Cedre Information BULLETIN

Feature

Spill in *Sainte-Anne-sur-Brivet*

STUDIES | Oil dispersibility

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EDITORIAL

Diversification and international reach

Cedre is entering a crucial stage in its development and is preparing to rise to a number of key challenges.

The first concerns our team, with the renewal of one third of our staff over a three year period. To turn this challenge into an opportunity, we are seeking to attract and reveal young talents with new skills and fresh energy. We are also making every possible effort to ensure that Cedre's pioneers can pass on their knowledge and experience to the next generation smoothly and efficiently.

The second challenge is that of diversification. Our work in the Ile-de-France area in the wake of major flooding in the spring and in the Loire-Atlantique area following an oil pipeline rupture last May provides an excellent illustration of our spill response expertise in inland waters. These skills have proven to be complementary to our experience in marine spills. Meanwhile, for several years now we have been developing our know-how in the field of hazardous and noxious substances or HNS. Hence we are involved in several national and European research projects on aspects related to the behaviour of HNS spills at sea. This year we also launched a new training course on response to chemical spills in industrial environments and in rivers.

The third challenge lies in our international reach beyond the boundaries of Europe. Asia, which boasts 19 of the world's 25 largest ports and holds over a 57% market share in the chemical industry, would appear to be a potentially high risk area for spills. Africa and Latin America, given their rapid economic growth, also offer interesting medium term development opportunities.

So the coming years are set to be filled with challenges. These challenges will without doubt provide positive opportunities to mobilise and motivate Cedre's team, of which I am proud to be the new captain.

Stéphane Doll,
Director of Cedre

FEATURE

Spill in Sainte-Anne-sur-Brivet

On 5th April 2016, levelling work in the municipality of Sainte-Anne-sur-Brivet in north-western France caused an accidental leak from the pipeline which runs from Donges refinery (Loire-Atlantique) to the storage facility at Vern-sur-Seiche (Ille-et-Vilaine). An estimated 400 m^3 of diesel fuel containing an additive (FAME - Fatty Acid Methyl Ester) was released from the pipeline, affecting a residential area then the natural environment.

Protection system on the stream downstream of the spill

Protecting local inhabitants

The spill started to trickle through the roadside ditches before reaching a stream which flows successively into two ponds surrounded by wetlands. Measures were rapidly implemented by the command centre, which was set up within hours of the spill under the auspices of the local authority (*Préfecture de Loire-Atlantique*), to protect local inhabitants:

- evacuation of the inhabitants of several affected houses along the edge of the road,
- cordoning off of affected area and ban on traffic,
- preventive ban on water consumption (water systems and wells),
- response actions and specific monitoring of the pollution of houses, several wells, gardens and individual sanitation systems (septic tanks, etc.),
- various other response actions immediately implemented at the source of the leak.

Response segmentation

Clean-up sites were set up for three specific types of affected areas: ditches, ponds and surrounding wetlands, and streams.

Ditches

As the incident occurred at the edge of road, the fuel with additive collected in and flowed through several hundred metres of roadside ditches.

In the village, the ditches were drained using vacuum trucks, then scraped out. Further downhill, small accumulations of fuel at the base of vegetation was recovered by pumping. Sorbents and filter barriers were placed in the entire length of ditches, where rinsing and fuel recovery operations were subsequently carried out to compensate for the low rainfall at the time.

Ponds and surrounding wetlands

The largest quantities of fuel collected in the ponds and surrounding wetland areas. At the downstream end of the ponds, large amounts of fuel accumulated along the walls and weirs. In the first few days following the leak, the layer of diesel floating at the surface was several centimetres thick in these areas. It was at these sites that the greatest clean-up efforts, in terms of the workforce and equipment deployed, were concentrated. Alongside the immediate response implemented by the firefighters from Donges refinery and the Loire-Atlantique fire brigade, two specialised companies were contracted on the very first evening to carry out clean-up operations.

During the **initial clean-up phase**, containment, pumping, storage and transfer operations were implemented. The fuel was contained by light-weight floating booms, used in conjunction with manufactured sorbents (mainly skirted booms, standard booms and pads), bunds with transversal pipes and bales of straw. To recover the oil from the banks, weir skimmers connected to diaphragm pumps were initially used. This solution was then replaced by oleophilic skimmers (disc and grooved drum) connected to centrifugal screw pumps, offering a more selective system which was less sensitive to oiled plant debris. This helped to optimise the quantities recovered by only collecting a small proportion of water. In this case, this choice was justified by the difficulties in accessing the banks, which restricted intermediate storage capacities for the collected fuel pending its transfer by floating hoses over long distances to more accessible areas.

Recovery at the downstream collection area

During the final clean-up phase, operations in the ponds were difficult due to the complex morphology of the banks and the dense vegetation (damp woodland, wet grassland, reed beds), in particular with the presence of a remarkable stretch of water horsetail upstream of one of the ponds.

