Oil Spill Contingency in the Arctic

The mining company Store Norske Spitsbergen Kulkompani, SNSK, produces coal at Spitsbergen island in the Arctic region. The coal is shipped to the middle of Europe in vessels up to 75,000 dwt. The production facilities are located at Svea approximately 50 km inside the van Mijen fjord. The vessels are sailing in sensitive environmental areas, with the shallow strait Akselsundet being regarded as the most risky area to pass.

A set of risk reducing measures has been taken for safe sailing through the strait. With tidal currents up to 7-8 knots, sailing through the strait will only commence if the current is less than 2 knots and the wind speed is less than 10 m/s. The vessels shall not carry more than 350 m³ heavy fuel oil when sailing through the strait. These and the other risk reducing measures reduces the probability for an incident to happen and the consequences if an oil spill should occur.

SINTEF has performed several analyses concerning the oil spill contingency in the van Mijen fjord. Among these studies are:

• Weathering studies of relevant heavy bunker fuels.
• Mapping of beaches in the area and interaction of oil with beach sediments.
• Environmental risk and oil spill response analyses with simulation of potential release scenarios with the OSCAR (Oil Spill Contingency And Response) model system.
• Preparation of an oil spill contingency plan.

SNSK has established an oil spill contingency plan with equipment for mechanical recovery at sea, using two tugs as a platform. Equipment for near-shore and shoreline operations is stored in a depot in Svea. SNSK and the Governor of Svalbard have also signed an agreement that gives SNSK access to a depot in Longyearbyen owned by the Norwegian Pollution Control Authorities (SFT) and the Governor. The oil spill contingency is built around the following main strategies:

• Early deployment of booms around the grounded vessel in order to prevent spreading.
• Emergency loading of the ships bunker fuel tanks.
• Recovery of oil on the sea surface to reduce stranding.
• Strategic use of booms to protect vulnerable natural resources, to lead the oil to pre-selected shoreline areas and to recover oil close to the shoreline.
• Shoreline cleanup.
• Environmental monitoring program (see next page)
SINTEF responsible for field monitoring during and after oil spills

Experimental field trials
SINTEF has more than twenty years experience in field monitoring in connection with experimental field trials in the North Sea and in the Arctic. A recent example is the “DeepSpill” trial in 2000, when oil and gas were released at 800 m depth. SINTEF was responsible for the scientific sampling and chemical analyses of the oil assessments in water column and on the sea surface.

Environmental surveys in connection to real-life oil spills
SINTEF has also been engaged both by the Norwegian Pollution Control Authorities (SFT) during recent spill incidents in Norway like the Green Ålesund and the John R (see News. no. 1-2001), and by the International Tanker Owners Pollution Federation Ltd (ITOPF) during the Erika (France), the Baltic Carrier (Denmark) and the Amorgos (Taiwan) incidents.

Monitoring agreements with the oil companies
In connection with the establishment of contingency plan for use of dispersants as a first-line response to the Balder/Jotun oil fields in the North Sea, Esso Norge signed a special monitoring agreement with SINTEF for monitoring services during eventual spill operations, to optimize dispersant actions and to secure sufficient documentation of the effects when using dispersants, according to the new “Regulations for use of dispersants in Norway”.

Last summer the Norwegian Clean Seas Association for Operating Companies (NOFO) signed an agreement with SINTEF that includes:
- Characterizing oil properties on the sea-surface during response operation
- Monitoring in water column during underwater / deep water blow-outs
- Effects of oil on shore during / after stranding of oil
- Aftermath monitoring during the recovery of polluted areas (restoration phase)

The most recent monitoring assignment is with the SNSK (see front page in this issue). In connection to the increased shipment of coal from Arctic regions in Norway, SNSK has established an oil spill contingency plan at Spitsbergen that involved use of SINTEF expertise in an environmental monitoring program after an eventual spill incident at Spitsbergen.

