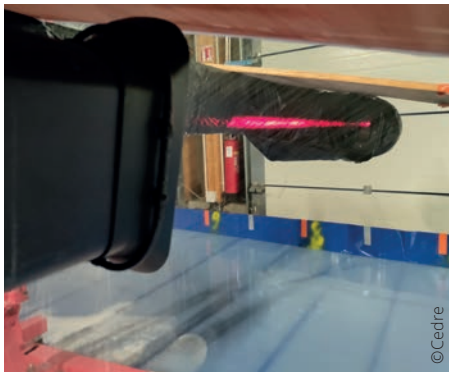
Chemical dispersion

Characterisation of spray plumes generated by single-point nozzle systems

By **Fanny Jouannin**, Analysis and Resources Department engineer, Cedre.

In the event of a spill, the treatment of oil slicks with dispersants is one of the possible at-sea response techniques. When used appropriately, this technique aims to minimise the damage caused by an oil spill by preventing large quantities of oil from reaching coastal habitats and shores (dilution of the pollutant in the environment), and by promoting the natural biodegradation and decomposition of the oil.

As part of its permanent programme for the evaluation of spill response techniques and equipment, in 2022, at the request of its partners, Cedre tested single-point nozzle dispersant spraying systems. These systems are designed to be installed on all types of vessels, including vessels of opportunity, such as tugs, offshore supply vessels and workboats. Whether portable or fixed, single-point nozzle systems are more compact than spray arms or booms, easier to fit and suitable for use in rougher sea conditions.

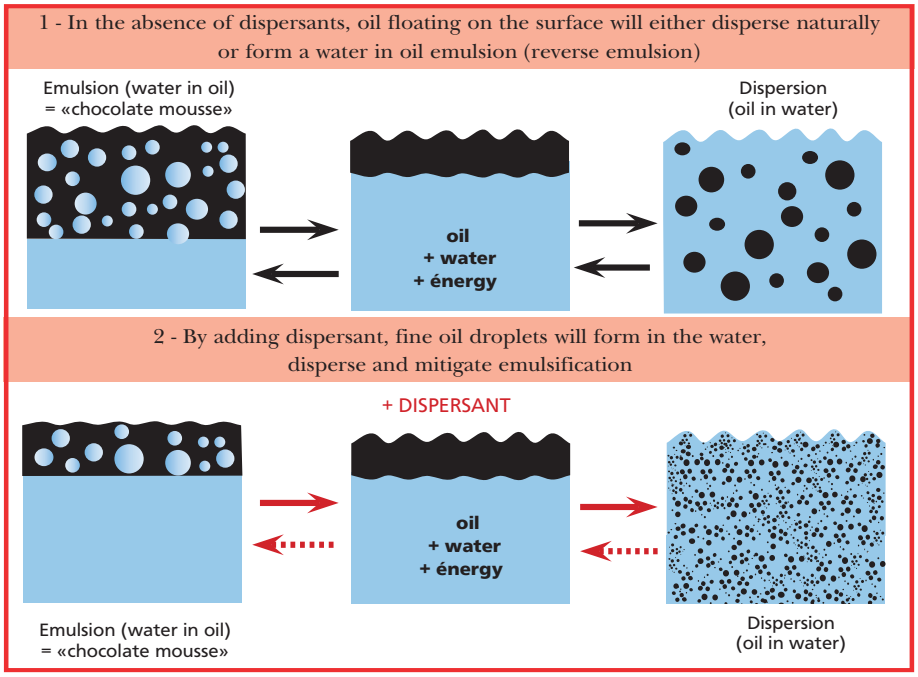


Measuring droplet size in a spray plume using a laser diffraction system

The tests, conducted at Cedre with water and with real dispersant, consisted in characterising the homogeneity of the volumes applied on the ground (deposition study) as well as the droplet size in the plume (measurements made in partnership with Certam*). The advantages and drawbacks of each system were correlated with the recommendations on the use of chemical dispersants.

The results of this study indicate that the use of single-point nozzle systems should only be considered when other spill response strategies, or other specialised dispersant spraying systems such as spray arms, which meet the recommended oil spill response criteria, are not available or feasible. Operators must also take into account the operational constraints associated with their use. ■

Deposition measurements



Dispersion and emulsification of oil in water, with or without dispersant.

SAY WHAT ?

*Certam

Centre Régional d'Innovation et de Transfert Technologique (Regional Centre for Innovation and Technology Transfer), in Rouen

more info
http:// certam.fr

IMAROS European project

The European project IMAROS (Improving response capacities and understanding the environmental impacts of new generation low sulphur MARine fuel Oil Spills, 2020-2022), co-financed by the European Union (DG-ECHO), brought together partners from six countries with a view to gaining a better understanding of very low sulphur fuel oils (ULSFO* and VLSFO*) in order to develop recommendations for operational response in the event of a spill involving this type of oil.

By Fanny Chever, Engineer in the Analysis and Resources Department, Cedre.

The IMAROS project first identified 13 fuels used by ships in Europe. These substances were analysed at a laboratory scale, under temperature conditions representative of Western and Northern Europe (between 5°C and 15°C).

The chemical composition and physical properties of fuels represent essential data for understanding the behaviour of an oil when spilt at sea. Fresh LSFOs* were characterised by their viscosity and density, flash point, pour point, asphaltene and paraffin content, evaporation rate, and detailed chemical composition. Dispersibility tests were conducted at 15°C to assess the effectiveness of this response technique.

Artificially weathered samples were also characterised to assess the potential weathering of these substances at sea. The main finding of this phase was the high variability of the samples, implying different behaviours and response options in the event of a spill. The viscosity of the fresh LSFOs ranged from less than 400 mPa.s* at 15°C to solid substances. Emulsification was also highly variable, related to heterogeneous rheological properties. Pour points ranged from -27°C to +27°C, making it difficult to recover LSFOs with high pour points using conventional skimmers. Persistence in the environment can be expected. Some fresh LSFOs showed a potential for chemical dispersibility, which tended to drop rapidly once the substances had undergone weathering and emulsification. The chemical fingerprints of the samples were determined and the results were integrated into the COSIweb database (bonnagreement.org).

Based on the results of this first phase, three samples were selected for an in-depth study of weathering in the Polludrome®, combined with modelling of their behaviour. The results confirmed the variability in behaviour observed during the first phase of the study.