To remobilise the fuel trapped in vegetation on the banks without damaging the environment or potentially burying the fuel, a low pressure rinsing system was set up to flush the fuel towards recovery points in areas of open water. These rinsing operations were carried out either from small boats on the water body using medium pressure jets or from the banks using a sprinkler system (variable droplet size and reach). The arrangement is completed by a low pressure flow at ground level created by

Water level control system and oil containment system at the weir of the first pond

→

perforated pipes. Simultaneously, the flow rate of the stream which irrigates the wetlands surrounding the first pond was increased by pumping water from the pond (100 m^3/h) and reinjecting it further upstream. The residual fuel released by these operations was recovered on the water using skimmers, by trawling and occasionally using water suction systems. In difficult access areas, the fuel was pushed towards the banks by operators in the water, wearing waders and carrying blowers. It was then recovered, or collected using floating sorbents. In a few oiled areas, hard surfaces (pond walls) were manually scraped and oiled vegetation was cut back in places.

Rinsing the grassland and reed beds with sprinkler systems to flush the fuel towards the open water

Streams

Upstream of the ponds, in between them, and downstream towards the River Brivet, many sorbent booms were deployed at the surface of the streams and barriers were built to filter the water column. Makeshift barriers were constructed using wire mesh and loose sorbent or bales of straw. These systems were alternated or reinforced with manufactured sorbent booms and pads. Whether in easy access areas, such as bridges, or difficult access areas such as wooded banks, these installations required very regular maintenance to ensure they remained effective. Meanwhile, oiled plant debris and oily sheen were recovered manually.

Site-related difficulties

The regulation of the water level in the ponds raised a two-fold issue during the first weeks. It was important to:

- prevent overspill of the fuel if the pond were to overflow downstream in the event of heavy rain, by deploying major pumping equipment – four high flow rate centrifugal pumps – and mobilising a duty team around the clock,
- restrict the drop in water level in the ponds to prevent oiling of the banks by prolonging the floating oil recovery phase.

Changes in wind direction meant that several recovery areas had to be set up and containment systems had to be frequently readjusted to prevent recontamination of areas that had already been cleaned.

Protection system on the stream downstream of the spill

Given this fragile environment and the site access difficulties, particular efforts had to be made in terms of traffic channelling and reduction (transport of equipment and movement of personnel), by marking out, building and consolidating pathways (e.g. walkways).

Environmental sensitivity

The ponds, riparian wetlands and streams form a patchwork of environments of ecological interest, justifying the introduction of precautionary measures during the response and influencing technical choices (in particular the implementation of major rinsing operations).

Preliminary surveys of wildlife contamination and mortality (in particular aquatic invertebrates, amphibians, fish and birds), as well as preliminary vegetation surveys, were carried out by the French agency for water and aquatic environments ONEMA throughout the response. A system of perforated hose pipes, supplied with compressed air, was set up to compensate for a potential oxygen depletion.

In terms of vegetation, burns caused by the fuel were seen on the aerial parts of certain plants, in particular horsetail. Yet after a few weeks, new shoots appeared like on other plant species in the reed bed. Spring growth of aquatic plants was also observed. The mortalities recorded were restricted to certain clumps of rushes which had trapped the fuel.

Horsetail regrowth

Horsetail in the summer

Contamination assessment and monitoring

Very soon after the spill occurred, measurement networks were established to assess the degree of contamination of the environment. These measurements were taken in the water (river, ponds and wells) and the sediment, but also in the air at the homes directly affected by the spill. The quality of the drinking water supply was also tested. The tests measured the total hydrocarbon content, the PAH (Polycyclic Aromatic Hydrocarbon) content and the VOC (Volatile Organic Compound) content.

Once response operations had come to completion, this measurement network was supplemented and reinforced to offer a comprehensive post-spill environmental monitoring programme. It aims to assess the spontaneous rehabilitation dynamics of the environment and the different compartments affected: sediment, surface waters (chemical analysis and biological indices), aquatic macroinvertebrates (standardized global biological index), fish populations, amphibians, odonates and birds.

Ivan Calvez, Mikaël Laurent, Florence Poncet,
Ronan Jézéquel and Christophe Rousseau, Cedre

CEDRE'S ROLE

Cedre was called out by the Loire-Atlantique authorities from day one. A rota involving several agents was organised to ensure a continual presence throughout operations to assist government services – in particular ONEMA, the Loire-Atlantique fire brigade, the Regional Environment Directorate – and Total, jointly in charge of coordinating the response, but also the clean-up contractors.
Cedre provided its expertise in terms of surveys, recommendations on implementing the appropriate clean-up techniques and equipment, clean-up site monitoring and advice relating to the area's environmental sensitivity. Sampling and testing programmes were also implemented.
Furthermore, Cedre assisted the municipality of Sainte-Anne-sur-Brivet with its communication and information actions geared towards the local inhabitants.
Within hours of the spill, a chemist from Cedre was sent on site to answer the questions which soon arose on the product, its behaviour and its persistence in the environment. Several on-site missions were then organised to monitor, with figures in hand, the evolution of the water contamination and the behaviour of the fuel.
In addition to the samples regularly taken by Cedre's agents in the field and the analyses performed in our laboratory, two missions were carried out with the use of mobile analytical equipment on site. The first aimed to ascertain the nature of the orange particles in suspension in the water. The second, initiated as soon as the bulk of the fuel had been removed from the ponds, sought to determine the PAH levels in the ponds and streams. The stir bar sorptive extraction (SBSE) technique for PAHs was proven useful for field missions.

