ABSTRACT

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Improving response capacities and understanding the environmental impacts of new generation low sulphur MARine fuel Oil Spills (IMAROS)

Fanny Chever[1], Silje Berger[2], Kathrine Idas[2], Jelena Savic[3], Sebastien Legrand[4], Torben Iversen[5], and Mevric Zammit[6]

[1] Cedre, 715 rue Alain Colas, Brest, France
[2] Norwegian Coastal Administration, Environment Emergency Response, Moloveien 7, Horten, Norway
[3] Swedish Coast Guard, Stumholmen, Box 536, 371 23 Karlskrona, Sweden

[4] Institut Royal des Sciences Naturelles de Belgique, RBINS, Bruxelles, Belgium
[5] Royal Danish Navy Command, Karup J, Denmark
[6] Authority for Transport in Malta, Marsa, Malta
Contact: *Fanny.Chever@cedre.fr*

Abstract

Successful oil spill response after ship incidents reduces the impacts on the marine environment and socio economic consequences on affected coastal communities. Changes in IMO regulations to reduce air emissions from ships have resulted in a "new generation" of fuel oils (Ultra and Very Low Sulphur Fuel Oils). These new fuel types may be challenging during accidental oil spills as their behaviour at sea is not well known. A ship incident involving this new generation of oil may result in severe impacts on the marine and coastal environment with subsequent challenges for responders, since it might be difficult to recover the oil with conventional oil spill response equipment and methods. Additionally, polluter's compensations for damage may also increase. IMAROS project, co-funded by the EU / DG-ECHO, aims to bring together knowledge and experiences from different countries.

The project first identified 13 relevant products (11 VLSFO and 2 ULSFO) used by ships in Europe and analysed them at the laboratory scale, in conditions of temperatures representative of west and northern Europe (5°C and 15°C). The chemical composition and physical properties of the fuels are basic data to understand how a spill behaves when released into the sea. Analyses consisted in a physical-chemical screening in order to give a first indication of the products' characteristics and potential behaviour at sea. Fresh oils were characterised by their viscosity and density, at 5°C and 15°C, flash point, pour point, asphaltenes and waxes contents, evaporation rate and chemical composition. Dispersibilty tests were conducted at 15°C in order to evaluate the efficiency of this response option. Artificially weathered samples (distillation at 250°C and emulsification of the residue) were also characterized to assess the oil weathering extent. The main result from this screening phase is the high

variability of the samples implying different behaviours and response options if accidentally released. Viscosity of the fresh oils ranged from < 400 mPa.s at 15°C to solid oils. The extent of the emulsification process was also very variable, in relationship with these heterogeneous rheological properties. Persistency in the environment should be observed with evaporation rate ranging from 3% to 28%. Pour points of the fresh oils varied from -27°C to +27°C, leading to potential difficulties to recover some oils with conventional oil spill response equipment. Some fresh oils exhibited a potential for chemical dispersibility with efficiency slightly higher than 50% for IFP tests. Fingerprinting of the samples was determined and results were integrated into the COSIWEB database. Based on the results from this screening phase, three samples were then selected for in-depth analysis of weathering properties in flume tank, combined with the modelling of their behaviours. OCNS ecotoxicity testing, following ISO norms and OECD or OSPAR guidelines, were also carried out on algae (*Phaeodactylum tricornutum*), copepods (*Acartia tonsa*) and amphipods (*Corophium volutator*). For the two first species, tests were conducted on the water soluble fractions while they were conducted on the oil itself for amphipods.

The suitability of different response techniques for spills management were assessed on those new products. Practical tests of equipment for mechanical recovery testing were performed by two partners, using different skimmer technologies. These tests confirmed the challenge induced by some oils in case of accidental spill. The applicability of sorbent booms was tested. The tested samples were not able to penetrate into the absorbing material inside the sorbent booms. In Situ Burning tests will be conducted in order to assess the ignitability of the fuels as well as the behaviour and composition of the residues. Finally, shoreline clean-up tests will be conducted at the pilot scale in a specifically designed device, in order to evaluate the impact of such fuels on the shore by assessing the fuel adhesion on hard substrates and the efficiency of high pressure cleaning systems.

The overall aim is to develop recommendations for oil spill response involving the new generation of fuel oils. This includes capacities and methods for response at sea, as well as on the shorelines. An effective response at sea will also reduce the amount of oil which could reach the shorelines. The results of this experimental program could hopefully contribute to the development of marine fuels with less adverse properties in case of an oil spill.