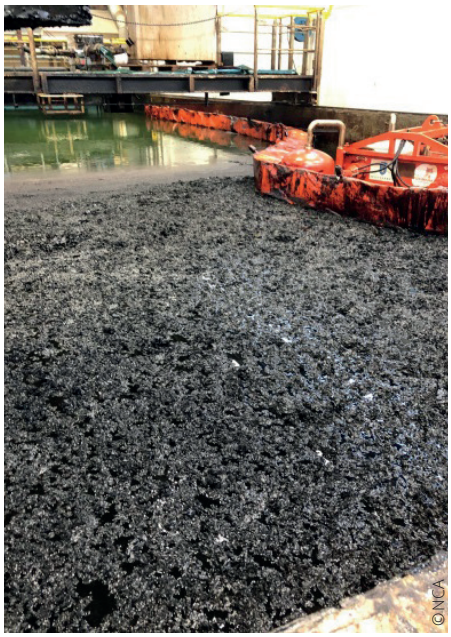
Test of a grooved drum oleophilic skimmer in Cedre's test tank

In accordance with ISO standards and OECD or OSPAR guidelines, ecotoxicity tests were also performed on algae (*Phaeodactylum tricornutum*), copepods (*Acartia tonsa*) and amphipods (*Corophium volutator*). The results of these tests demonstrated the toxicity of LSFOs on amphipods and copepods, but with this toxicity appearing to be within the same range as that observed with traditional bunker fuels.

Penetration of a VLSFO in a slab of granite

Different spill response techniques were then tested on these new substances. Tests on mechanical recovery equipment were conducted by two of the project partners, Cedre and NCA (Norwegian Coastal Administration or Kystverket) in Norway, using different types of skimmers on spills of 1 to 3 m3 of VLSFO in Cedre's and NCA's test tanks. These trials confirmed the challenge posed by certain LSFOs (those with high pour points) in the event of a spill. The use of sorbent booms was tested but proved ineffective. In-situ burning tests were conducted to assess the flammability of these substances, this technique also proving to be relatively ineffective. Finally, shoreline clean-up tests were conducted on a pilot scale within a device designed by Cedre in order to assess the impact of LSFOs on the coastline, notably their adherence to hard substrates and the effectiveness of high-pressure cleaning systems. These tests concluded that substrates can be cleaned, with the exception for some LSFOs of certain rock types (granite and marble) which demonstrated significant absorption.

The IMAROS project has improved our understanding of the environmental risks associated with LSFOs. The results of the project highlight the importance of accurate knowledge of the substance spilt as no general recommendations adapted to all LSFOs exist. Response operations must therefore be systematically adapted to the characteristics of the substance involved. ■



Solidification of a ULSFO with a high pour point after discharge into the NCA test tank

SAY WHAT ?

***LSFO**
Low Sulphur Fuel Oil

***mPa.s**
milliPascal.second
Measurement of dynamic viscosity

***OECD**
Organisation for Economic Co-operation and Development

***OSPAR**
Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic

***ULSFO**
Ultra-Low Sulphur Fuel Oil (less than 0.1%)

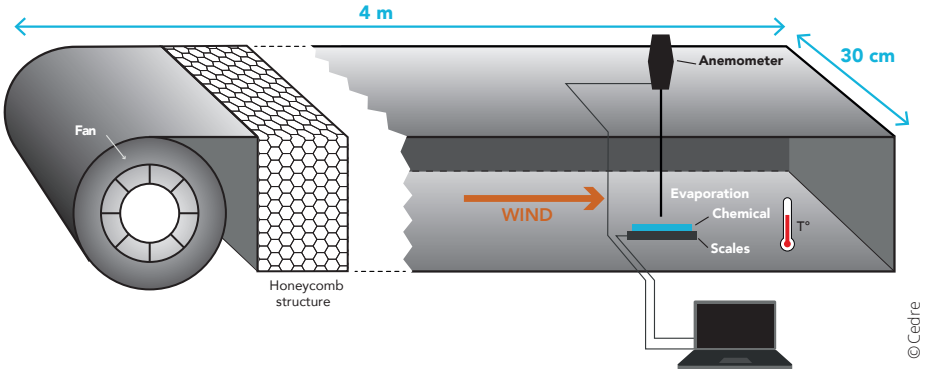
***VLSFO**
Very Low Sulphur Fuel Oil (less than 0.5 %)

From chemical slick to gas cloud, evaporation in the spotlight

MANIFESTS Project

Among the chemicals or HNS (Hazardous and Noxious Substances) transported, volatile and gaseous substances are particularly problematic for the authorities in charge of spill response operations. Their discharge at sea can lead to the formation of clouds of toxic, flammable or explosive gases, sometimes invisible to the naked eye, capable of drifting over large areas within a short time frame. Response operations for pollution events of this nature prove difficult to manage as little data is available to assess the risks to the responders or coastal communities concerned. It is within this context that the European MANIFESTS project, coordinated by Cedre, has been running for almost two years now.

By Laura Cotte, Engineer in the Research Department, Cedre, Laurent Aprin, IMT Mines Alès, and Raphaël Fachinetti, CEPPOL.

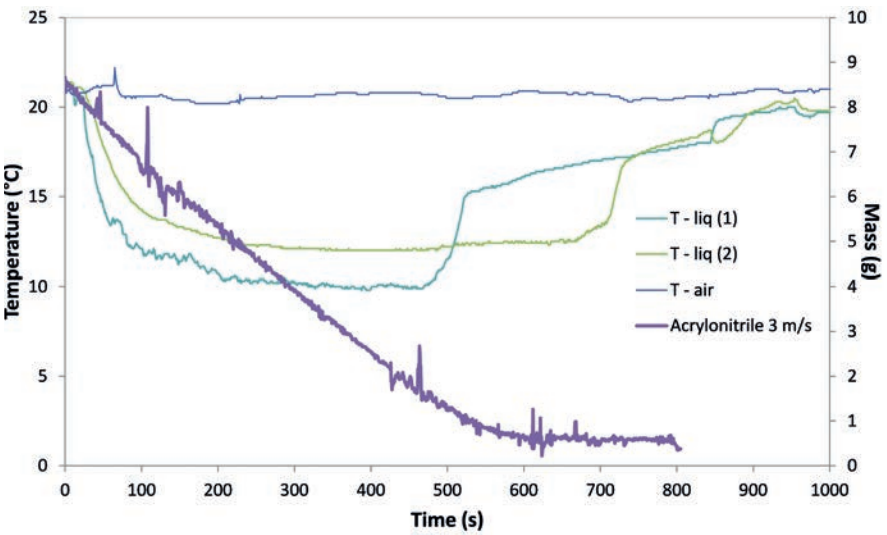


Experimental tool to characterise the effect of wind on the evaporation of chemical substances

Evaporation

The mechanisms involved in the evaporation of a chemical substance at the water surface were studied using a wind tunnel developed by Cedre as part of the MANIFESTS project and with the support of the IMT Mines Alès engineering school. This new experimental tool characterises the impact of wind speed on the evaporation process of volatile organic compounds and calculates the corresponding evaporation rate.