Oil dispersibility

Over the past 15 years or so, many studies have upped the oil viscosity limits for dispersant use. A certain number of these conclusions concern products that have undergone little or no weathering, and are therefore less representative of real conditions.

Left, dispersion of a crude oil into fine droplets
Right, rough dispersion of a heavy fuel oil

Context

The pilot-scale experimental systems developed by Cedre (floating microcosms and flume tank) are valuable tools for performing oil dispersibility trials, which may include a pre-treatment weathering period. While microcosm trials appear to be more realistic, they require considerable logistics and are affected by variations in environmental conditions according to the time of year at which they are carried out. The flume tank would appear to be more appropriate as the experimental conditions can more easily be controlled and reproduced.

The possibility of dispersant use can be assessed, from a physico-chemical perspective, according to two criteria:
- the efficiency of the treatment itself, i.e. its capacity to eliminate the oil from the water surface
- the quality of the dispersion, defined by how fine the droplets produced are.

The latter aspect has been the focus of many studies since the *Deepwater Horizon* spill. “Acceptable” efficiency in the case of large droplets can result, in the medium term, in the oil resurfacing and spreading at the surface. Experimental studies should therefore include a characterisation of the physical form of the dispersed oil, a determining factor in the prediction of its behaviour and fate in the water column.

It is with this as a backdrop that Cedre carried out a study to predict the dispersibility of an oil in real conditions from laboratory tests.

Materials and methods

IFP and MNS laboratory tests

Oil dispersibility can be estimated based on various laboratory tests, most of which have been developed as part of dispersant approval procedures.

In France, the procedure applied to conduct IFP tests complies with AFNOR standard NF T 90-345. The specificity of this test lies in the continuous water inflow, causing dilution within the dispersion tank. The energy level, considered low in comparison to other procedures, is generated by the vertical movement of a ring acting as a wave generator.

Experimental set-ups used for the IFP tests (left) and MNS tests (right)

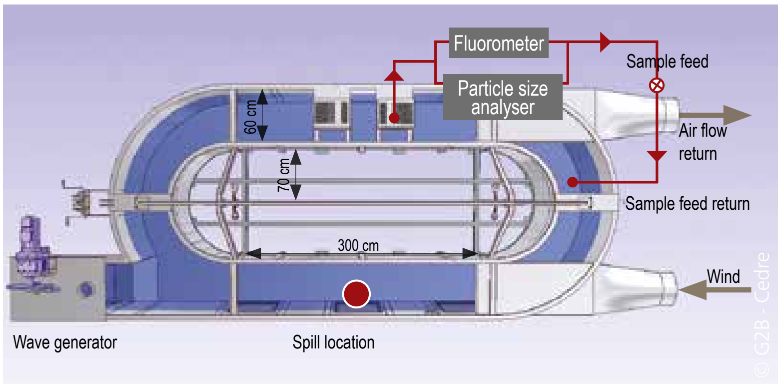
The MNS test protocol, primarily used in Norway, was described by Mackay and Szeto in 1980. The high energy which characterises this set-up is generated by a wave created by a strong air flow. Several levels of energy are described based on various air flow rates.

Flume tests

Pilot scale tests have been conducted in Cedre's flume tank. Two levels of energy – low and high – were tested. This system, designed to carry out oil weathering studies, was altered to conduct dispersibility tests and was fitted with sampling and measurement devices.

The quality of dispersion was assessed by measuring droplet size and their relative distributions. The laser particle size analyser is a Malvern Mastersizer 2000 which determines droplet size distributions in terms of number and volume.

Dispersion efficiency is assessed by spectrofluorimetry by continuously measuring the oil content in the water column.



Flume tank: experimental facility comprising a sampling and measurement system

Oil and dispersant

The oil used was an IFO 220 (Intermediate Fuel Oil with a maximum viscosity of 220 cSt at 50°C). Products with increasing viscosities were obtained by generating emulsions with a 0, 10, 20, 30, 40, 50 and 57 % water content. The method used produces "water-in-oil" emulsions by simulating the energy level generated by wave action.

The dispersant applied for all the tests was Finasol OSR 52 (Total Fluids, France), at a concentration of 5% of the volume of IFO 220 released, whether emulsified or not.

All the tests were carried out in duplicate and at the same temperature (close to 15°C) for each emulsion. The viscosity was controlled with each new sample preparation, adjusting the measurement temperature to that of the water. The results were compared qualitatively and quantitatively.

Results

Relationship between trial conditions and real conditions

Modelling software, into which the characteristics of the IFO 220 were entered, was used to determine correspondences between the different emulsions and the time spent at sea.

Weathering was thus recreated on a pilot scale correlated to a sea state of 2-3 with wind speeds of 10 to 15 knots. This confirms the calibrations performed previously in other studies.

