Oil in Ice – a challenge in oil spill response?

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Within the last few years, SSPA has seen an increase in activities in the Arctic areas, and, along with this, come new risks and new challenges. Much focus is put on the risk of oil spills and the potential problems these may cause in cold climates, especially since the environment in the Arctic is highly vulnerable and, to a great extent, unexploited. Even though the risk of oil spills is minimised, we still have to deal with the consequences if it happens.

The oil blowout accident from the Deepwater Horizon rig in the Mexican Gulf has put considerably more focus on safety and the environmental risks associated with all offshore activities. This accident further emphasises the importance of minimising risks and showing that there are effective response organisations and plans for all planned and forthcoming exploration operations.

Ice Management

Oil spills in ice and cold climates are completely different from spill situations in thermal waters. The presence of often drifting pack ice in high concentrations and low temperatures rule out ordinary spill response strategies and techniques. Oil booms are hindered by pack ice; the oil may be frozen and captured in growing ice or spread below a solid ice sheet. The ice conditions more or less fully dominate the situation. Still, all parts of the well established operational and logistical strategies for handling oil spills in water must be fulfilled including detection, control, recovery, storage and destruction of recovered oil.

The key factor in all winter spill operations in the Arctic, and also in the Baltic Sea, is the requisite access to capable transport and operational resources. Oil spill recovery operations in ice require effective ice management resources and you must be able to reach the spill site! It is, therefore, strongly recommended that a well-prepared spill contingency plan is fully integrated in the ice management plan set up for a drill site operation or in other remote arctic operations. Powerful, modern ice breakers also operate as supply vessels, providing storage capacity for equipment and recovered oil. Emergency plans are implemented by professional and trained crew onboard. As described in previous SSPA Highlights, SSPA is very active in this area, providing decision support tools for the offshore and oil industries.

The ice – exercises, experiences and the need for know how

SSPA has been active since the 1980s in the field of oil in ice. SSPA's experts actively participated in the European Union funded SPREEX, Spill Response Experience, with a special focus on the need for developing of winter spill response methods and techniques. This Concerted Action finalised its work during 2009. Today, SSPA can provide a wide range of expertise in marine pollution and can offer risk analyses, training courses and operational advice.

In April this year SSPA took part in a workshop and exercise on oil in ice arranged by the Swedish Civil Contingencies Agency (MSB) in cooperation with the Swedish Coast Guard. The focus was on near-shore oil contamination and SSPA provided lectures on available techniques and presented a new updated manual on shoreline clean-up, including recommendations and methods applicable in winter conditions. About 40 officials and employee from various organisations attended the workshop and took part in the field demonstrations and exercises in the 60 cm thick ice outside Umeå on the Baltic coast of northern Sweden.

The ice demands advanced strategies and methods

The total number of oil spills per year has declined drastically over the last thirty years, but nonetheless serious accidents are still a common reality that which can happen at any time. In fact, most large oil spills have not occurred in icy conditions, as yet. This makes the actual experience of responding to oil in ice rather limited, and only relatively small spills can be referred to as good

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One spectacular field experiment was conducted in sea ice outside Gävle, where blasting techniques were used to create a hole in ice to facilitate the recovery of oil trapped under level ice. Blasting is a quick method but conventional hole cutting using a chain saw creates smoother edges and an ice free surface with more favourable conditions for mechanical recovery.
PHOTO: JIM SANDKVIST

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PHOTO: BJÖRN FORSMAN

examples of how to handle oil in ice. However, known winter spills clearly emphasise the need for winterised response strategies and methodologies to be developed.

The oil recovery equipment available in almost every modern spill response organisation is basically designed for open water use and only a few pieces of equipment are considered to be effective in ice conditions. Thus, more designated winter equipment and training are needed in order to be able to handle spills with the presence of ice.

Oil in Ice Code

In order to design an effective spill response organisation, the main design criteria must be defined and operational conditions identified. SSPA has set up an Oil in Ice Code. This code is a decision backing support system that systematically structures expected ice conditions, concentrations, thermal regimes, spill types, the logistical resources available, expected weather conditions and the expected oil types to be handled. In accordance with regional conditions, statistics and other input, the response team will be prepared with efficient tools and strategies. It is recommended that the code approach becomes an integral part of operational planning, also based on ICE MASTER support, see Highlights 47/2009.

The icy water and dispersants

The latest developments regarding oil spill responses in ice conditions have mainly been related to the use of dispersants in cold climates. While dispersants were previously seen as inefficient and hence not to be recommended in icy conditions, recent tests have shown that new products can actually also work in cold climates and, to some extent, also in brackish waters, such as, for example, the Baltic Sea. For instance, it has been shown that one can use the propeller water from vessels to mix the dispersant into the mix of oil and ice, which increases the effectiveness of the dispersant.

Oil in ice may well also remain a challenge for those responding to oil spills in the future. Depending on how the development of oil drilling in the Arctic continues, the issue could also become much bigger than it is today. As the Arctic ice diminishes in size, the seaborne traffic in the Arctic will increase, and inevitably so will oil spills. It is, therefore, important to establish not only methods and techniques for oil spill responses in cold climates, but also to secure a well planned contingency for future accidents, which also involves training and building up an organisation.

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Oil in Ice Code

F / C / T / D

iceform / concentration / temperature / dynamics

F – iceform, -type

0	=	ice free water	
1	=	slush	< 2 cm
2	=	small brash	< 40 cm
3	=	brash	< 2 m
4	=	bigger pieces	< 6 m
5	=	floes	≥ 6 m
6	=	large floes / pack ice	

C – concentration

0	=	no ice
1	≤	1/10 concentration
2	≤	2/10
3	≤	3/10
4	≤	4/10
5	≤	5/10
6	≤	6/10
7	≤	7/10
8	≤	8/10
9	≤	9/10
10	>	9/10, incl. ridges

T – temperature:

–	=	freezing
0	=	close to 0°C
+	=	melting

D – Dynamics

0	=	calm
1	=	oil and ice drift
2	=	severe movement, ridging, waves

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