In general, the evaporation rate increases with the wind speed until it reaches a plateau above a given wind speed. This could be explained by the saturation of the air with vapour. Moreover, the evaporation process is systematically marked by a significant drop in the temperature of the liquid, between 10°C and 15°C below the initial temperature. This is a normal phenomenon: evaporation is an endothermic process that absorbs heat from the environment, thereby lowering the ambient temperature. In this specific case, the heat exchange with the environment (air, solar radiation, etc.) was insufficient to compensate for the heat loss. This resulted in a transient drop in the temperature of the liquid, which in turn led to a decrease in vapour pressure and thus in the evaporation kinetics. In the case of cyclohexane, the temperature drop was such that it reached its melting point (6.6°C), with crystals of frozen cyclohexane being observed during the various tests conducted. This phenomenon could also be observed at sea, but would be marked by a lower drop in temperature.



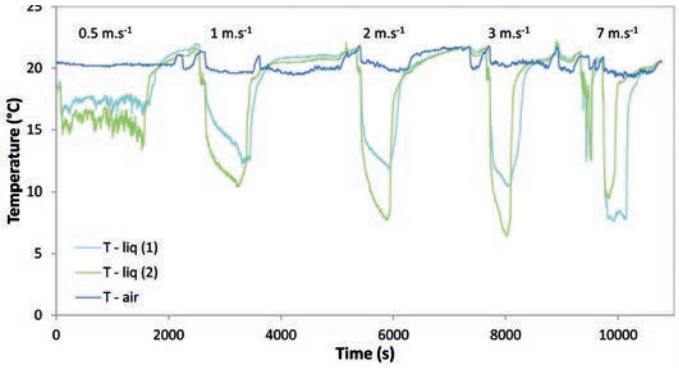
Evaporation of acrylonitrile at 3 m.s-1 and associated air and liquid temperatures

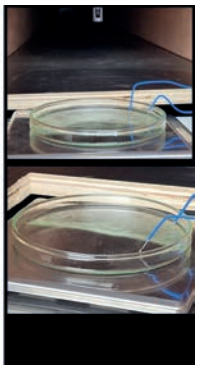
Based on the experiments conducted, the evaporation rate could be calculated using the model developed by Mackay and Matsugu (1973):

$$J = K_G \cdot \frac{P_V \cdot M}{R \cdot T} \text{ with } K_G = 0.0048 U_{wind}^{7/9} \cdot X^{-1/9} \cdot Sc^{-2/3}$$

Where:
K_G = Mass transfer constant [m.s-1]
P_V = Vapour pressure [Pa]
M = Molecular mass of the substance [kg.mol-1]
R: Gas constant [J.mol-1.K-1]
T = Temperature [K]
$U_{(wind)}$ = Wind speed [m.s-1]
X = Diameter of the slick [m]
Sc = Schmidt number

The experimental rates will be used to validate the evaporation model developed within the framework of the MANIFESTS project.





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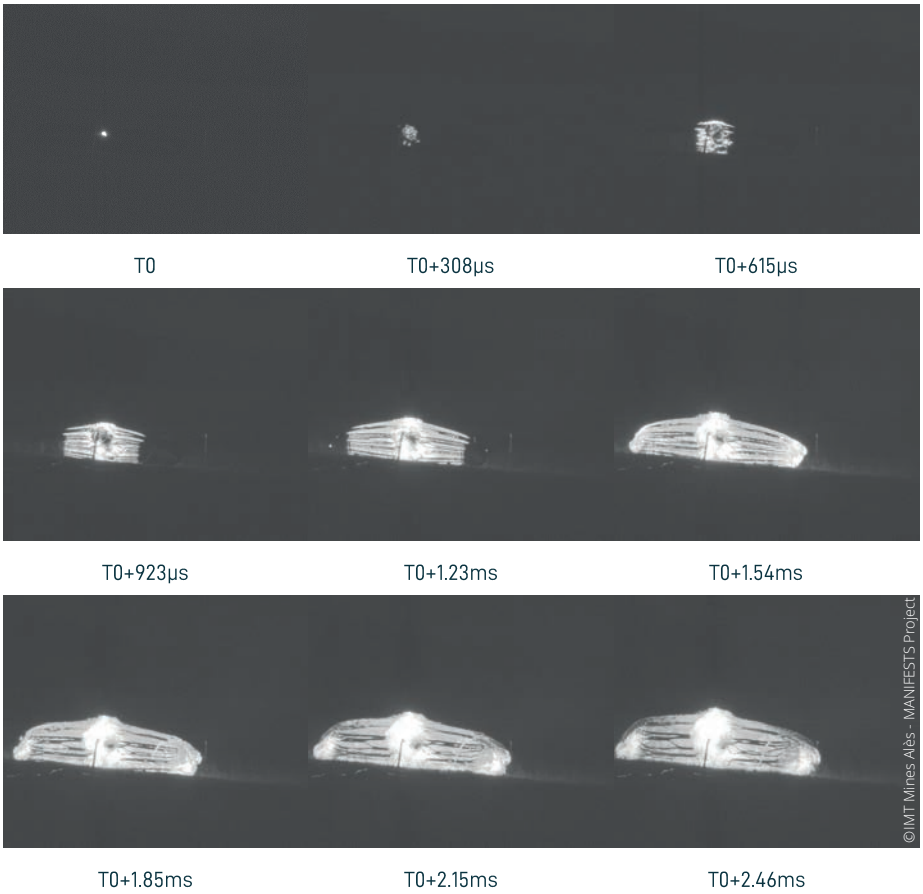
Air and liquid temperatures during the evaporation of cyclohexane at different wind speeds. In the image on the right, cyclohexane crystals can be observed in the Petri dish as the substance begins to freeze



©IMT Mines Alès - MANIFESTS Project

Image sequence obtained using a high-speed camera for the explosion of a 3.8 m³ gas cloud

Explosion

The tests consisted in experimentally studying the consequences of a chemical slick fire or a gas cloud explosion and comparing them with regulatory thresholds and theoretical models.

A first series of tests thus consisted in measuring the radiative heat flows received at different distances from a vegetable oil fire measuring 80 cm in diameter. The radiative heat flux represents the amount of energy emitted by the flames. Ten vegetable oils were tested and the results demonstrated that the models strongly underestimated the experimental values.