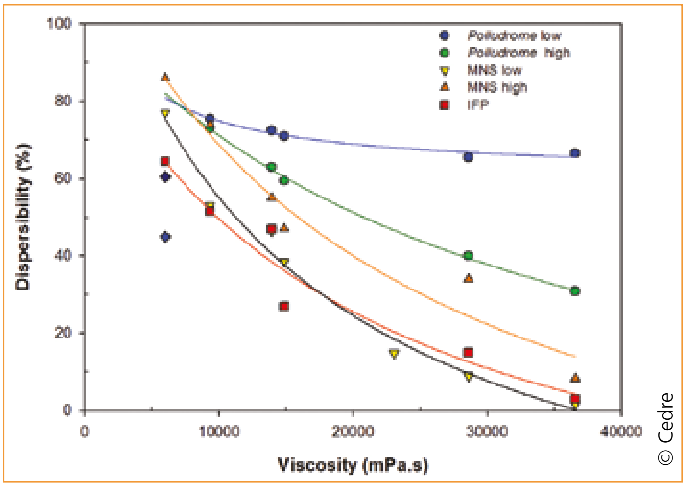
Based on the laboratory samples, a relationship was also demonstrated between the percentages of water and the corresponding viscosities at 15°C. In this way, the experimental conditions were determined for a range of viscosities from 5,000 to 35,000 cSt, between which the dispersibility generally differs considerably.

Dispersion efficiency

The comparison of the dispersant's efficiency according to the oil's viscosity shows that the different laboratory tests lead to similar results.

However, the experiments conducted in the flume tank, which were intended to provide reference values, showed very little difference in the efficiency values. In the case of the high energy level, even although a decrease can be seen for emulsions, all the values remain close to the initial efficiency of 45%. In the case of the low energy level, the values are stable and are situated between 67% and 76% for the full range of viscosities studied.

While these results make it possible to compare laboratory tests, it is not however possible to determine how representative they may be in the case of a real spill, represented here by experimentation in the flume tank, using only on the efficiency values. The droplet size distributions found during the various trials were used to estimate the quality of dispersion.

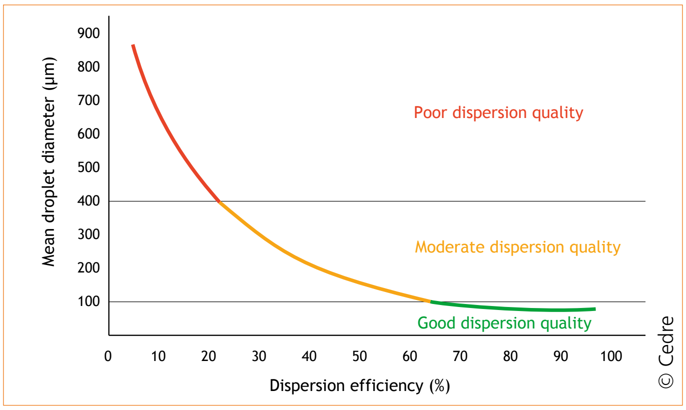


Graph 1: dipersibility according to viscosity

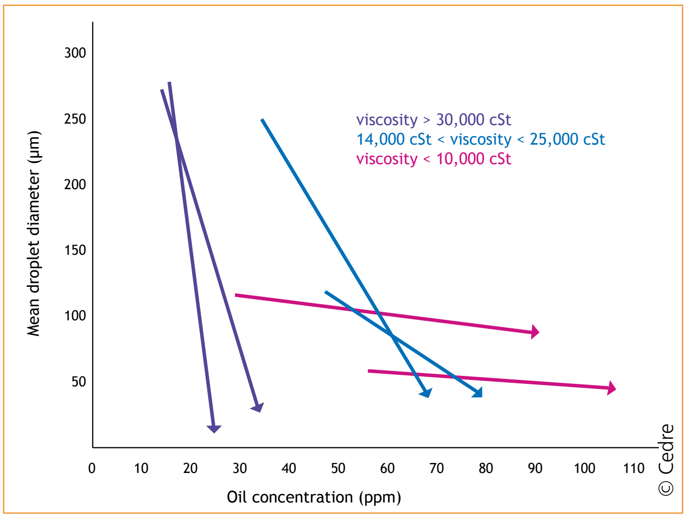
Dispersion quality

The laboratory trials revealed a relationship between the dispersion efficiency and the droplet size distribution generated during the trial. The curve in Graph 2 shows the evolutions observed for the MNS and IFP tests. It indicates that the efficiency threshold values defined in the literature require to be reconsidered. This is particularly the case for the 5% value established for the MNS test which would appear to be too low: poor dispersion quality is generally associated with values below 20%.

In the flume tank, emulsions containing 50 to 57% water (Graph 3, purple arrows) were made up of moderately sized droplets whose size evolved considerably throughout the experiment. Conversely, the 10% emulsion and the non-emulsified IFO 220 (Graph 3, pink arrows) led to low average droplet sizes which evolved little throughout the dispersion phase, as the effect of the dispersant was almost immediate. Between these two opposing behaviours, representing poor and good dispersion, were positioned the other emulsions and therefore the intermediate viscosities (Graph 3, blue arrows). The final size was small, but dispersion was not immediate.



Graph 2: relationship between dispersion efficiency and droplet size distribution



Graph 3: droplet size distribution according to oil concentration

Discussion

While the experiments carried out as part of this study generated considerable quantitative and qualitative data, they also gave rise to a number of questions. The results of the two series of trials in the flume tank carried out with low and high energy levels were contrary to expectations, with the low energy trial showing a better efficiency. What's more, the higher the viscosity of the emulsion – i.e. in theory making it more difficult to disperse – the greater this gap proved to be.