Contact persons:
Alf.G.Melbye@chem.sintef.no
Phone: +47 73 59 13 85
Per.Daling@chem.sintef.no
Phone: +47 73 59 12 41
Ivar.Singsaas@chem.sintef.no
Phone: +47 73 59 12 11

New Programmer Joins SINTEF Applied Chemistry
Marinela Gerea has recently joined the Environmental Engineering Division of SINTEF Applied Chemistry as software engineer. Marinela received her BSc Degree in Computer Science from the University of Bucharest in 1998.

Her work experience includes one year in Rome as software developer for Italian Bank System, and 18 months in Paris with IRI-Secodip, the French subsidiary of the Chicago-based Information Resources Inc. She moved to Trondheim in August 2001 together with her husband who recently joined Statoil Research Centre in Trondheim. Marinela’s programming skills and interests include: Visual Basic, Visual C++, Java, C, SQL and Oracle database. At present, she is working on the design and development of user interfaces, numerical models, and databases for a variety of marine environmental impact assessment problems. We welcome Marinela to the environmental modeling team, and to SINTEF.

AMORGOS Oil spill - Taiwan
The bulk carrier AMORGOS grounded on rocks off the southern tip of Taiwan 14th January 2001. The ship carried 60,000 tonnes of iron ore and approximately 1,000 tonnes of the fuel has been spilt into the sea. Approximately 4-5 km of shoreline within the Kenting National Park has been oiled to varying degrees.

SINTEF Applied Chemistry has worked with the International Tanker Owners Pollution Federation Ltd (ITOPF) to perform sampling and analysis of sediment and water column. SINTEF has performed sampling in May, July, and September, and the sampling programme is co-ordinated with a Taiwanese sampling programme.
Natural processes on drill cuttings piles

SINTEF has been involved in several tasks in the UKOOA drill cuttings research and development programme, which has been carried out in two phases since 1999. In the second phase (2000/1) experimental studies were performed on the basis of the recommendations made during the first phase (literature study - “state-of-the-art”). A representative range of cuttings piles with different physical characteristics were selected for experimental studies in order to generate input data to a numerical model for predicting natural processes and episodic incidents in the piles. SINTEF were involved in two different tasks with the objects to determine characteristic changes over time caused by natural processes of degradation/depletion, erosion, sedimentation and recolonisation/bioturbation, and assessment of “in-situ” enhanced natural bioremediation. The in-situ bioremediation project focused on description on the potential and cost of treating contaminated drill cuttings on the seabed using a subsea bioreactor.

Studies and quantification of the natural processes was a joint project involving SINTEF Environmental Engineering (degradation/depletion), SINTEF Coastal Engineering (erosion), Rogaland Research (aerobic/anaerobic degradation, bioturbation/recolonisation), ERT (recolonisation) and AEAT (biomarkers). The meso-scale degradation/depletion studies were performed in a simulated seabed system (http://www.sintef.no/units/chem/environment/remediation/sim-seabed_fact.htm) with intact cuttings piles samples (0.1 m2) dominated by OBM (oil based drilling mud) and WBM/PBM (both water and pseudo based drilling mud), respectively. The experiments were performed with continuous supply and exchange of seawater under simulated environmental conditions. Two different approaches were used to study biological activity and depletion of contaminants in the drill cuttings; chemical analysis and “sediment oxygen consumption” (SOC). The data from the experiments showed that the rates of the processes in the drill cuttings sediment were slow, and a high degree of drilling fluid heterogeneity was measured in the sediments from each pile. The results also showed that a surface active layer which facilitated depletion was approximately 10mm. The results indicated that depletion was dominated either by leaching (OBM) or biodegradation (WBM/PBM) processes in the different cuttings, and that these processes were increased due to erosion of surface sediment.

