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MEMO

MEMO CONCERNS

Oil monitoring and in-situ burning of "oil under ice" experiment Svea, Svalbard 2006

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Monitoring of experimental oil spill under ice on Svalbard spring 2006

This memo summarise the last part of the field work on the project entitled "New and Innovative Equipment for Remote Sensing, Detection and Tracking of oil in and under ice". The oil release, radar/acoustic experiments, film thickness measurements and initial oil/ice/water sampling were finished late in March and this field work are described in the first field report. This memo focus on the monitoring of the oil and in-situ burning performed in April and May 2006.

The monitoring of the oil was resumed in mid April after the Easter holidays. The temperatures in Svea in April were high for the season, +8ºC at daytime and even above zero at night. The warming of the ice increased the vertical migration of the oil trough the first year sea ice (65 cm) and the first oil were visible on the ice surface in mid April (see figure 1). This also made it difficult to operate snowmobiles on the ice and sampling for a period late in April was done by helicopter. Later snow conditions improved and two snowmobiles were stationed in Svea and used throughout the project period until June 2.

The oil migrated as small droplets trough the brine channels in the porous sea ice to the surface of the ice. As the ice gets warmer the brine channels open up and increase the migration. Although some oil were visible on the surface in late April the majority of the oil were still under or in the bottom section of the ice. Figure 2 shows cores taken both inside the skirt containing the oil and outside the skirt.

Due to the warm weather and the reports from the SINTEF/UNIS crew stationed in Svea preparations were made to perform the in-situ burning on May 8-10. However, a few days before this date the weather changed and become considerably colder. This slowed considerably down the rate of oil migration. Surfaced oil formed a nice meltpool inside the skirted area on May 8., but coring trough the ice revealed that approximate 1200 litres were still captured in the ice. For this reason the in-situ burning was postponed to increase the amount of on the surface. Ice thickness inside the skirt was 35-40 cm, while the thickness on the outside was still 65-70 cm.

Reports from the crew stationed in Svea indicated very promising conditions for successful in-situ burning towards the end of May. Most of the oil was available on the surface of the meltpool and most of the ice inside the skirt was melted. Evaporative loss was estimated to approximately 30% (based on density measurements) and water-in-oil emulsification was very low (<5%).

On May 30. a weak easterly wind had pushed the surfaced oil towards one side of the meltpool and the film thickness was measured to 35 mm. Air temperature was -5C, the wind was very weak (2-3 m/s) and conditions were regarded close to ideal for in-situ burning. The oil was ignited by a handheld igniter and burned for 11 minutes. All residue was collected and the meltpool was treated with adsorbents (bark) to bind small residual oil captured/hid in the ice/snow. Burning efficiency is estimated to > 96%, but will depend on quantitative analysis of sampled material.

A comprehensive set of samples (oil, ice cores, residue) have been sampled in Svea and are stored at UNIS in Longyearbyen, SINTEF in Trondheim and some samples are sent to Houston. This sample material will be analysed during this summer and early fall.

A report similar to this (in Norwegian) regarding the field work, the in-situ burning and especially the status of the spill site before leaving the area is delivered to the Governor of Svalbard in Longyearbyen.

Figure 1: The first oil visible on top of ice under the snow. Picture is taken in the middle of the skirt circle on April 20. 2006.

Figure 2: Comparison of ice cores inside the skirt and outside. Inside cores are 10 cm shorter than the outside cores (April 29. 2006). Oil droplets (< 1 mm) are seen in the core taken inside the skirts, but the majority of the oil are either under the ice or adsorbed in the skeleton structure of the bottom section of the core.

Figure 3: Surfacing oil forming an meltpool early in May 4.