The second series of tests assessed the air overpressures resulting from the explosion of a mixture of 3.8 m³ of propane and oxygen. These overpressures represent a sudden increase in ambient pressure and can have serious consequences both for people and for structures and buildings. Despite overpressure values well above the regulatory thresholds, the theoretical models used showed very good correspondence with the experimental data.

These two series of tests clearly demonstrated the need to define safety margins to protect not only spill response personnel but also the populations that could be affected.

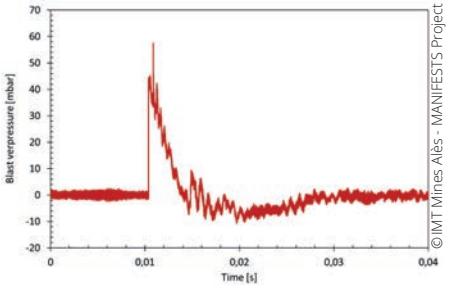
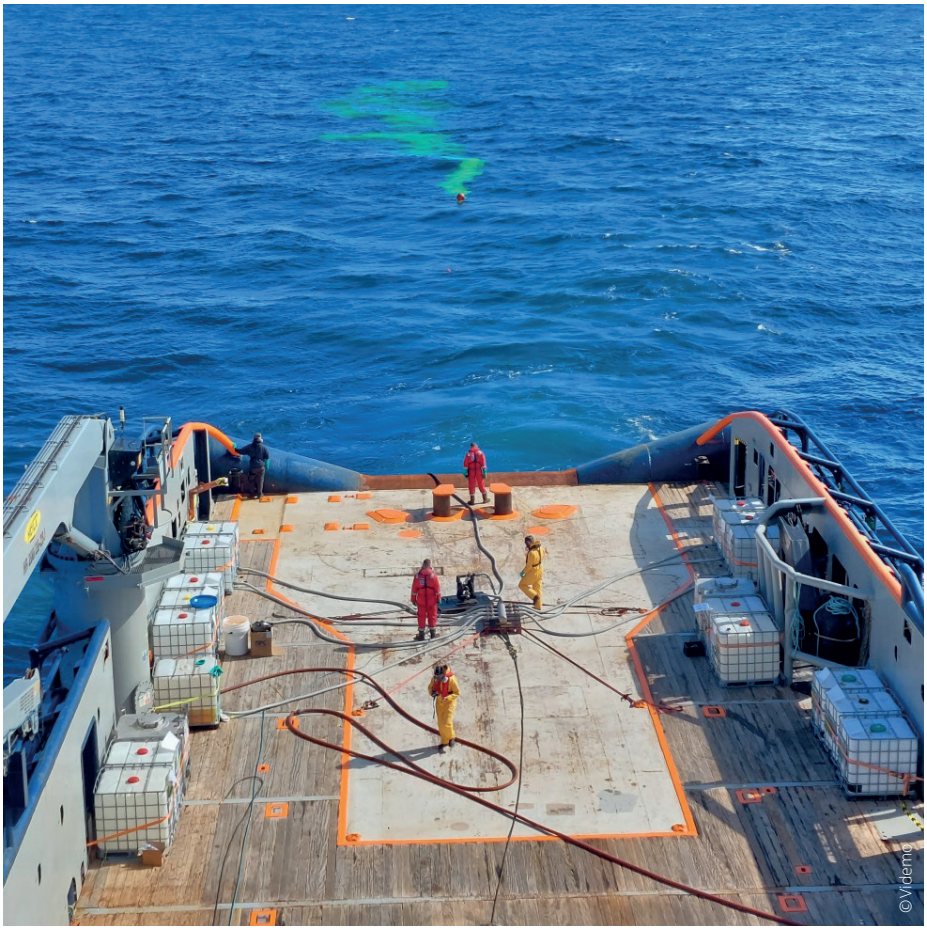


Illustration of the overpressure peak measured for the explosion of a 0.5 m³ cloud of propane gas

Trial in the Atlantic Ocean to improve response capabilities

While experimental data are necessary for improving risk prediction models, sea trials remain essential for establishing or validating the most appropriate response protocols and PPE (Personal Protective Equipment) to guarantee the safety of the responders. For example, when an assessment and response team is sent to a chemical tanker in distress, are the current means adequate for detecting a chemical leak?

Cedre and CEPPOL (French Navy Centre of Practical Expertise in Pollution Response) thus organised a sea trial to test newly-developed onboard and airborne sensors for the detection of gas clouds, and notably the SIMAGAZ and SIGIS 2 multispectral infrared cameras from ONERA and from the Belgian Civil Protection. Organised on an international scale, this trial also included the participation of the Belgian Coast Guard and French Customs. An intercomparison of drift models was conducted by monitoring the drift of a slick of vegetable oil using drifting buoys and aerial observations. The processing of infrared images of controlled chemical spills will also allow the validation of the evaporation model developed within the framework of MANIFESTS. ■



Testing of the spill system via a release of fluorescein upstream of the spills of chemical substances

ABOUT MANIFESTS

MANIFESTS aims to improve the intervention capabilities of oil spill response coordinators through the characterisation of substance evaporation rates and the consequences associated with explosions, the programming of impact models (dispersion, fire and explosion), and the conducting of large-scale testing in the Atlantic.

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Mackay, D., Matsugu, R.S., 1973. Evaporation rates of liquid hydrocarbon spills on land and water. The Canadian Journal of Chemical Engineering 51, 434–439.

more info

www manifests-project.eu

INTERSPILL

By **Stéphane Le Floch**, Research Department Manager, Cedre.

The Interspill conference, part of the cycle of conferences on the issue of oil and chemical pollution (Spillcon in Australia, IOSC in the United States and Interspill in Europe), was held in June 2022 in Amsterdam. More than 50 specialist companies notably presented the latest developments in terms of oil spill response products, materials and equipment. Some aspects of the conference particularly worth mentioning here include the following: the growing market share of organic spill response products (eco-friendly sorbents and washing agents); drones, now used not only for pollutant detection but also for recovery, particularly the recovery of floating solid waste in ports; and virtual reality with, for example, a visit of a merchant navy vessel by the European Maritime Safety Agency (EMSA) and ITOPF simulating an aerial survey designed to distinguish between real pollution and natural phenomena. Located within the French exhibition space, Cedre's stand welcomed many visitors, suggesting good prospects for future partnerships. The high point of Interspill 2022 for Cedre was the organisation and facilitation of scientific workshops presenting and discussing two topical subjects, namely new developments in terms of propulsion capability and the associated challenges, and HNS spills which generate toxic and explosive gas clouds. At Cedre's invitation, IMT Alès, ONERA, INERIS and RBINS contributed their expertise to these discussions. In addition, Cedre gave a dozen plenary conferences covering all of the projects in its Technical Programme with a view to actively communicating about and seeking new partnerships around its various research themes. ■

^ *Cedre's stand at Interspill*

PARTNERSHIP WITH THE ROYAL BELGIAN INSTITUTE OF NATURAL SCIENCES

museum
Royal Belgian Institute of Natural Sciences

By **Stéphane Le Floch**, Research Department Manager, Cedre.