For further information on the UKOOA drill cuttings initiative see; http://www.ukooa.co.uk/issues/index.cfm?page=drillcuttings/rdintro.htm

Contact persons:
Odd Gunnar Brakstad
Phone: +47 73 59 63 97
odd.g.brakstad@chem.sintef.no

Svein Ramstad
Phone: +47 73 59 51 75
svein.ramstad@chem.sintef.no

IMEMS 2001

The Fifth International Marine Environmental Modelling Seminar was held October 08-11 in New Orleans. The meeting was hosted by the U.S. Minerals Management Service, and chaired by Robert LaBelle of MMS and Mark Reed of SINTEF. Of the 56 registered attendees, there were 34 from the US, 8 from Norway, 4 from Japan, 3 from Finland, 2 each from Morocco and the Netherlands, and 1 each from Australia, New Zealand, Canada, France, and South Korea.

The first day consisted of sessions on coupled model systems, model validation, and an impromptu New Orleans hospitality presentation by the Hotel Ponchartrain Catering Sales Manager, Steven Crockett. Day 2 included sessions on oil spills, followed by two special sessions: the Prince William Sound (Alaska) Nowcast-Forecast System, and DREAM, a European program to develop a Dose-related Risk and Effects Assessment Model. Day 3 covered papers on applications and analyses of marine environmental problems.

Papers from IMEMS 2001 are being submitted for peer review to the Journal of Marine Systems, Environmental Modelling and Software, and Spill Science and Technology, as appropriate. Papers from last year’s meeting in Athens are now available in Marine Pollution Bulletin, Vol. 43, Issue 7-12.

IMEMS 2001 was sponsored by the U.S. Minerals Management Service, ExxonMobil, the Offshore Operator’ Committee, TotalFinaElf, Statoil, and SINTEF Applied Chemistry. We thank them for their support.

IMEMS 2002 is now being planned for Trondheim, Norway. To be added to the mailing list, send an email to May.Ditlevsen@chem.sintef.no.
Biofouling in fish farming

Biofouling is a severe problem in marine fish farming. Of special concern is the growth of micro- and macroorganisms on the nets. This growth increases the net weight severely and reduces oxygen access for the fish in the nets. To combat biofouling the nets may be impregnated by anti-fouling chemicals. These chemicals were previously based on tri-butyl tin (TBT), but are recently replaced by copper-based chemicals. Norwegian authorities have agreed on certain environmental goals for the fish farming industry, e.g. recommending to prohibit the discharges of copper-based chemicals during net washing and to introduce a toll on copper as anti-fouling agents. This toll is expected to be followed by development of new anti-biofouling agents and stimulation of alternative methods.

A group of researchers from different SINTEF has been established to initiate and co-ordinate research activities on biofouling in fish farming. This group includes scientists from several SINTEF institutes and research companies: SINTEF Fisheries and Aquaculture, SINTEF Unimed, SINTEF Applied Chemistry, SINTEF Material Technology, and SINTEF Applied Chemistry. The scientists of the group cover competence within aquaculture technology, aquaculture bioresources, marine material technology, marine chemical and environmental sciences, and aquaculture magnetic resonance for process regulation and quality control. Research areas of interest will be optimisation of current anti-fouling technology, new development and testing of new anti-fouling agents and materials, including non-lethal chemicals, studies of primary processes and succession in biofouling, and environmental impacts of anti-fouling treatment.

The idea is that this group will function as a channel for the fish farming industry searching for the best available competence on biofouling in the SINTEF group, and as a co-ordinator for ideas and project proposals from SINTEF scientists directed towards the industry and research programs.

For further information contact:

Odd Gunnar Brakstad
SINTEF Applied Chemistry
Phone: +47 73 59 63 97
E-mail: Odd.G.Brakstad@chem.sintef.no

Leif Magne Sunde
SINTEF Fisheries and Aquaculture
Phone: +47 73 55 06 28
E-mail: Leif.Sunde@fish.sintef.no

Ingrid Salvesen
SINTEF Fisheries and Aquaculture
Phone: +47 73 59 63 71
E-mail: Ingrid.Salvesen@fish.sintef.no

Ole Øystein Knudsen
SINTEF Material Technology
Phone: +47 73 59 29 26
E-mail: Ole.Knudsen@matek.sintef.no

Finn Drabløs, SINTEF Unimed
Phone: +47 73 59 05 31
E-mail: Finn.Drablos@unimed.sintef.no