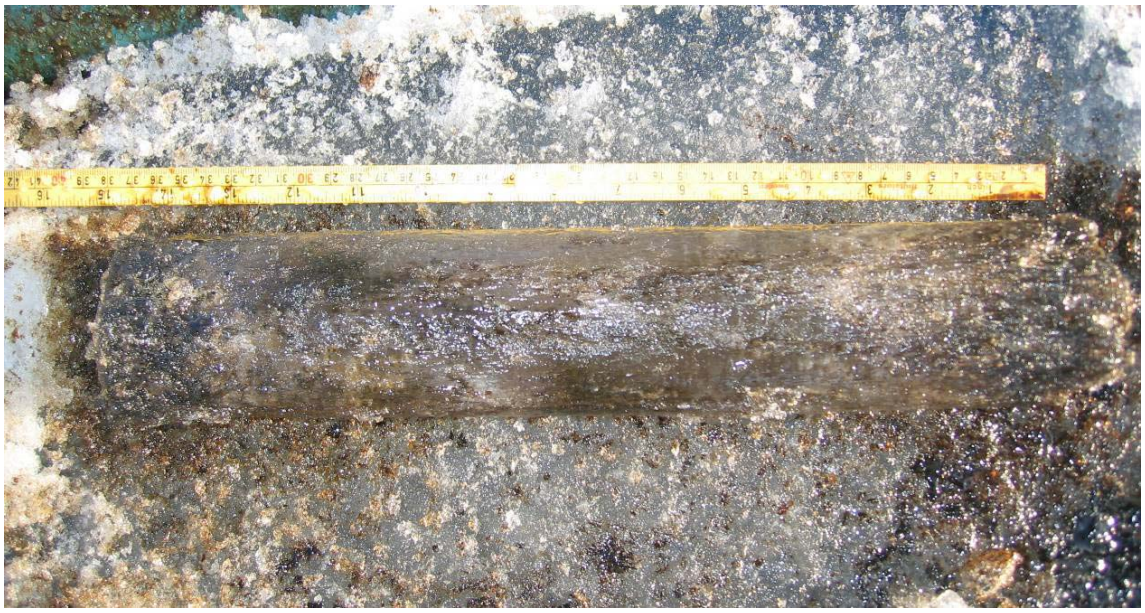

Figure 4: One of the ice cores taken inside the skirt on May 04. 2006. Considerable amount of oil can be seen in evenly distributed in the brine channels as small droplets. Very little oil is present under the ice.

Figure 5: Ignition of the surface oil on May 30. using a 250 ml of gellified gasoline and a small propane torch by the MSc student Roger Daniloff (NTNU/UNIS).

Figure 6: In-situ burning of approximate 3000 litres of Statfjord crude. Burning time 11 minutes.

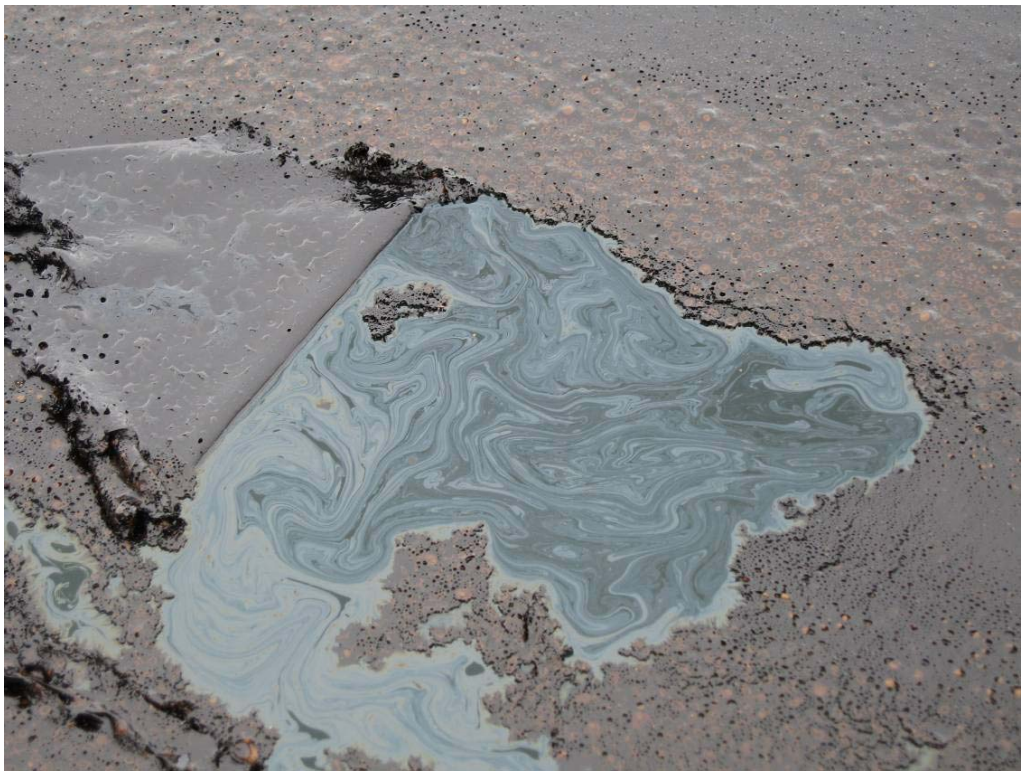

Figure 7: The burning residue of the Statfjord crude is solid and very easy to recover by simple mechanical means.

Figure 8: Residue recovery and treatment of meltpool with adsorbents (bark) to bind any oil residue bound in the ice or snow.