Analysis of the droplet size distribution may provide an explanation for these observations. The more viscous the oil is, the longer the dispersion process will take. With the high energy level, the oil slick is regularly submerged by the waves. The dispersant, which takes longer to take effect on more viscous substances, is therefore washed away before having time to penetrate the slick, hence the lower efficiency. On the other hand, with the low energy level, there is sufficient agitation to disperse the oil, while allowing prolonged contact between the oil and the dispersant before it is washed away.

It is important however to bear in mind the purpose of this study, which was to predict the efficiency of a dispersion operation in real conditions from laboratory test results. Where trials cannot be carried out in real conditions, the flume tank constitutes the "field" reference. The two energy conditions must be considered simultaneously, as they represent the range of sea states compatible with dispersant application operations.

Over and above the legitimate doubts about how representative they may be of real conditions, the definition of efficiency threshold values remains a fundamental question. We can consider that a dispersion operation should only be carried out if it will treat the entire spill, in order to prevent the difficulties raised by partially dispersed slicks which remain fragmented at the surface, affecting an even larger stretch of shoreline.

By adopting this approach, the dispersions characterised in this study were divided into three categories, labelled good, uncertain and poor. This categorisation combined both the absolute efficiency value and an effect related to the agitation time required to reduce the droplet size. This approach provided a better interpretation of the results obtained at laboratory scale and put them into perspective.

Conclusion

Given the results obtained, and in particular the comparisons between the different scales and types of tests, it would appear that new threshold values could be defined for the IFP and MNS tests. These values are close to those previously estimated at Cedre for the IFP test, but call into question the threshold found in the literature for the MNS test (15% in our case compared to 5%).

These results concur with the viscosity limits generally accepted for dispersant application in the case of asphaltenic oils. Emulsions with a viscosity below 10,000 - 12,000 cSt are efficiently dispersed, while uncertainty remains for the range 14,000 – 25,000 cSt. For higher viscosities, dispersant application is not recommended.

Water content	Viscosity (cSt)	Dispersion quality
0 %	6,000	Good
10 %	9,300	
20 %	14,000	Uncertain
30 %	15,000	
40 %	23,000	
50 %	28,500	Poor
57 %	36,500	

Future prospects

This study highlighted trends which call for confirmation, or further investigation, in at least three respects.

The efficiency of the flume tank does not appear to be directly related to the level of energy simulated. Experiments including at least two additional energy levels should be carried out: one intermediate level between the two levels already defined and one below the lowest level.

The range of viscosities obtained during this trial correlates to a single product, asphaltenic in nature, emulsified to different degrees, i.e. with different water contents. Further studies should cover a wider range of oil types (in particular including naphthenic or paraffinic oils) with different initial viscosities, while emulsification will, like in our experiment, provide a greater variety of products to be tested.

Trials in real conditions combining measurements in the water column (ideally concentration and droplet size measurements) and the use of sensors (to characterise surface slicks) would lead to a better estimation of the representativeness of the laboratory and flume tests. Such trials at sea should prioritise the control and number of conditions over the volume of oil released.

Julien Guyomarch (Cedre)

PARTNERSHIP

POSOW II

development of train-the-trainer materials and courses on oil spill response in the Mediterranean

The project POSOW II (Preparedness for Oil-polluted Shoreline cleanup and Oiled Wildlife interventions) began on 1st January 2015 and was a sequel to POSOW I which ran in 2012 and 2013. It focused on the production of manuals and training materials to improve spill preparedness in the Mediterranean region.

Partners and aims

Funded by the European Commission's Humanitarian Aid and Civil Protection department (DG ECHO) and coordinated by Cedre, this two-year project also involved REMPEC (Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea, Malta), ISPRA (*Istituto Superiore per la Protezione e la Ricerca Ambientale*, Italy), FEPORTS (*Instituto Portuario de Estudios y Cooperacion de la Comunidad Valenciana*, Spain), AASTMT (Arab Academy for Science, Technology and Maritime Transport, Egypt) and DG-MARINWA (General Directorate of Maritime and Inland Waters, Turkey). The main aim was to reinforce the knowledge and skills of volunteers involved in spill response in the Mediterranean area, by developing training materials and manuals and by running training courses.

Developing training materials

Following the issues of volunteer management, oiled shoreline assessment, oiled shoreline clean-up and oiled wildlife response addressed in POSOW I, this follow-up project covered the themes of waste management and assistance to fishermen involved in response on water. These two themes were the focus of manuals, posters, slideshows and train-the-trainer manuals, produced in English by Cedre and FEPORTS respectively. In total, six train-the-trainer and field manuals have been produced, along with 16 posters and 17 slideshows which can be downloaded free of charge from the website posow.org for training in English.

Examples of the materials produced through the POSOW project: manuals and posters

POSOW project partners

Train-the-trainer courses

These materials were used during two train-the-trainer courses held at Cedre as part of POSOW II, from 19th to 22nd April, then from 26th to 29th April 2016, with support from all the partners. During these four-day practical courses, 32 future trainers from the project's seven target countries (Algeria, Egypt, Lebanon, Libya, Morocco, Tunisia and Turkey) were trained. Two Portuguese trainers who are keen to use the POSOW materials to run sessions in their home country also attended the course, with permission from the European Union.

