

**ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
Research and Development Projects (2000–2010)**

YEAR	PROJECT TITLE	PROJECT DESCRIPTION
1997–2005	Environmental Sensitivity Index (ESI) Mapping	<p>Series of seasonal maps intended to provide a regional overview of the environmentally sensitive resources that would receive priority protection during oil spill planning and response. The resources depicted on the maps are selected on the basis of their high sensitivity and/or vulnerability to spilled oil or their special management status. The following is a summary of the ESI mapping status by subarea:</p> <ul style="list-style-type: none"> • Aleutians (2002) • Bristol Bay (2004) • Cook Inlet (2002) • Kodiak (1997) • North Slope (2005) • Northwest Arctic (2002) • Prince William Sound (2000) • Southeast Alaska (2001) • Western Alaska (2003) <p>More information available at: http://response.restoration.noaa.gov/book_shelf/827_ERD_ESI.pdf</p>
2000	International Oil & Ice Workshop, 2000	Workshop on oil spill preparedness and response for cold climates. Provided an opportunity to congregate experts on oil fate and behavior, Arctic oil spill response, ice environments, and Arctic oilfield development in order to present the state of knowledge in a combined classroom and field setting (Anchorage and Prudhoe Bay).
2000	MORICE Phase 5	Mechanical Oil Recovery in Ice Infested Waters (MORICE) was a multiphase Joint Industry Program (JIP) to develop technologies for more effective recovery of oil spills in ice-infested waters. Phase 5, evaluated four different internal oil recovery units for the lifting grated belt at a test tank in Hamburg, Germany, in May 2000. Upon completion of these tests, the prototype skimmer was shipped back to Prudhoe Bay, AK, where it received further equipment modifications, and more powerful hydraulics and a larger power pack were installed. Selected skimmer manufacturers were invited to participate and provide an internal recovery system for evaluation. The complete prototype skimmer was evaluated for ice processing on the Alaskan Beaufort Sea during October 2000.
2000	Oil Detection in Ice	Pangaea Geochemical Technologies demonstrated the potential use of gas-sieve gas chromatograph instrumentation capable of detecting molecular levels of hydrocarbons in ice core samples.
2000	Barge Ice Deflection System	Design and construct a Barge Ice Deflection System (BIDS). The concept, design, fabrication, and testing of BIDS was a direct result of lessons learned from fall 1999 drilling on the North Slope. Spill responders recognized the need to deflect ice away from barge skimming systems in order to maintain a reasonable recovery capacity.

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2000	Temporary Pipeline Concept	As a result of lessons learned during a barge offloading demonstration on the North Slope, a study was implemented to examine the feasibility, design, process, and rough order-of-magnitude costs for a system capable of handling recovered oil spill fluids consistent with the response planning standard (RPS) requirements from the Northstar C-Plan.
2000	Viscous Oil Pumping Demonstration	Previous tests indicated the injection of water through an annular injection flange significantly reduced the discharge hose pressures while pumping viscous fluids. This test investigated the potential to adapt this technology to a cold climate through injection of alternative lubricating fluids.
2000	Emulsion Breaker Study, 1	Determined the effect of small dosages of emulsion-breaking chemical on several North Slope crude oil emulsions at or near freezing temperatures.
2000	Crude Oil Evaporation Study	Study to provide an educated analysis of the potential evaporative losses from an oil and gas surface well blowout from the Northstar and Pt. McIntyre fields on the Alaskan North Slope.
2000–2002	GNOME Oil Trajectory Model for the Alaskan North Slope	In coordination with NOAA, this project worked to develop a regional oil spill trajectory model appropriate for use in the nearshore marine environment of the Alaskan Beaufort Sea. GNOME, the General NOAA Oil Modeling Environment, is a general-purpose oil spill trajectory model used by NOAA/HAZMAT.
2001 and ongoing	Geographic Response Strategies (GRS)	<p>GRS are oil spill response plans tailored to protect a specific sensitive area from oil impacts following a spill. These response plans are map-based strategies that can save time during the critical first few hours of an oil spill response. They show responders where sensitive areas are located and where to place oil spill protection resources. The following is a summary of the GRS initiatives thus far by subarea:</p> <ul style="list-style-type: none"> • Aleutians (2004 and ongoing) • Bristol Bay (project to be initiated over next 1–2 years) • Cook Inlet (2001 and ongoing) • Kodiak (2001 and ongoing) • North Slope (project to be initiated over next 1–2 years) • Northwest Arctic (project to be initiated over next 1–2 years) • Prince William Sound (2002 and ongoing) • Southeast Alaska (2002 and ongoing) • Western Alaska (project to be initiated over next 1–2 years) <p>More information available at: http://dec.alaska.gov/spar/perp/grs/home.htm</p>

