

□ Marine Environmental Technology

Upgrading of the MCSM lab in Murmansk

Murmansk Centre for Standardization, Metrology and Certification Laboratory

Oil weathering at sea

When oils are spilled at sea different weathering processes alter the properties of the oil as a function of time and weather conditions. The weathering processes are e.g. evaporation, emulsification, natural dispersion, dissolution of water soluble components, spreading and photo oxidation. Large variations in the physical and chemical qualities of the crude oils and fuel oils make the oils' behave very different when spilled at sea. Laboratory data of the weathering properties of the oils are important input to the models in order to obtain reliable predictions of the weathering behavior at sea at various conditions.

Why is knowledge about oil properties, fate and behavior of importance?

Knowledge about oil properties, fate and weathering behavior is important for:

- Environmental Risk Analysis
- Contingency analysis and planning
- NEBA-analysis (Net Environmental Benefit Analysis) Weighing of advantages and disadvantages of alternative oil spill responses for all aspects of environmental effects, compared with "no response"
- Decision making during oil spill response operations

Why study weathering of Russian oils?

The transport of Russian crude oils and refined fuel products in tankers along the Norwegian coast will increase in the years to come.

At present, 6-8 tankers (circa 3 loaded and 3 unloaded tankers) are sailed daily along the Norwegian coast with an average size of approximately 40000 tons. However, it is expected that the tanker size in the near future will increase up to 100000 tons.

Figure 1 shows the transportation route of tankers from Murmansk to Rotterdam. The Norwegian authorities will have the responsibility for oil spill contingency along the Norwegian coast and are concerned about the increased risk for major spill incidents. Today, we need better documentation of the weathering properties and behaviour of the Russian crude- and fuel oil products transported through the Barents Sea and along the Norwegian coast in order to supply important information for Russian and Norwegian oil companies, spill response organizations, and environmental authorities.

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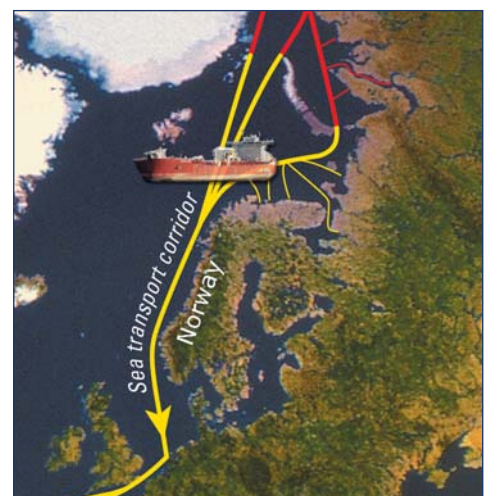


Figure 1 Transportation route of tankers from Murmansk to Rotterdam

Upgrading of the MCSM laboratory in Murmansk *continues*

In addition, supply important information for inclusion in Russian Oil Spill Contingency plans.

Laboratory in Murmansk:

Based on an initiative from SINTEF and the Norwegian Coastal Administration (NCA), Statoil is financing a project regarding to upgrade a laboratory in Murmansk to perform weathering studies of oils based on a well established methodology developed in Norway.

The Murmansk Centre for Standardization, Metrology and Certification (MCSM) was established in 1935 and is a federal laboratory which mainly receives samples from the North/West Russia. MCSM organization are divided into 5 laboratories which include several physical and chemical analysis such as product control from the industry, food and medicine control, microbiology and oil product analysis (e.g. petrol and diesel). MCSM has also long experiences of calibration of instruments and testing of navigation equipments.

Project description

The basis of the project is to perform weathering studies of two Russian crude oils for training, technology transfer and interlaboratory calibration. Two different Russian crude oils will be sampled and shipped to SINTEF for use in the training. Two laboratory personnel from MCSM will be trained in the weathering methodology at SINTEF Marine Environmental Technology facilities in Trondheim. Personnel from SINTEF will also perform training of laboratory personnel at MCSM in Murmansk during the project period. In addition, the project supplies MCSM with both necessary equipment and upgrading of necessary laboratory facilities.

The training and technology transfer includes the following main activities:

- Physical-chemical characterization of oils
- Topping (distillation) of oils
- Emulsion properties
- Dispersibility of weathered oils
- Prediction of oil weathering properties using SINTEF oil weathering model (OWM)

The project is expected to be completed during 2007, and will be finalized by an interlaboratory test between the laboratories based on comparing analytical

results of the same crude oils. A weathering manual for the two crude oils will be prepared in both English and Russian languages based on the intercalibration results.

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IMEMS 2006

SINTEF

Call for Papers

9th International Marine Environmental Modelling Seminar Rio de Janeiro, October 9-11, 2006

The major themes for **IMEMS 2006** are marine environmental risk analysis, and the development and application of software for support of decision-making by marine environmental managers. We welcome papers describing both pure and applied research topics.