Cedre and the Royal Belgian Institute of Natural Sciences (RBINS) have been working side by side for many years. The nature of this partnership is both operational, such as during the management of the sinking of the chemical tanker *Ece* (2006), and contractual, via their joint involvement in research projects. This partnership was particularly rich in 2022 with, notably, the contribution by RBINS to the MANIFESTS project via its involvement in the development of the Decision Support System, and its participation with the MUMM (Management Unit of the Mathematical Model of the North Sea) aircraft in the experiments conducted at sea (detection of slicks of floating chemicals). RBINS also took part in the scientific workshops organised by Cedre during the Interspill conference. At Cedre's "Aerial Observation" standard training course, RBINS presented its aerial surveillance aircraft equipped with sensors enabling the detection and measurement of gases emitted by ships (implementation of Annex VI of the MARPOL Convention). It is also worth noting the strong collaboration between RBINS and Cedre, as technical advisor to the French delegation, in the work conducted within the context of the Bonn Agreement and in particular as co-convenors of the working group tasked with identifying the priorities in terms of scientific research in the area concerned by the Agreement. Cedre's duty team also regularly use the chemicals database developed as part of the HNS-MS project maintained by RBINS and continuously enriched by Cedre.

Cedre and RBINS are both contributors to the workshops organised by EMSA on the observation and detection of pollutants at sea. Finally, the RBINS management team welcomed Cedre's management team to its offices in Brussels in order to discuss various ways of further strengthening these ties. ■

Members participating in the first feedback sharing workshop at Cedre

Feedback sharing workshop organised by the European Maritime Safety Agency (EMSA)

By **William Giraud**, Engineer in the Research Department, Cedre.

From 13 to 15 September, the first feedback sharing workshop entitled "How to respond to maritime incidents involving HNS transported in bulk (HNS-Bulk)?" was held at Cedre as part of the European Maritime Safety Agency's Technical Correspondence Group on HNS. Coordinated by Cedre, this group is part of the Consultative Technical Group for Marine Pollution Preparedness and Response (CTG MPPR).

The workshop brought together some 20 participants from 14 Member States and two representatives from EMSA. The format of the event allowed for discussions between experts on the topics discussed, including the risks and behaviour of chemicals transported in bulk, the respective roles of the stakeholders in the event of an incident, the relevant sources of information and decision support tools.

During a tabletop exercise, the participants worked in groups to consider all possible options and necessary adaptations in the event of a change in the situation, in order to limit impacts and monitor the marine environment.

One highlight of the workshop was a practical demonstration with the participation of various French organisations, including the firefighters of Brest Naval Base, the Atlantic Bomb Disposal Unit and Ifremer, as well as the Belgian Civil Protection. Cedre's experimental tools and field sensors were also presented. ■

Demonstration of the equipment used by clearance divers from the French Navy's Atlantic Bomb Disposal Unit (GPD) and the procedure for putting on, decontaminating and removing protective suits

Demonstration of the detection equipment and PPE of the marine firefighters from Brest

Chemical spill in Cedre's outdoor test tank, and detection by the Belgian Civil Protection with a detector using infrared spectrometry

DEPARTURE OF GABINO GONZALEZ, HEAD OF OFFICE, REMPEC

By **Arnaud Guéna**, Deputy Director, Cedre.

Mr Gabino Gonzalez left his position as Head of Office of REMPEC (Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea) in December 2022 to become Deputy Coordinator of the Mediterranean Action Plan (United Nations Environment Programme – Barcelona Convention). Cedre worked together with Gabino for 20 years on numerous projects related to oil spill response preparedness.

Indeed, from March 2003 to March 2005, Gabino worked at REMPEITC (Regional Marine Pollution Emergency Information and Training Centre) in Curaçao within the framework of a position funded by the French government and the oil company Total. This is how Gabino and Cedre, notably through our Caribbean delegation based at the time in Martinique, began to work together on oil spill response preparedness projects supported by IMO in various countries in this part of the world.

Gabino then joined OSRL in the summer of 2005, notably to manage the GI WACAF project, our collaboration thus continuing for the benefit of West African countries. In 2006, he moved to Malta to join REMPEC, with which Cedre regularly works, and which Gabino managed from 2015 onwards. Our partnership therefore continued with the organisation of national or regional training courses and workshops in the Mediterranean, the drafting or updating of manuals (Condensates, Gases, Surveys, Waste Management...), the development of information tools, our contribution to joint European projects (POSOW1 and 2, West MOPoCo in recent years), as well as providing assistance to countries dealing with marine pollution within the framework of the Mediterranean Assistance Unit (Greece, Israel, Lebanon).

Many of Cedre's experts have therefore had the opportunity to work with Gabino over the years. Through this article, they express their gratitude for the excellent working relationship they enjoyed with him and the quality of the projects managed together, and they wish him every success in his new position. ■

PARTICIPATION IN THE GOVERNING BODIES OF THE IOPC FUNDS

By **Christophe Logette**, Director of Cedre.

For the first time since 2019, the governing bodies of the International Oil Pollution Compensation Funds (IOPC Funds) were able to hold in-person sessions from 25 to 28 October 2022 at the International Maritime Organization (IMO) headquarters in London. Some 63 Member States of the 1992 Fund, of which 23 Supplementary Fund Member States and 13 observer organisations (including Cedre), participated in the sessions of the 1992 Fund Administrative Council, the 1992 Fund Executive Committee and the Supplementary Fund Assembly. The IOPC Funds are two intergovernmental organisations (the 1992 Fund and the Supplementary Fund) which provide compensation for oil pollution damage resulting from spills of persistent oil from tankers. ■

Cedre at IMO headquarters

OUR ACTIONS WITH ISMI

By **Natalie Monvoisin**, Training and Studies Department Manager at Cedre.