During these train-the-trainer courses, the six themes addressed in POSOW I and II were presented using the slideshows and posters developed during these projects as well as through practical sessions with the release of real oil at Cedre's technical facilities. In addition to the spill response sessions, a module on the basic training rules and comprising role play exercises was also run.

All the participants were given all the training materials produced to reinforce their knowledge which they were then in turn able to apply to train teams of volunteers in their own countries during national pilot training courses held during the last quarter of 2016.

Train-the-trainer course, Brest

Training materials translated

To facilitate the understanding of their content by the trainee volunteers, the training materials developed were translated into the languages of the POSOW target countries. During POSOW I, only the slideshows and posters were translated into Croatian, Spanish, French, Greek, Italian and Slovenian. During POSOW II, all the materials developed throughout the two project phases were translated into Arabic and Turkish by AASTMT and DG-MARINWA.

An example of a poster in Turkish and a manual cover in Arabic

National pilot training courses

During POSOW I, nine national training courses were organised and 252 volunteers trained. Following on from this, some of the people trained at Cedre ran national sessions in their home countries. An additional 150 volunteers were trained in the Mediterranean region during these sessions.

Training in Italy

Volunteer database

During POSOW I, a database was designed and developed. The 276 people trained from the eight target countries in the original project were recorded. This database was updated for those trained during POSOW II.

For further information and free downloads of the many training materials developed during the projects POSOW I and II, please visit the website **posow.org**.

Arnaud Guéna, Cedre

MARINER

a DG ECHO project on chemical spills

Context

Like for POSOW II discussed in the previous pages, the MARINER project (Enhancing HNS preparedness through training and exercising) is funded by the European Union's civil protection mechanism DG ECHO for a two year period. Launched at the beginning of 2016, it is coordinated by CETMAR (*Centro Tecnológico del Mar*) in Spain. This project also involves the Spanish partners INTECMAR (*Instituto tecnológico para el control del medio mariño de Galicia*) and the University of Vigo, the Portuguese partners Action Modulers and CIIMAR (*Centro Interdisciplinar de Investigação Marinha e Ambiental*) and an English partner, PHE (Public Health England).

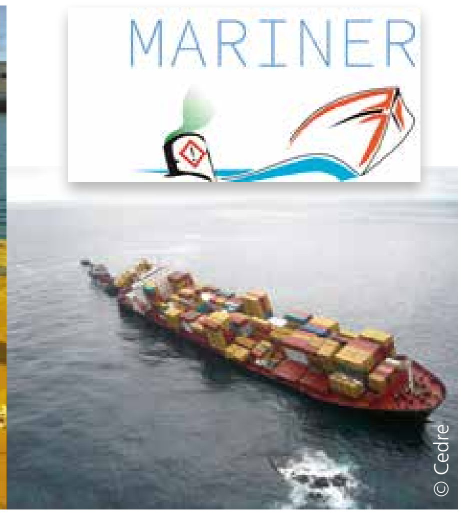
Cedre's actions

Cedre is particularly involved in collecting data on response techniques and equipment, in preparing training and exercise materials as well as in running test training courses on response to hazardous and noxious substances spills.

In early 2016, in addition to attending the project kick-off meeting on 23rd February at CETMAR in Vigo, Cedre was involved in preparing materials to present and promote the project, in particular the website mariner-project.eu. The teams also organised meetings with various private and public stakeholders involved in managing chemical spills in France and abroad to collect the information required to define the content of the course lectures and exercises. A summary was drafted in order to prepare the training materials during the first half of 2017. These materials will then be used in the second half of the year during courses and exercises with a view to adjusting them, where necessary, before their publication in late 2017.

Latest meetings

On 9th October 2016, a second meeting of the project's steering committee was held in Cardiff and brought together all the project partners to review the progress of each of the tasks since kick-off and to organise the work over the coming months. The following day, a meeting was held on the development of the training materials and modelling tools. The first deliverables are due to be available soon at mariner-project.eu.



A summer plunged in the marine sciences

On the theme "Ocean and climates"

From 13th to 19th July 2016, Brest hosted one of the world's largest maritime festivals, held every four years. Both on and offshore, the crowds were delighted by the tall ships, exotic boats and leisure yachts on display. Marine sciences and technologies were in the limelight in an area dubbed "Quai des sciences". Over 40 academic and industrial organisations from western France were present to offer visitors a fun and educational experience on the theme of "Ocean and climates".

Models and explanations

Cedre's team took an active part in this event. Several models were on display to present the one-of-a-kind equipment we develop to study the behaviour of products spilt at sea. A workshop was run to explain how dispersants work and to outline the rules governing their use. It also provided the opportunity to present a research project currently in progress at Cedre on the influence of hypoxia and oil exposure on sea bass.

Young visitors at Cedre's stand at the "Quai des sciences" exhibition

A receptive audience

The feedback from visitors was very positive as this was an excellent opportunity for them to interact directly with spill response specialists. The *Amoco Cadiz*, *Erika* and *Prestige* are still engraved in people's minds and many visitors expressed their satisfaction in knowing that teams were actively working on this issue on a daily basis.