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2001	Ice Access Guidelines for Spill Responders	Sandwell Engineering Inc. conducted research and developed a manual focused on oil spill response efforts to support both on-ice and under-ice cleanup activities on the North Slope. The manual provides equipment operators, site managers, and project managers the information necessary to understand the factors and requirements to maintain safety during on-ice operations.
2001	MORICE Phase 6	The prototype skimmer (from Phase 5) was considered ready for oil in ice testing. The unit was shipped to Svalbard, Norway, in May 2001 for testing, however, due to complications, the unit was not field-tested. The MORICE project concluded after Phase 6A which successfully tested and evaluated the prototype skimmer at Ohmsett in January 2002. The unit was tested in cold water and broken ice conditions with oil and two different internal recovery systems.
2001	National Institute of Standards & Technology (NIST) Well Blowout Dispersion Modeling	Contract with NIST to create a 3-D model of a drilling related blowout. The model includes the presence of a rig structure and can account for variations in flow rate, oil properties, gas-to-oil ratios, discharge pressures, wind conditions, and impingement effects of drill rig structure on the oil and gas plume.
2002	Alaska Incident Management System (AIMS) Guide	The AIMS Guide was developed for use by public and private agencies to fully coordinate response efforts during a significant oil or hazardous materials release. While the roles of the government organizations may vary from directing the response, augmenting the response, or providing regulatory oversight, the intent of this document is to foster a common understanding of the roles and responsibilities of all responding agencies to ensure a safe, effective response. More information is available at: http://dec.alaska.gov/spar/perp/docs/AIMS_Guide-Complete(Nov02).pdf
2003	NIST, Well Blowout Droplet Size Study	Preliminary study to investigate the drop size distributions created from various pipe diameters under a range of flow rates and GORs.
2003	Viscous Oil Pumping Studies, USCG	Joint Viscous Oil Pumping System (JVOPS) Workshop, headed by representatives of the Canadian and US Coast Guards was held in Houma, LA, Dec 1–15, 2003. The purpose of the workshop was to improve oil spill response systems for heavy viscous oils. The workshop targeted testing in the critical 200,000–500,000+ cSt range and pumping distances up to 450 meters. A range of pumping systems was also tested.
2003	Viscous Oil Pumping Studies, Mini Barge	In a test, a vacuum truck pumped a 249 bbl mini barge of its cargo of emulsified Northstar crude oil at 32°F in 46 minutes. The pumping confirmed long-standing planning assumptions regarding transfer rates of emulsified oil at ambient sea temperatures stored by on-water spill response systems.

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2003	Emulsion Breaker Study, 2	Test to examine the fate of emulsion breaker chemicals that may be used to help decant free water from oil storage barges.
2004	Testing Portable Pumps with Viscous Oil	Demonstrated pumping capability of ACS equipment for recovering oil spilled to tundra in cold conditions. The key elements of this test were to measure the rate at which weathered oil could be recovered with small, portable pumps and to determine the limits of pumping related to pour points of the oil.
2004 – 2006	NIST Well Blowout Model Development	Continue National Institute of Standards and Technology’s (NIST) well blowout model development. Develop Alaska-based capability to apply and run NIST’s oil dispersion model for cases of rig and no rig and fire and no fire. Compare the results of a no-fire-no-rig case to SL Ross’s model results. Develop capability to model the affect of a plume deflector.
2004	TAP II Modeling, North Slope	Trajectory Analysis Planner (TAP II) Modeling. GNOME model location files for Alaskan Beaufort Sea provided opportunities to expand spill trajectory modeling to statistically-based projections of potential spill impact areas. The graphical output from TAP II includes threat zone analysis, shoreline impact analysis, site oiling analysis and resource impact analysis.
2004 – 2005	Testing Emulsion Breakers to Improve Pumping of Viscous Emulsions	Quantify the effectiveness of demulsifier addition in reducing emulsion viscosity, and hence friction-induced backpressures, when pumping emulsions in hoses.
2004 – 2006	North Slope Coastal Ocean Dynamic Applications Radar (CODAR)	Support for a project led by the University of Alaska Fairbanks to develop a land based radar system for measuring the speed and direction of the Beaufort Sea’s surface currents.
2004 – 2006	Ground Penetrating Radar (GPR) for Detecting Oil in and Under Ice	<p>Studies of GPR for the detection of oil in and under sea ice:</p> <ul style="list-style-type: none"> • November 2004 experiments at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, NH; • April 2005 Prudhoe Bay, AK, field experiments (without oil at temperatures -20 degrees F); • March 2006 Svalbard, Norway, field experiments with oil under ice.
2005	North Slope Nearshore & Offshore Breakup Study	Provides an analysis of ice conditions and the dates associated with seasonal transitions in the nearshore and offshore Beaufort Sea environments including the lagoon areas inside the barrier islands affected by major river overflows. More information available at: http://dec.alaska.gov/spar/ipp/nscharter.htm