Abstracts of 500 words or fewer are sought in the following areas:

<ul style="list-style-type: none"> ■ Environmental Management Support Systems ■ Coupled Physical-Biological-Chemical Systems ■ Operational Met-Ocean Modelling ■ Modelling of Coastal Marine Releases ■ Integrated Environmental and Socio-Economic Assessments ■ Environmental Risk and Impact Assessment ■ Transport and Impacts of Pollutants 	<ul style="list-style-type: none"> ■ Dose - Response Modelling ■ Oil and Chemical Releases ■ Deepwater and Offshore Issues ■ Contaminated Sediments ■ Ecological and Food Web Models ■ Real Time Monitoring ■ Data Assimilation ■ Model Testing and Validation
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Abstract deadline: 30 April, 2006

E-mail abstracts to May K. Ditlevsen, IMEMS Secretary: may.ditlevsen@sintef.no

www.sintef.no/imems2006/

Manuscripts will be printed in the proceedings as submitted, available at the start of the meeting as part of the registration package. As with previous IMEMS meetings, manuscripts passing a peer-review process will be published in a scientific journal. Previous meetings have produced publications in Marine Pollution Bulletin, Environmental Modelling and Software, Spill Science and Technology Bulletin, Journal of Marine Systems, and Estuarine, Coastal and Shelf Science.

This years sponsors:

New kit for taking oil spill samples at sea and on beaches

When an oil spill occurs or has been discovered at sea, it is important to take samples for documenting the spilled oil e.g.:

- for identifying the source of unknown spills (based on diagnostic oil spill fingerprinting analysis)
- for performing physico-chemical characterization of the surface oil / emulsion (e.g. viscosity, water content of the emulsion, dispersant effectiveness etc.) that are relevant for decision-making during oil spill response operations.

To take reliable samples in the marine environment for such purposes is often crucial. SINTEF has therefore developed a new sampling kit that is customized for taking good quality samples both at sea and on oily beaches (see Fig. 1 to the right).

The equipment is easy to use, and user-friendly instructions (sampling procedures) are enclosed for:

- sampling of thin oil films (sheen) at sea
- sampling and handling of thick oil / emulsion at sea
- sampling and handling of high viscous oils, globules and tarballs
- sampling of oil on beaches
- sampling from oil contaminated birds/ animals

To maintain the “chain of custody”, procedures for sample labeling, packing and shipment to the laboratory are included. The equipment in the sampling kit is in accordance with the recommendations given in the coming guidelines from the European Committee for Standardisation (CEN) for sampling of petroleum and petroleum products spilled into the marine or aquatic environment.

SINTEF has in cooperation with NOFO, oil companies and the Norwegian Coastal Administration performed training courses for using the sampling kit (see Fig. 2)

Sampling kits have now been purchased by response organizations (e.g. NOFO) for use on their oil spill response vessels, oil companies have installed the kit on several platforms, refineries and oil terminals, and both the governmental oil spill response agencies (the Norwegian Coastal Administration) and local municipalities (IUA) have bought the sampling kit.



Fig.1. The new oil spill sampling kit developed by SINTEF

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Fig. 2. Oil spill personnel from oil companies and governmental agencies participating in training course arranged by SINTEF and NOFO in how to take samples of oil spilled in the marine or aquatic environment.



Toxicity of the unresolved complex material (UCM) of in-reservoir biodegraded oils

Many oils contain large fractions of poorly characterized mixtures of unresolved complex materials (UCM), also called "the hump" due to their characteristic chromatographic profile (see Figure 1). The UCM contain mixtures of aromatic hydrocarbons and polar compounds which are toxicologically important, e.g. compounds containing oxygen-, nitrogen-, or sulphur-molecules. Experimental data also show that UCM compounds are recalcitrant to biodegradation in the environment and may therefore persist after oil spills or produced water discharges.

In a project sponsored by the Norwegian Research Council we have focused on the toxicity of UCM separated from water-soluble fractions (WSFs) of selected oils. The project is a cooperation between SINTEF, NIVA (Oslo), and the University of Plymouth.

In phase 1 of the project (2005) UCM in the WSFs were separated by polarity in several fractions by high-pressure liquid chromatography (HPLC), and the toxicities of individual fractions were assessed by several bioassays at NIVA. Preliminary results have so far shown that UCM-related fractions are associated with sub-lethal effects like metabolic inhibition, estrogenicity, induction of CYP1A activity, and DNA damage. Acute toxicity (cytotoxicity) was observed in crude extracts, but not in individual fractions.

In phase 2 (2006) we will focus on the comparison of the toxicities of UCM-related compounds and well-characterized compounds like polycyclic aromatic hydrocarbons (PAH), alkylated phenols (AP) and NPD (naphthalenes, phenanthrenes, dibenzothiophenes). Some toxic UCM-rich fractions will also be analysed by high-resolution chromatography methods. In this way selected compounds representative for toxic UCM-groups may be identified and used for toxicity screening.

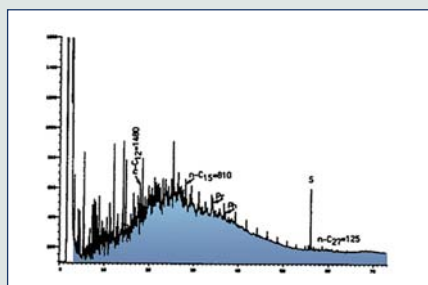


Figure 1. Gas chromatographic diagram of a typical UCM-rich oil

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