Testing of a Spreading Agent for Non-spreading Oils and Emulsions to Enhance Evaporation and Natural Dispersion

In November 2011, spreading agent testing was conducted at the U.S. Army Engineer Research and Development Center's Cold Regions Research and Engineering Laboratory (CRREL) and conducted by Ian Buist, SL Ross Environmental Research, Drs. Tim Nedwed and Amy Tidwell, ExxonMobil Upstream Research Company, and with facility oversight and testing assistance by Leonard Zabilansky, CRREL.

Theory: If heavy, viscous oils or emulsions could be induced to spread out to thin sheens, their rate of evaporation would greatly increase and they would be much more susceptible to natural dispersion by waves. The thinning of emulsions to sub-micrometer thicknesses may also cause entrained water droplets to drop out.

Proposed Testing: This research involved testing the potential oil spreading agent Silwax 5016 at three scales: 1-m^2 and 10-m^2 at the SL Ross Lab; and, 100-m^2 at CRREL. Several different heavy oils and water-in-oil emulsions were selected for the experiments.

Testing: Initial testing took place in 1-m^2 metal pans lined with rinsed plastic film to ensure a clean water surface. The interfacial tension of the water in the pans was confirmed before each test. Overhead digital photos were taken at appropriate internals in both regular and ultra violet (UV) light to document the spreading of the test oils. The test variables were:

- Five test oils;
- Emulsified and unemulsified oil samples;
- 32 percent saltwater;
- Silwax 5016 dose rate (0, 0.5, 1, 2 and 4 percent); and
- Pre-mix versus drop-wise addition of the Silwax pre-dissolved in the parent crude.

At SL Ross: Based on encouraging results from the initial testing, further experiments were conducted on saltwater in a 10 ft. x 10 ft. frame built with 2 in. x 4 in. lumber on the floor of the SL Ross lab and lined with plastic film. Overhead digital photos were taken at appropriate intervals in both regular and UV light conditions to document the spreading of the test oils.

At CRREL: A series of experiments took place at CRREL in the Ice Engineering Facility's Research Area. Two 29 ft. x 29 ft. frames were constructed using 2 in. x 6 in. lumber placed on the concrete floor of the Research Area, centered under a roof truss (on which two video Web cameras were mounted to record each experiment). UV lights were also employed to enhance the visibility of thin oil sheens. The pools were filled with 32 percent saltwater to a depth of several centimeters. Overhead digital photos were also taken at appropriate intervals in both regular and UV light conditions to document the spreading of the test oils. Additionally, photomicrographs were taken of emulsified test oils both before and after spreading to document emulsion changes.

Learn More:
Access the following Websites to learn more about their testing:
http://www.slross.com/
http://www.exxonmobil.com/Corporate/about_what_upstream.aspx
http://www.crrel.usace.army.mil/