FIELD RESEARCH USING HERDERS TO ADVANCE IN SITU BURNING - FACT SHEET

WHAT ARE HERDERS?

Herders use surface active agents to thicken slicks without the need to collect the oil in a physical boom. They are effective in the open sea, with or without the presence of ice, up until there are breaking waves present.

An ongoing multi-year research project initiated in 2004, is studying oil-herding surfactants as an alternative to booms for thickening slicks in light ice conditions for in situ burning (ISB) burning.

HOW DO THEY WORK?

In-situ burning (ISB) is an oil spill response option particularly suited to remote, ice-covered waters. The key to effective ISB is thick oil slicks. If ice concentrations are high, the ice can limit oil spreading and keep slicks thick enough to burn. In drift ice conditions and open water, oil spills can rapidly spread and become too thin to ignite.

Herders applied onto water surrounding an oil slick result in the formation of a monolayer of surfactants on the water surface. These surfactants reduce the surface tension of the surrounding water considerably (from about 70 mN/m to 20-30 mN/m). When the rapidly spreading surfactant monolayer reaches the edge of a thin oil slick, it changes the balance of interfacial forces acting on the slick edge. This creates a physical situation whereby interfacial tensions contract the oil into thicker layers. Herders do not require a boundary to "push against" and work even in unbounded open water.

Herders cause oil slicks to contract, the same way a drop of dish soap in a wet, greasy pan forces the grease to the edges. As oil spills shrink in surface area, they get thicker, growing from about a millimeter (0.04 inch) to 6 millimeters (0.24 inch) thick. This thickening makes it possible to ignite the slick and achieve an efficient burn, without the need for containment booms or ice edges to hold the oil. The thicker a spill is before it is burned, the more oil gets removed and the higher the overall response effectiveness. Experimental burns in open water in the Barents Sea have achieved 80-90% oil consumption.

ARE THEY SAFE?

Two herding agents (ThickSlick 6535 and SilTech OP-40) are now on the U.S. Environmental Protection Agency National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Product Schedule for consideration for use in U.S. waters.

Toxicity testing required for listing with the U.S. EPA found that ThickSlick 6535 was "practically non-toxic" (as defined by the U.S. EPA aquatic toxicity ranking system). OP-40 had somewhat greater toxicity. Initial biodegradation tests indicate that ThickSlick 6535 biodegrades rapidly, while OP-40 biodegrades more slowly.

As herders are low toxicity and used in extremely small quantities (the recommended field application rate for herders is 150 mg/m2, more than 30 times less than the design application rate for dispersants, which have already been shown to be non-toxic), they represent very little risk to the environment.

The species and temperatures used for prior toxicity and biodegradation tests were not the same as would be found in arctic waters, however, similar findings are expected after completion of testing under more representative conditions. The International Association of Oil and Gas Producers (IOGP) are carrying out experiments to determine acute and chronic toxicity, bioaccumulation, and biodegradation of herders on representative arctic species and in arctic conditions.

Researchers at the Arctic Station laboratory, Greenland, and the laboratory at the Danish Center for Environment and Energy (DCE) will observe the short and long-term toxicity and bioaccumulation using both Thickslick 6535 and OP-40, to facilitate decisions on their use to be made using Net Environmental Benefit Analysis (for further information see the NEBA factsheet at www.arcticresponsetechnology.org/news-media). This project is scheduled to be completed in late 2015.

ARE HERDERS ALREADY COMMERCIALLY AVAILABLE?

Two herders have been placed on the U.S. EPA National Contingency Plan (NCP) Product Schedule and are now commercially available. These can be used, with the Federal On-Scene Commander's concurrence, for spill response operations in U.S. waters. Quantities have been produced and are stockpiled at DESMI in Buffalo, NY.

At present, there are no other jurisdictions that have approved herders for use in their waters. Samples have been sent to Environment Canada, along with all the EPA test data, for consideration. Environment Canada is expected to introduce regulations to approve the use of spill-treating agents offshore, including herders, in the very near future.

WHAT DOES THE FIELD RESEARCH ENTAIL?

After obtaining the required permits and approvals, the construction of a large, above-ground fully-lined test basin (8,400 square meters) was completed in October 2014 at Poker Flat, Fairbanks, Alaska.

A simulated ice field has been created in the basin in preparation for testing.

A series of individual test releases of oil (100 to 200 litres or up to ~ 1 barrel of oil each) will take place on different days over a ten day period, followed by the application of herding agents (around 1.2 litres) from manned and remote-controlled helicopters, around the oil slicks. The thickened oil will then be ignited in simulated drift ice coverage of ~10%.

On completion of the field research, a project technical report will be prepared and research findings will be published in a peer-reviewed scientific journal and presented at a scientific/technical conference.

WHAT IS THE OBJECTIVE OF THE FIELD RESEARCH UNDERTAKEN BY THE JIP?

The project's overall objectives are twofold:

- Prove the operational feasibility of an aerial herder/burn response strategy using manned and/or remote-controlled helicopters.
- Reaffirm the effectiveness of herders in open water and with ice present.

The primary objective of the field research is to validate the use of herders in combination with in-situ burning (ISB), when both are applied by helicopter. The aim is to demonstrate a rapid response aerial system that enhances responders' ability to use offshore ISB in drift ice conditions ranging from limited ice cover (1 to 3/10) to ice-free waters.

WHAT WILL THIS MEAN FOR OIL SPILL RESPONSE?

A significant potential advantage of using herders in drift ice conditions is the possibility that the entire operation could be carried out using helicopters, or possibly even an unmanned aircraft, to spray herders on the water around slicks and then ignite the thickened oil with aerially-deployed igniters.

With aerial application of both the herding agent and ignition source (igniter), the herder/burn combination becomes an extremely rapid and effective new response tool, lessening the need for vessel support. This combined aerial response maximises the use of resources and minimises the number of personnel required to remove a surface slick from the marine environment where it can do the most harm.

In addition, the entire response operation becomes safer by reducing the exposure of response personnel to marine operations such as boom deployment and recovery under challenging conditions. The slower weathering of oil slicks in ice and cold water can also extend the window of opportunity for this new tool.

For more information, visit: www.arcticresponsetechnology.org/research-projects/field-research-using-chemical-herders-to-advance-in-situ-burning