Herding Agents Thicken Oil Spills in Drift Ice to Facilitate \textit{In situ} Burning: A New Trick for an Old Dog$^1$

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\textbf{ABSTRACT}

\textit{In situ} burning is an oil spill response option particularly suited to remote ice-covered waters. The key to effective \textit{in situ} burning is thick oil slicks. In loose drift ice conditions oil spills can rapidly spread to become too thin to ignite. Fire booms can collect and keep slicks thick in open water; however, even light ice conditions make using booms challenging. A multi-year joint industry project was initiated to study oil-herding agents as an alternative to booms for thickening slicks in light ice conditions for \textit{in situ} burning.

Small-scale laboratory experiments were completed in 2004 and 2005 to examine the concept of using herding agents to thicken oil slicks among loose pack ice for the purpose of \textit{in situ} burning. Encouraging results prompted further mid-scale testing at the US Army Cold Regions Research and Engineering Laboratory (CRREL), the Ohmsett facility, and the Fire Training Grounds in Prudhoe Bay, AK.

The non-proprietary cold-water herder formulation used in these experiments proved effective in significantly contracting oil slicks in brash and slush ice concentrations of up to 70\% ice coverage. Slicks in excess of 3 mm thick, the minimum required for ignition of weathered crude oil on water, were routinely achieved. Herded slicks were ignited, and burned equally well in both brash and slush ice conditions at air temperatures as low as $-17^\circ$C. The burn efficiencies measured for the herded slicks were only slightly less than the theoretical maximums achievable for equivalent-sized, mechanically contained slicks on open water.

$^1$ The opinions, conclusions, and recommendations contained in this report are those of the authors and do not necessarily reflect the views and policies of the U.S. Minerals Management Service or the Petroleum Environmental Research Forum. The mention of a trade name or any commercial product in this report does not constitute an endorsement or recommendation for use by the U.S. Minerals Management Service or the Petroleum Environmental Research Forum.