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2005	Viscous Oil Pumping Studies	Continuation of previous work. Tested a range of North Slope pumps in North Slope liquids to determine their capability. Tested a range of additional annular injection unit types. Measured viscosity and pump rates resulting from treatments of a range of oils with a range of emulsion breakers. Developed pump well and lids accommodating hard pipe sections and cargo level gauging for mini barges. Developed ready-to-go prototype annular injection packages for skimmer pump, mini barge pump and vacuum truck pump.
2005	ADEC Tundra Treatment Manual	Updated the manual with new tactics. The purpose of this manual is to provide a menu of tactics which can be used to treat and monitor tundra impacted by spills of crude oil, petroleum products, seawater, and other substances after initial response efforts have eliminated the threat of large-scale spill migration. More information is available at: http://dec.alaska.gov/spar/perp/r_d/ttman/tt_man.htm
2005–2006	Spill Related Analysis of North Slope Crude Oils	Oil characteristics affecting recovery and transfer planning were determined by laboratory tests. The viscosity, emulsification tendency, specific gravity, and evaporation rates of crude oils from 11 North Slope sources were measured.
2005–2009	SINTEF Oil in Ice Joint Industry Program (JIP) Support	Provided support through Alaska Clean Seas. The objective of the JIP Oil-in-Ice project led by the Norwegian research group SINTEF was to “further develop tools and technologies for environmental beneficial oil spill response strategies for ice-infested waters.” The project culminated with a large-scale field trial with actual releases of oil in ice-infested waters (FEX 2009). The FEX 2009 was carried out in the period May 9–25, 2009, east of Hopen, Norway, in the Barents Sea.
2006	Alaska Commercial Fisheries - Water Quality Sampling Methods and Procedures Manual	This manual presents scientific water-quality sampling methods to assess potential contamination of commercial fishery resources and gear in Alaska waters during an oil spill. It is intended for oil spill response personnel and fishery managers as they assess and manage the risk to commercial fisheries during spill events. The manual presents both a general discussion of factors for consideration in designing a sampling program after a spill event, and a description of specific methods and procedures. More information available at: http://dec.alaska.gov/spar/perp/wq/wq_manual.htm
2006	Spill Tactics for Alaska Responders (STAR) Manual	This project led to the development of a statewide spill response tactics manual for use by the spill response community, including federal, state, local, industry, and spill cooperatives throughout Alaska. The final product is available for general use by the spill response community in Alaska, and also serves as a means for the oil industry to meet contingency planning requirements. More information available at: http://dec.alaska.gov/spar/perp/star/index.htm

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2006	De-Ice Rope Mop Skimmer Studies	Methods of de-icing rope mop skimmers in cold temperatures were examined. The research included a literature review of the state-of-the-art in de-icing technology, and a series of small-scale tests at the SL Ross laboratory to evaluate candidate technologies.
2006	Pour Point Depressants Studies	Measure the affect of pour point depressors on the viscosity and “pump-ability” of cold, viscous recovered and stored oil and oil emulsions. Pour point depressors are introduced in ppm. They are typically used in some oil production processes, but had not yet been examined for spilled oil transfer.
2006 and ongoing	Potential Places of Refuge (PPOR)	<p>PPOR are pre-identified sites that may aid decision-makers in responding to vessels in distress. These plans are tailored to protect sensitive areas from impacts from possible spills and are map-based to save time during the critical first few hours of a vessel response. The following is a summary of the PPOR initiatives thus far by subarea:</p> <ul style="list-style-type: none"> • Aleutians (completed in 2007) • Bristol Bay (project to be initiated over next 1–2 years) • Cook Inlet (completed in 2007) • Kodiak (completed in 2006) • North Slope (project to be initiated over next 1–2 years) • Northwest Arctic (project to be initiated over next 1–2 years) • Prince William Sound (completed in 2008) • Southeast Alaska (2008, to be completed in 2010) • Western Alaska (project to be initiated over next 1–2 years) <p>More information is available at: http://dec.alaska.gov/spar/perp/ppor/home.htm</p>