Faced with recurring threats to maritime security in the Gulf of Guinea, the African and international maritime communities have introduced various instruments at regional and international levels. Thus, with the support of key partners such as France, the United States, the European Union and the Maritime Organisation of West and Central Africa (MOWCA), Côte d'Ivoire requested the creation of the Interregional Maritime Security Institute (ISMI) from the Board of Directors of ARSTM (Regional Academy of Marine Science and Technology).

Under its mission to ensure training and the strengthening of the capacities of civilian and military managers from administrations and private entities with maritime expertise or activities, ISMI has included spill response seminars and actions conducted by Cedre as part of its training programme since 2018.

In 2022, ISMI mobilised Cedre for the facilitation of two in-person training courses:

- The first took place in June, on Reunion Island. This four-day IMO 2 level training for spill response operators in the Indian Ocean, supported by French cooperation via the Directorate of Cooperation of Security and Defence (DCSD), also benefited from financial support from the Indian Ocean Commission (IOC) within the framework of a co-financing partnership. In addition, the ISMI organisers and the trainers from Cedre benefited from strong support from local stakeholders. This included the mobilisation of personnel and equipment from the naval base and the POLMAR centre for the preparation of the training, as well as during the practical exercises.
- In October, as part of the project for technical assistance and strengthening of the security and safety of ports in West and Central Africa (WeCAPS project), ISMI, in partnership with the European Commission, organised theoretical and practical training to IMO 2 standards in Abidjan, on the sites of ARSTM and the Autonomous Port of Abidjan (PAA). This training was led by two trainers from Cedre for some 20 port officers, representing 11 countries from the Gulf of Guinea.

A practical exercise was organised in the PAA to set up a complete containment, recovery and storage chain.

Oil containment and recovery exercise

We would like to thank ISMI for their renewed confidence, and we are already beginning to explore further ways of developing our partnership. ■

GI WACAF - BI-ANNUAL

By **Natalie Monvoisin**, Training and Studies Department Manager at Cedre.

Cedre participated in the 9th Regional Conference of the Global Initiative for West, Central and Southern Africa to enhance oil spill preparedness, response and cooperation, organised in Accra, Ghana, from 7 to 10 November 2022. Scheduled to take place at the end of each biennium, this regional conference is a key milestone in the GI WACAF project cycle.

After two years of the COVID-19 pandemic, the event was eagerly anticipated by all of the participants and organisers alike. It aimed to launch the new 2023-2024 project, taking into account the challenges to be met, in particular that of resuming the numerous in-person activities.

Cedre has been supporting this initiative since its creation in 2005, working alongside IMO and Ipieca to help improve the level of oil spill preparedness and response in the countries of West, Central and Southern Africa.

Facilitation of a working group

Within this specific context, Cedre gave a presentation on response preparedness and crisis management, led working groups and facilitated discussions and debates. Furthermore, and with a panel of international experts, Cedre contributed to the establishment of the strategic priorities for the next biennium for the 22 African partner countries of the GI WACAF project.

Finally, this conference was the opportunity for Cedre to work for the first time with the brand new project team: Anaïs Guillou, GI WACAF Project Manager at Ipieca, and Rim Al Amir, Project Coordinator at IMO, who have taken over the helm since May and October 2022, respectively. We wish them fair winds off the coast of this beautiful WACAF region! ■

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  - Behaviour of HNS spilled on water

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NEW ADDITIONS

Offshore wind farms

Aims:

- To obtain key information on: the **regulatory framework**, the **organisation** set up in the event of a pollution incident, the **procedures** to be applied, the **response strategies and techniques** suited to the port environment and to offshore wind farms.

Oil spill response in ports

Aims:

- To be familiar with **response strategies**, **techniques and equipment** that can be used in ports
- To understand how **the overall emergency response organisation** fits together
- To be capable of defining and deploying **appropriate response equipment** in the event of a spill

Shoreline pollution - first responders

Aims:

- To be familiar with the **first-line response measures** to be implemented in the event of a major spill affecting the coastline
- To be capable of taking **initial measures**, particularly with regard to shoreline users
- To learn to **conduct surveys** and **take samples**
- To know how to define **clean-up site organisation rules**, to deploy **protective equipment** and to implement **initial clean-up techniques**

Participation in the 2nd edition of the "Rade Propre" operation in Cherbourg

For the second edition of the "Rade Propre" ("Clean Roadstead") operation organised at the initiative of the Maritime Prefecture for the Channel and North Sea, Cedre was present in Cherbourg on 23 and 24 June 2022. The aim of this event was twofold: to remove the macro-litter accumulated on the bottom of the Cherbourg roadstead, while also bringing to the surface all fishing gear found in prohibited areas or which could pose a danger to navigation. Cedre was thus invited to showcase its activities on aquatic litter alongside SMEL (Synergie Mer Et Littoral) and the Cotentin Agglomeration Community. We notably presented our coordination of the French monitoring programme for beach litter and litter from drainage basins to several entities participating in the operation, including the French Navy and the Departmental Directorate for the Territories and for the Channel. ■

Debris collected during the "Rade Propre" operation

Participation in the 7th edition of the International Marine Debris Conference

From 18 to 23 September 2022, Cedre participated in the 7th edition of the International Marine Debris Conference (IMDC) which was held in Busan, in the Republic of Korea. Organised for the first time outside the United States, this conference series aims to bring together governments, industry, academia, civil society and all relevant stakeholders to address the global problem of marine litter and plastic pollution. Cedre presented its work on the assessment of litter pollution on the beaches of the North-East Atlantic, which it coordinated as part of the preparation of the 2023 Quality Status Report for the OSPAR Maritime Area (see p. 20). ■

Presentation of Cedre's work at IMDC

Annual "Polymères et Océans" and "Plastiques, changement de cap !" meetings

The annual event organised by the "Polymères et Océans" Research Group that studies the fate and impacts of plastic litter in aquatic environments took place in Brest from 27 to 29 June 2022. Cedre was in attendance to present the results of several projects, in particular those obtained through the Interreg OceanWise project on the impact of expanded/extruded polystyrene and its biodegradable alternatives.

Following on from this event, Cedre took part, alongside national stakeholders, in the "Plastiques, changement de cap !" event, organised in Brest on 30 June and 1 July. During this two-day event, Cedre ran a stand presenting its various activities related to the theme of aquatic litter.

In parallel, Cedre contributed to a radio programme produced by the maritime cluster Pôle Mer Bretagne Atlantique in partnership with Ouest-France and Le Marin on the "zero plastic at sea" target, and took part in a panel session on the question of the environmental and health risks related to plastic. ■

By **Silvère André** and **Camille Lacroix**, Aquatic Litter Monitoring and Studies Department, Cedre.

