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International research on arctic oil spill response strengthens preparedness

SINTEF has, together with international scientists, finalised the most comprehensive research programme on oil spill preparedness and response for arctic and ice-covered waters ever undertaken. The results from the study provide further basis for developing techniques that will enable effective management of oil spills should they occur in the Arctic and ice-covered areas.

The three-year research programme combined small- and medium scale laboratory experiments with medium- and large-scale field experiments approved by the Norwegian authorities. As part of the programme SINTEF scientists spent two weeks in May 2008 and in May 2009 in the pack ice in the Norwegian Barents Sea to study the behaviour of oil spills in arctic waters and to test various response options in realistic oil-in-ice conditions. During a number of controlled spills, SINTEF tested several cleanup techniques, including collection of the oil with skimmers, burning of oil surrounded by fireproof booms and oil released in the field (in-situ burning), as well as dispersion of the oil in broken ice by use of chemical dispersants. The laboratory and field tests demonstrated that ice can act as a natural boom and reduce further spreading of the released oil.

The behaviour of oil in water determines the operational time frame, also called *window of opportunity*, for use of various methods to clean up oil spill in ice-covered waters. The programme has improved the ability to define the window of opportunity for various response techniques. The experiments have documented that the window of opportunity for use of in-situ burning and of dispersants in ice-covered waters can be longer in ice-covered waters compared to an open water scenario.

"It has been very interesting to lead this international project not least due to the timing and need to advance oil spill response methods in ice-covered waters, as oil and gas activity increase in the high North. With the results from the program we are better equipped to decide the opportunity for various response options. This is important input for the response teams assisting them in defining how much time they have to react to and clean up a spill as effectively as possible", says Stein Erik Sørstrøm, programme manager at SINTEF.

Availability of different response options is the key to a successful oil spill response operation. The findings revealed that oil spill contingency in arctic and ice covered waters should be based on a complete toolbox including all available techniques. More specifically, laboratory and field experiments showed that in-situ burning can be an effective response method for removing oil in ice, with a burn-efficiency above 90 percent and also that dispersion of oil can be an effective response method to clean up oil in ice.

The research identified a systematic way to predict the operational time frame for the various response options for different types of oil. All in all, the research programme has provided a valuable knowledge base for planning, implementation and further improvement of oil spill contingency in ice-covered waters.

The programme was initiated in 2006 as a joint industry project (JIP). It is led by SINTEF (Norway) and it's cooperating R&D partners; SL Ross Environmental Research Ltd (Canada) and DF Dickens Associates (USA), and sponsored by the Norwegian Research Council and the oil companies AgipKCO, ConocoPhillips, Chevron, Shell, Statoil and Total.

"*This research is a milestone and shows that oil spill-response techniques are continuously improving. This JIP programme has brought much relevant and valuable knowledge and support both from the authorities, scientific environment, and industry experts to the table. The findings can be used for oil spill response planning in arctic waters and could also lead to more research projects and new developments of oil spill response equipment. Overall purpose is that we as an*

industry can continue our efforts to minimise risk and develop arctic oil and gas responsibly", says chairman of the JIP steering committee, Eimund Garpestad".

The results are presented to stakeholders at a side-event during the conference, Arctic Frontiers in Tromsø, Norway, January 27th 2010.

Further information about the programme:

SINTEF JIP "Oil in Ice" Programme Manager, Stein Erik Sørstrøm,
E-mail: Stein.E.Sorstrom@SINTEF.NO
Phone: +47 99536050

www.sintef.no/jip-oil-in-ice

Further Background

SINTEF is an independent research foundation in Norway and among the fourth largest contract based R&D organisations in Europe. Further information may be found on http://www.sintef.no

The international research programme includes projects at three levels: laboratory trials at SINTEF SeaLab in Norway, field experiments in Svea on Svalbard, and offshore field experiments in the marginal ice zone around the Svalbard archipelago. The program has provided valuable information about oil spills in ice and state-of-the art response techniques, and proved that field experiments are very important as a means of verifying the findings of laboratory studies under realistic conditions.

The research program was coordinated by SINTEF and involved collaboration with the following organisations: the Norwegian Research Council, Agip KCO, Chevron, ConocoPhillips, Shell, StatoilHydro and Total. Other research partners are: Alaska Clean Seas (ACS) and Oil Spill Research Institute (OSRI), USA. SL Ross Environmental Research Ltd, Canada and DF Dickins Associates, USA.

Testing oil in ice

The trials included studies of oil slick drift, tests of new mechanical recovery equipment, in-situ burning of oil in broken ice, use of oil spill dispersants on oil weathered in high ice concentrations, and remote sensing systems for monitoring of oil spreading among the ice.

The tests have demonstrated that in-situ burning is a valuable response technique for an oil spill in broken ice and that conventional fire resistant booms could be used to corral and burn oil in a wide range of ice concentrations. The oil was still burnable after five days of weathering in the ice, which in some cases can make it easier to respond to an oil spill in ice compared to an open water spill scenario.

The field tests also demonstrated that crude oil in broken ice could be efficiently dispersed with conventional dispersants even after six days weathering in ice. It is the first time that dispersants have been applied in the field to an uncontained oil slick in high ice concentrations.

The tests proved that the weathering process is slowed down, enabling a larger window of opportunity for dispersant application as well as for in-situ burning than first estimated.

Environmental protection

Prior to the tests, a permit from the Norwegian Coastal Authority was secured. The requirements of the permit ensured close monitoring of oil behaviour and maximum protection for the environment. A thorough clean-up was conducted after each test, partly by use of mechanical recovery and absorbents after the skimmer tests, by use of absorbents after the in-situ burning tests, and by use of dispersants as part of the dispersant tests as well as clean-up of the large uncontained spill. Traces of oil (sheen on the water) left on the surface when the clean up was concluded were treated with milled bark. Bark is an absorbent product prepared from the outer layer of pine trees. It absorbs and immobilises the oil and is regarded harmless to arctic fauna.

During the experimental period no polar bears, sea mammals, or sea birds came in contact with the oil.