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2007	Vessel Emergency Towing System (ETS)	<p>Develop emergency towing capabilities for disabled vessels using locally available tugboats in conjunction with ETS equipment that may be stationed in strategic locations in Alaska or air deployable via US Coast Guard or other assets.</p> <ul style="list-style-type: none"> • Unalaska (2007; two systems in place) • Kodiak (2009) • Two additional systems to be purchased in 2010–2011 (Southeast Alaska; Anchorage air deployable system) <p>More information is available at: http://dec.alaska.gov/spar/perp/aiets/home.htm</p>
2007	International Oil & Ice Workshop, 2007	<p>Workshop on advancing spill response in cold water and ice. Provided an opportunity to bring together an international audience with this common interest. The two-day technical program was made up of presentations by recognized experts on a wide range of key topics including:</p> <ul style="list-style-type: none"> • International Arctic oil and gas developments • Ice environments • Ice-going vessel technology • Remote sensing • Enhancements to mechanical recovery systems • Chemical herders in ice • Cold-water dispersants • Experimental spills • Case studies • Ongoing and future research programs
2007	Mechanical Recovery Systems for Ice-Infested Waters – Examination of Technologies for the Alaskan Beaufort Sea	<p>A report identifying the existing state-of-technology for mechanical recovery in sea ice, and investigating any new mechanical recovery systems that may be transferable for use in ice-infested waters.</p> <p>More information is available at: http://dec.alaska.gov/spar/ipp/nscharter.htm</p>
2007	Beaufort Sea Current Study	<p>A report describing analyses designed to estimate the distance and direction an oceanic oil spill could travel during each of the two primary circulation regimes found in the nearshore Beaufort Sea: (1) under landfast ice during winter and (2) in open water or partial ice cover during summer.</p>

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2008	Alaska In Situ Burning Guidelines	The Alaska in situ burning guidelines are used by the Alaska Department of Environmental Conservation, US Coast Guard, and US Environmental Protection Agency on-scene coordinators to authorize an emergency in situ burn of oil. More information is available at: http://dec.alaska.gov/spar/perp/docs/ISB-Rev1(Final-August%202008).pdf
2008	Ground Penetrating Radar (GPR) Workshop and Demonstration	A two-day GPR workshop was held on the North Slope to familiarize ADEC, ADNR, BPXA, ConocoPhillips, and ACS spill response personnel in using the GPR. ACS now has an operational GPR system on the North Slope.
2009–2010	Airborne GPR for Detecting Oil In and Under Ice	Continued studies of airborne supported ground penetrating radar (GPR) for detecting oil under sea ice. This project focuses on hardware development that will produce two prototype, higher-powered GPR systems that can be tested in Arctic field environments using commonly available light helicopters. The goal is to significantly expand the practical operating window for oil detection on and under sea ice with GPR to cover a wider range of sea ice and climate conditions.
2009–2010	ADEC Tundra Treatment Manual	The initial document was produced in 2001. Additional research and studies are warranted to validate the procedures in the document, and documenting results of actual case studies of past spills that have impacted the tundra. Work includes field investigations and revising the guidelines, followed by changes to the manual, then production and distribution. More information is available at: http://dec.alaska.gov/spar/perp/r_d/ttman/tt_man.htm
2009–2010	Oleophilic Skimmer Research	In controlled conditions of cold and broken ice, test the effects on the Crucial disc skimmer's operation and durability and the skimmer's oil recovery rate and efficiency including the skimmer's ice-processing capability. In a test tank, measure the effects and recommend skimmer modifications to reduce ice interference in order to maximize recovery rate. Follow modified ASTM F2709 procedure as applicable to the conditions. These tests follow-up on Ohmsett tests that were conducted in non-Arctic conditions.
Ongoing	ShoreZone Mapping	ShoreZone is a mapping and classification system that specializes in the collection and interpretation of low-altitude aerial imagery of the coastal environment. Its objective is to produce an integrated, searchable inventory of geomorphic and biological features of the intertidal and nearshore zones, which can be used as a tool for science, education, management, and environmental hazard planning. Subareas with some if not entire coverage include Southeast Alaska, Prince William Sound, and Cook Inlet. For complete project description and status, visit: http://alaskafisheries.noaa.gov/habitat/shorezone/szintro.htm

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		For other R&D projects, see: http://dec.alaska.gov/spar/perp/r_d/research_list.htm