30th anniversary of the Brest International Maritime Festival

The 30th anniversary of the Brest International Maritime Festival was held from 10 to 14 July 2022.

Cedre offered fun and participative family activities on oil, chemicals and aquatic litter to raise awareness about pollution right from a very young age.

Our range of activities and our areas of expertise were also presented to adult visitors.

For this edition, Cedre shared a stand with the teams from LABOCEA and Iodysséus.

Cedre's stand

European Researchers' Night 2022

The 2022 edition of the European Researchers' Night was held on 30 September at Océanopolis in Brest. This 18th edition of the event was organised around the theme "UNEXPECTED". Our laboratory manager and an engineer from the Research Department told stories with unexpected outcomes in the amphitheatre. Examples of "researcher's surprises" were also presented by two other engineers from the Research and the Aquatic Litter Monitoring and Studies departments.

Cedre's stand at Océanopolis in the Brittany exhibition space

As every year, a games-based stand was set up to welcome those curious to discover our different activities.

This very successful 2022 edition marked the end of event-related restrictions of recent years and attendance was high! ■

In-house response training

On 27 and 29 September and on 8 November, all of Cedre's employees attended in-house training on response preparedness. This training included topics on international action and legal frameworks, as well as the spill response organisation in France both at sea and on land. The second day dealt with spill response strategies and techniques.

Briefing prior to the survey exercise on Cedre's artificial beach

Cedre employees in training

The third day presented Cedre's operational procedure in the event of a major crisis, followed by practical exercises with the release of real oil in Cedre's outdoor test tanks. Cedre's personnel were thus able to practise spill survey techniques, recovery on a water body, the use of sorbents, manual recovery and recovery using beach cleaners, the cleaning of riprap using the flushing technique, and the washing of pebbles using impact lances. A unique experience appreciated by all! ■

By **Marion Lavenir**, Information Department, Cedre.

EXCERPT FROM SEA AND SHORELINE TECHNICAL NEWSLETTER #52

Strandings of plastic pellets along the coastline following a loss at sea (*CSAV Trancura*, South Africa)

Significant strandings of plastic pellets were reported by users on the beaches of the Eastern Cape (South Africa) around 20 October 2020, raising questions about a possible resurgence in connection with the *MSC Susanna* spill (Durban area, October 2017). South African Maritime Safety Authority (SAMSA) investigations pointed to the Liberian-flagged *CSAV Trancura*. En route from the Dominican Republic to China, it called at the Port of Ngqura (Gqeberha, South Africa) on 27 August, shortly after the collapse of some of its containers – a number of which were lost overboard. ITOPF, the insurers' expert, reported that SAMSA believed the incident to have occurred on 18 August off Plettenberg Bay (Eastern Cape).

According to SAMSA, the national and local authorities, supported by associations and volunteers, were immediately involved in the initial actions to recover the stranded plastic pellets. Quickly, the implementation and coordination of the clean-up operations were entrusted to SpillTech, mandated by the local P&I representative, to supervise the responders and organise the waste recovery and management chain (establishment of storage facilities, disposal of the plastic pellets, etc.). With technical support from ITOPF, SpillTech conducted surveys from the west of St Helena Bay (about 100 km northwest of Cape Town) to the east of East London (some 900 km east of Cape Town).

The plastic pellets were spread over very large distances, requiring the implementation of clean-up operations between Yzerfontein and the mouth of the Great Kei River, i.e. over a stretch of coastline of approximately 1,000 km including sensitive areas (De Mond Nature Reserve, a UNESCO World Heritage site, and the Sardinia Bay Marine Protected Area).

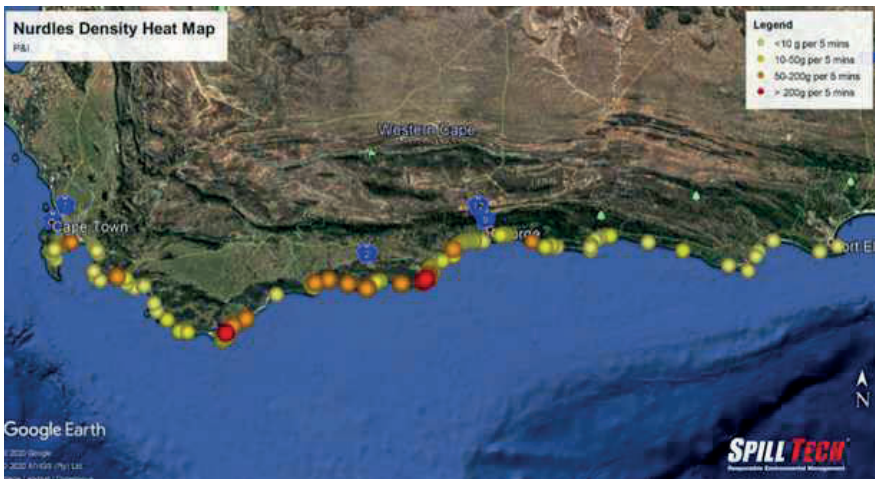
The highest concentrations of plastic pellets were observed on the eastern beaches of Cape Town and Cape Agulhas in Jorgensfontein (the area where the containers are believed to have fallen overboard).

The vessel's P&I Club estimated that 174.5 tonnes of plastic pellets had been spilt into the sea. Analyses of the plastic pellets recovered on shore were conducted in an attempt to identify their source(s) and link them to the cargo transported by the *CSAV Trancura* (no information was found on the findings of these analyses).

By January 2021, in addition to volunteers, 18 teams from SpillTech (totalling 360 responders) were working to recover the plastic pellets on the beaches using mobile vacuum suction units or manually using shovels and screens, in some cases with sink-float separation of the sand and plastic pellets (in buckets of water).

