

## Mid-Scale Tests of *In Situ* Burning in a New Wave Tank at Prudhoe Bay, AK

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### Abstract

A series of research burns was carried out in the fall of 1997 in Prudhoe Bay, AK in a new wave tank purpose-built for *in situ* burning studies. These tests were the culmination of a three-year research project by Alaska Clean Seas (ACS) and SL Ross into the effects of oil type, emulsification, temperature and waves on *in situ* burning in Arctic open water conditions. The experimental program involved conducting mid-scale (1.7 m diameter) burns with fresh and weathered Alaska North Slope (ANS) and Milne Pt. crude oils and emulsion slicks in waves. Over 60 individual burns were conducted varying slick thickness, water content, wave energy, degree of weathering and oil type. In addition to the valuable data on the scaling of *in situ* burning processes in waves, perhaps the most significant operational result was that it was possible to burn 60% water content emulsions of heavily weathered ANS crude in the highest wave conditions tested (23 cm high waves with a length of 4.7 m and a period of 2 seconds) with the addition of emulsion breakers. The 60% water emulsion of the weathered Milne Pt. crude was burnable in these waves without emulsion breaker addition.

### 1.0 Introduction

*In situ* burning (ISB) of oil spills on water has the potential to quickly remove large quantities of oil from the water surface and can be an effective countermeasure during a spill cleanup; however, evaporation of an oil's light ends and the formation of a water-in-oil emulsion can quickly lead to the slick becoming unignitable, and the closing of the "window-of-opportunity" for a successful *in situ* burn. Recent tests in Alaska, which followed from studies in Norway and Canada, have demonstrated the potential for greatly extending the ISB window-of-opportunity by applying chemical breakers to emulsions contained by fire resistant booms. Previous laboratory tests, small-scale burns in pans, and meso-scale tests (e.g. SL Ross, 1995; Guénette *et al.*, 1994 and 1995) have proved that the addition of emulsion breaking chemicals to certain oils can permit the successful ignition and burning of otherwise unignitable slicks.

The operational approach envisioned is to: i) collect emulsion with a "U" of fire boom towed through the slick; ii) move a safe distance crosswind from the main slick; iii) apply emulsion breakers aerially at low (ca. 1:500) dose rates to the entire surface of the contained emulsion; iv) allow the emulsion breakers to work for a period of time; and, v) ignite the contained emulsion over a wide area using alternative, gelled fuels dropped from a Heli-torch. The waiting period between breaker application and ignition is probably dependant on the oil type, chemical and mixing environment - for some oils this time is zero and the emulsion breaker and igniter can be applied simultaneously.