The "Quai des sciences" exhibitors from 40 academic and industrial organisations based in western France

New recruits

Stéphane Doll

With a dual qualification as a naval officer and an engineer, Stéphane Doll embarked upon a maritime career. In 1982 he joined the French Naval Hydrographic and Oceanographic Service (SHOM), where he worked on a range of missions in mainland France and its overseas territories as a hydrographer, operations officer then commanding officer. Stéphane later became involved in teaching in a number of establishments and also took command of several ships. As commanding officer of the French Navy supply tug *Rari*, he was in charge of oil removal operations from the wreck of the *Erika*. In 2002, Stéphane was appointed Deputy Director of CEPPOL (French Navy Centre of Practical Expertise in Pollution Response) and was in charge of the centre's operations, finances and personnel. In 2008, he joined the shipbuilding and repair group Piriou based in Concarneau, where he was in charge of ship maintenance then later commercial operations and sales. He became Director of Cedre in March 2016.

Mélusine Gaillard

Mélusine has a dual academic background with a PhD in marine microbiology and a master's degree in scientific mediation. From 2008 to 2015, she occupied various communication positions, in particular in the pharmaceutical and agri-food industries. In 2009 and 2010, she worked in Cedre's Information and Documentation Department on the development of a learning guide on chemical spills at sea, a project carried out together with Transport Canada. In 2016, she was recruited as Cedre's Information Department Manager.

Justine Receveur

After studying chemistry at the University Institute of Technology in Rennes, Justine went on to earn a master's degree in strategy and quality in analytical chemistry from IUP Orléans. In 2011, as a new graduate, she first joined Cedre's R&D team. For almost five years, she came and went according to the projects in progress and was trained in all the techniques used in the laboratory. In 2016, she became a permanent member of the Analysis and Resources Department. Her field of work has expanded to cover the analysis of compounds dissolved in water such as Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs) and pesticides.

In-house promotions

Arnaud Guéna

With a master's degree in the ecology of aquatic systems under his belt, Arnaud arrived at Cedre in November 1996 for a 10-month period of environmental military service. He returned to Cedre in 1998 for a work placement to complete his university studies and was recruited by the Training Department in February 1999. In 2001, he climbed the ranks and became Training Department Manager. His responsibilities were expanded in 2014 to cover contingency planning. In July 2016, Arnaud was promoted to Deputy Director. He is also responsible for overseeing production at Cedre.

Natalie Monvoisin

After graduating as an engineer in industrial environmental engineering from EME (*Ecole des Métiers de l'Environnement*), Natalie was recruited by Cedre in 2003, just after the sinking of the *Prestige*. She joined the Emergency Response team and earned her stripes in the field. In 2004, she was sent to work abroad, in Hungary, as part of a European project and went on to land a permanent position as an engineer in charge of conducting studies and producing spill contingency plans. In addition to her regular involvement in organising and running training courses, Natalie became a duty officer in 2009. In 2016, she was promoted to Studies and Training Department Manager.

New horizons...

Fanch Cabioc'h

A chemical engineer specialised in oil drilling and the chemical industry, with a PhD in social anthropology and history, Fanch Cabioc'h held technical and commercial responsibilities in the oil industry for over ten years across many countries in Europe, Africa and the Middle East.

He joined Cedre in 1989 within the R&D team. He demonstrated a particular interest in experimentation at sea on oil, the question of oil burning and the issue of containers lost at sea.

In 2000, at the onset of a series of major spills, he was promoted to Emergency Response Department Manager. His main field of activity focused on the risks relating to hazardous substances. For 15 years, he coordinated the emergency duty team and call-outs to spills in France and abroad. In this capacity, he was the key correspondent for the maritime authorities, research institutes such as INERIS, national bodies such as Météo-France and French Customs, international administrations such as EMSA, as well as private sector organisations such as UIC and CEFIC.

As a high-level sportsman, horse rider, diver, aikido master (6th dan) with a passion for Breton culture, Fanch now has plenty of spare time to devote to his pursuits on his native Crozon Peninsula.

Gilbert Le Lann

After graduating from the *Ecole Polytechnique* and the ENSTA school of engineering, Gilbert Le Lann began his career in Brest. After experience in French navy dockyards and EPSHOM IT centre he moved (in early 1990) to Brussels where he worked for the NATO International Staff for over ten years. He had an advisory and administrative role covering the fields of navigation, identification, geographical information and telecommunications. From 2000 to 2005, he was Deputy Director then Director of an assessment and trial centre for military terrestrial equipment of the French Defense Ministry. In 2005, he joined the General Secretariat for the Sea where he came to know of Cedre, of which he went on to become Director from 2008 to 2016.

During his time at Cedre, certain key events for the association took place: a cut in the State subsidy, a change of president, a fire in the laboratory and a drop in oil prices. The centre was called out many accidents in France and abroad. In June 2015, Gilbert travelled to Oslo to receive a Green Star Award, one of the highest international distinctions in the field of environmental emergencies, on behalf of Cedre. Gilbert likes to organise and plan ahead. He led a number of major undertakings including an internal reorganisation to optimise the running of the organisation and to prepare for the forthcoming retirement of a third of Cedre's team. An engineer at heart, he earned the respect of his staff through his knowledge and integrity.