SAMSA indicated that a Joint Operations Committee (led by SAMSA and including representatives of all of the public and private parties involved, to oversee the response), was charged with assessing, during the course of the operations, the need to either continue or stop the clean-up based on the efficiency of the recovery (principle of diminishing returns). As of 15 June 2021, some 30,183 tonnes of plastic pellets had been recovered without any indication of when it would be possible to stop the clean-up operations. ■

Λ Sand screening by SpillTech teams; Screening stations and temporary storage of plastic pellets on tarpaulins



Distribution and density of pellet strandings between Cape Town and Gqeberha

Discover the other topics addressed in Technical Newsletter #52:

- Fuel oil leak following an explosion at a floating power plant (Philippines)
- Ferric chloride spill in the Mediterranean
- Spill of low sulphur fuel oil in a tropical coastal environment (*MV Wakashio* grounding, Mauritius)
- Coastal pollution from a refinery (Venezuela)
- Estuarine pollution following a diesel spill caused by a rail accident (UK)
- Oil tanker fire: major pollution at sea averted (Sri Lanka)
- Review of spills having occurred worldwide in 2020
- Ship-source oil spills tankers in 2020: ITOPF statistics
- Response preparedness/(inter)national strategies
- Oil industry initiatives
- In situ sensing
- Floating waste/debris
- Slick drift and monitoring
- Controlled in situ burning
- Impact

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NEW RECRUITS

Elizabeth Marin

After obtaining a Bachelor's degree in law from the University of Medellín in Colombia, Elizabeth crossed the Atlantic to pursue her academic career in France. She enrolled at Aix-Marseille University where she obtained a first-year Master's degree in public law and a second-year Master's degree in business law. In addition to her academic studies, Elizabeth has held a number of positions as an assistant. She worked for several companies including Cabrio2000 as a sales assistant, SFAM where she joined the team in charge of claims management, and Malakoff Humanis. She then moved to the Brest region and applied to work at Cedre. Since May 2022, Elizabeth has been the trilingual assistant of the Aquatic Litter Monitoring and Studies Department and the Research Department at Cedre. ■

Laura Cotte

After obtaining a Bachelor's degree in chemistry at the University of Nice Sophia Antipolis, Laura specialised in marine chemistry at the Institut Universitaire Européen de la Mer (IUEM) in Plouzané. There she obtained a PhD on the subject of metals present in seawater/deep hydrothermal fluid mixtures (Mid-Atlantic Ridge). This PhD enabled her to acquire skills in analytical techniques for the measurement of trace elements, and in field work thanks to her participation in two one-month oceanographic campaigns on the oceanographic vessel *Pourquoi Pas ?* (Ifremer/Genavir). She also worked for five months in a Croatian laboratory. After graduating, she held a position as European Project Officer at the maritime cluster Pôle Mer Bretagne Atlantique, then as European Project Manager at the Naval Hydrographic and Oceanographic Service (SHOM). In March 2021, she joined Cedre's Research Department where she works on projects relating to chemical pollution. Laura signed a permanent contract with Cedre in September 2022. ■

Thomas Le Bihan

Thomas holds a PhD in molecular and macromolecular chemistry in the treatment of cancers, with a specific focus on radiopharmaceuticals. His thesis, funded by the French association Ligue Contre le Cancer, offered him solid skills in both chemistry and biology. His professional career then took him to Pretoria, South Africa, where he conducted research and animal testing to study the efficacy and toxicity of anti-cancer molecules. Following a prematuration project concerning a start-up company, Thomas joined Cedre's Research team in April 2021 to work on projects aimed at understanding the behaviour and fate of pollutants in the aquatic environment (oil, gases, chemicals) and, by extension, their potential environmental impact (toxicity for aquatic organisms). Thomas signed a permanent contract with Cedre in September 2022. ■

Kevin Tallec

Kevin holds a Master's degree in marine biological sciences with a speciality in Marine Ecosystems, which he obtained at the Institut Universitaire Européen de la Mer (IUEM) in Plouzané. He then completed his PhD in aquatic ecotoxicology on the impacts of micro- and nanoplastics on marine organisms in 2019, again at IUEM. He went on to work for Ifremer as a research officer between July 2020 and December 2021 to assess the impacts of tyre residues on aquatic organisms. In January 2022, he joined Cedre's Aquatic Litter Monitoring and Studies Department as an ecotoxicology engineer in order to work on the impacts of expanded polystyrene, on the characterisation of pollution by meso- and micro-litter along the French coastline, and on pollution resulting from spills of plastic pellets. On 1 January 2023, Kevin signed a permanent contract with Cedre as environmental engineer in the Aquatic Litter Monitoring and Studies Department. ■

Simon Martin

Simon arrived at Cedre in February 2020 to conduct a comparative study of drift prediction models and the behaviour of oil pollutants at sea. Since then, he has performed several missions within the association and has notably contributed to the improvement of the tools developed for the emergency response team and the drift committee. As an environmental engineer with a Master's degree in ecosystem mapping and bioproduction, Simon has gained extensive experience both in France and internationally on a wide variety of habitats and using many different technologies. He also boasts considerable experience in the transmission of knowledge, having held several teaching positions at secondary school and university levels. Simon signed a permanent contract with Cedre on 2 January 2023. ■

NEW HORIZONS

Agnese Diverres

Agnese started her career with an audit firm in Switzerland before joining the agricultural cooperative Coopagri Bretagne - Triskalia, where she worked for 18 years, before moving to the Cogedis firm for 3 years. In June 2018, she joined Cedre's team as Information Department Manager. In this role, she was responsible for coordinating Cedre's information, publication and communication activities. In particular, she oversaw the production of our response guides, the publication of our newsletters and bulletins, the organisation of our annual information day, and the updating of our website and documentary collections. Drawing on her information and communication technology skills, she also managed the introduction of several specialised tools within Cedre's various departments. In July 2022, Agnese decided to leave Cedre to pursue new opportunities. We wish her every happiness in her new ventures. ■

Sylvie Ravailleau

After starting her career at the French Polar Institute to set up the computer network for the oceanographic vessel *Marion Dufresne*, Sylvie was recruited by Cedre, which was based at Ifremer's premises at the time, in July 1995 as IT manager. From 2010, Sylvie's responsibilities shifted towards setting up and using IT tools for the Emergency Response Department (mapping, modelling, databases), then in 2014 towards contingency planning and training (drift forecasts, development of training tools) before, in recent years, supporting the Information Department in the implementation of specific applications. During her 27 years at Cedre, Sylvie supported our different departments through the revolution of IT and digital technologies. In September 2022, Sylvie decided to seize the opportunity to join the Ifremer's IT team in Brest, at a site she knows from the early days of her career! We wish her every success in her new role. ■

NEW PUBLICATIONS

Key information on plastic pellets

This summary document produced by Cedre provides key information on plastic pellets:

- General characteristics
- Transporting plastic pellets
- Releases into the environment
- Properties and impacts
- Shoreline clean-up techniques

A review of Cedre's expertise developed since 2006 in the field of aquatic litter is also available. ■

Scan here to view

Marine HNS Spill Response Manual, french version

This Response Manual was drafted in collaboration with ISPRA and ITOPF, with contributions from the secretariats and member countries of the Bonn Agreement, HELCOM and REMPEC. It provides a review of available information on HNS spill preparedness and response at sea. ■

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www cedre.fr

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