In the new life on which he now embarks, he will be able to travel with his wife, spend time doing DIY and gardening, bring out is diodes and printed circuit boards and get back into electronics and, who knows, maybe even find his dream Chevrolet Corvette...

Bespoke training courses tailored to your needs!

Cedre offers bespoke training courses with tailor-made content in French, English or Spanish. They can take place at our unparalleled facilities where real oil can be released or at a site of your choice to offer a course that is perfectly suited to your facilities, tools and equipment.

2017 standard training courses

AERIAL OBSERVATION OF POLLUTION AT SEA

Intended for air crews (Navy, Customs, etc.), personnel from administrations, private sector personnel in charge of aerial surveillance

1 to 3 days
At Cedre in Brest (France)

MARINE POLLUTION CRISIS MANAGEMENT

Intended for naval officers, personnel involved in emergency crisis management both at sea and on the shoreline, shipping personnel

4 days
At Cedre in Brest (France)

WITH REAL OIL

OIL SPILL RESPONSE AT SEA AND ON THE SHORELINE

Intended for personnel from administrations and local governments, oil industry personnel, shipping company personnel

4 days
At Cedre in Brest (France)

WITH REAL OIL

OIL SPILL RESPONSE IN INLAND WATERS

Intended for fire-fighters and rescue services, personnel from the water police, waterway services and river transport companies, port authorities, administrations and local governments, private response teams

4 days
At Cedre in Brest (France)

PRINCIPLES OF CHEMICAL SPILL RESPONSE AT SEA

Intended for response and management teams of the maritime authorities, personnel from administrations and local governments, fire-fighters and rescue services, port authorities

3 days
At Cedre in Brest (France)

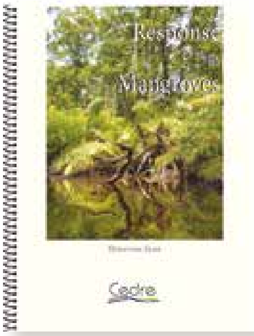
SHORELINE POLLUTION CRISIS MANAGEMENT

Intended for fire-fighters and rescue services, administrations and local governments

4 days
At Cedre in Brest (France)

MORE INFORMATION

See www.cedre.fr, Training section

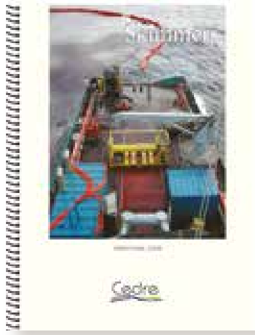


→ Hot off the press!

Response in Mangroves

2017, 93 p.

An oil spill in a mangrove can have detrimental effects whose intensity and duration will vary according to a number of factors. This guide presents the main aspects to be considered for response or to decide not to respond. The specificities of mangroves as well as those of the oil spilt in the environment are addressed. The broad principles of response are outlined and the guide also includes practical datasheets.



→ Hot off the press!

Skimmers

2017, 93 p.

This guide deals with skimmers for floating pollutants specifically designed to meet spill response needs.
It also strives to provide an overview of the main types of equipment available in spill response stockpiles and on the market. It also covers the related ancillary means, in particular pumping and storage equipment, which is required to ensure efficient recovery.

Operational guides

- Management of Volunteers in Coastal Pollution Response (2012), 52 p.
- Involvement of Sea Professionals in Spill Response (2012), 100 p.
- Local Authorities' Guide: What to do in the event of a spill (2012), 76 p.
- Custom-Made Spill Response Barriers (2012), 88 p.
- Manufactured Spill Response Booms (2012), 95 p.
- Use of Sorbents for Spill Response (2009), 52 p.
- Response to Small-Scale Pollution in Ports and Harbours (2007), 49 p.
- Surveying Sites Polluted by Oil (2006), 41 p.
- Using dispersant to treat oil slicks at sea (2005), 54 p.
- Aerial Observation of Oil Pollution at Sea (2004), 60 p.
- Oil Spill Waste Management (2004), 65 p.
- Vegetable Oil Spills at Sea (2004), 34 p.
- Containers and packages lost at sea (2001), 82 p.

Chemical Response Guides

- Ammonia, 68 p.
- Benzene, 56 p.
- Chloroform, 44 p.
- 1,2-Dichloroethane, 60 p.
- Dimethyl disulphide, 54 p.
- Ethyl acrylate, 48 p.
- Gasoline, 56 p.
- Methyl Ethyl Ketone, 70 p.
- Methyl Methacrylate, 72 p.
- Phosphoric acid, 76 p.
- Sodium hydroxide 50% solution, 56 p.
- Styrene, 62 p.
- Sulphuric acid, 64 p.
- Vinyl chloride, 50 p.
- Xylene, 69 p.

Learning guides

Understanding Chemical Pollution at Sea
Learning guide - 2012, 93 p.

Understanding Black Tides
Learning guide - 2007, 118 p.

MORE INFORMATION

See www.cedre.fr, Resources section
To order these documents, please email us at documentation@cedre.fr

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