Prince William Sound Regional Citizens' Advisory Council
Chemical Dispersants Program
1997 – April 2006

Introduction

Chemical dispersants are substances applied to spilled oil that disperse oil into the water column rather than leaving it floating on the surface in a slick. The Prince William Sound Regional Citizens' Advisory Council (the Council) has long endorsed mechanical recovery as the primary tool to combat an oil spill. Unlike dispersant use, mechanical recovery with booms and skimmers removes oil from the water.

Current state and federal laws and regulations hold that dispersants should be used only if it is clear that mechanical cleanup methods such as booming and skimming won't work. The Council supports these laws, opposes efforts to loosen these restrictions, and urges regulatory agencies to take a conservative approach towards the use of dispersants.

The Council promotes research and testing to increase knowledge about dispersants and the environmental consequences of their use. Among the Council's concerns is the scarcity of reliable scientific data about the efficiency, toxicity, and persistence of dispersants and dispersed oil in Prince William Sound and Gulf of Alaska conditions.

There has not been a conclusive demonstration that chemical dispersants work in the extremely cold waters of Prince William Sound. Although effort has been put into evaluating chemical dispersant use over the last 30 years, a good portion of this effort was conducted by the formulators of dispersants and not by independently funded surfactant scientists.

The purpose of this document is to describe the research efforts put forth by the Council in evaluating chemical dispersant use. The Council also routinely comments on dispersants related regulations (including Alaska Regional Response Team activities) and dispersants related issues that come up during oil spill drills. This paper will not cover this aspect of the dispersants program.

Background

The investigation into dispersant use falls under specific responsibilities outlined in the Oil Pollution Act of 1990 (OPA 90) including:

- monitoring developments in oil spill prevention, containment, response or cleanup technology; and
- conducting independent scientific research.

Even beyond OPA 90 responsibilities, the citizens of the region have consistently expressed concern over chemical dispersant use. The citizens should expect that chemical dispersant use is effective. They should also be fully aware of the risk involved in using chemical dispersants, if they are indeed proven effective for use in our region. Determining what oil spill response tool to use (or no action) in any particular situation requires knowledge of environmental trade-offs

and there are still areas regarding dispersant use that we know little about (fate and effects, long-term studies).

In 1998, the Council adopted a position paper on the use of dispersants. In 2003, the Scientific Advisory Committee adopted a position on the use of dispersants. In April 2006, the Scientific Advisory Committee adopted a revised position, as well as recommended a revised position to the Council.

Research

With our own research, we have been pursuing two tracks: Do dispersants work in the colder waters of our region? Is toxicity an issue, both in the short-term and long-term? Many of these reports can be found on our public website and links are provided.

Are Dispersants Effective in Alaskan Waters?

The Council has sponsored a number of projects to date that address this question.

- The Council contracted with the National Oceanic and Atmospheric Administration's (NOAA) Auke Bay Laboratory to test the effectiveness of dispersant Corexit 9527 and Corexit 9500 in dispersing various states of weathered Alaska North Slope (ANS) crude oil using a combination of realistic subarctic salinities and temperatures. At temperatures and salinities most common in the marine waters of Alaska, the dispersants were less than 10 percent effective at dispersing fresh or weathered ANS crude in these laboratory tests.

  "Effectiveness in the Laboratory of Corexit 9527 and 9500 in Dispersing Fresh, Weathered, and Emulsion of Alaska North Slope Crude Oil under Subarctic Conditions," by Adam Moles, Larry Holland, and Jeffrey Short, Auke Bay Laboratory, 2001.
  http://www.pwsrcac.org/docs/d0001400.pdf

- *Ohmsett dispersant observations*
  The Ohmsett dispersant test tank is a 2.6-million-gallon open-air saltwater test tank on the Atlantic seacoast and operated by the U.S. Minerals Management Service (MMS). It was created to test mechanical oil spill recovery equipment. Crude oil can be put on ocean water in the Ohmsett tank and sprayed with dispersants with little risk of release to the natural environment.

  In March 2002, the Council sent an observer to the Ohmsett cold-water dispersant tests conducted by Exxon and MMS. The Council disagreed with many of the test parameters and is concerned that tests like this have the potential for determining policies for dispersant use. In March 2003, the Council sent an observer to another dispersant test at Ohmsett conducted by MMS. The reports from these tests outlined several areas that needed improvement.

  Report on Visit to Ohmsett to Observe Exxon/MMS Cold-Water Dispersant Tests. Stan Jones, Prince William Sound Regional Citizens' Advisory Council. March 2002.
  http://www.pwsrcac.org/docs/d0001500.pdf

Report on Ohmsett Cold-Water Dispersant Tests. Stan Jones, Prince William Sound Regional Citizens' Advisory Council. February 2003.

Two major concerns have emerged from the 2002 dispersant effectiveness tests in cold water conducted at Ohmsett. The Council is concerned that oil used in the cold water tests was heated far above ambient water temperature before being dispersed, and that dispersant volumes in those tests were under-reported. These concerns are outlined in a full technical report and a shorter summary.

Heated Oil and Under-Reported Dispersant Volumes Mar MMS/Exxon Cold Water Dispersant Tests at Ohmsett: Prince William Sound Regional Citizens' Advisory Council. July 2004.
http://www.pwsrcac.org/docs/d0001600.pdf

- *Pending Ohmsett Reports*
  - Review of 2003 Ohmsett Tests by Dr. Jim Payne
  - Review of December 2005 Emulsified Oils Ohmsett Tests by Dr. Jim Payne
  - Review of Ohmsett cold water testing, February 2006 by Dr. Merv Fingas and Elise DeCola

- *Wave Tanks*
  The use of the Ohmsett facility lead the Council to ask Dr. Merv Fingas of Environment Canada to write a white paper outlining the critical factors involved in conducting wave tank testing of chemical dispersants. Dr. Fingas detailed 17 critical factors.

  A White Paper on Oil Spill Dispersant Effectiveness Testing in Large Tanks: Merv Fingas, Environment Canada. November 2002.
  http://www.pwsrcac.org/docs/d0001700.pdf

  The Council was invited in 2004 to visit a newly developed wave tank in Halifax, Nova Scotia. The tank is a joint venture by the Environmental Protection Agency and the Department of Oceans and Fisheries in Canada. It is a much smaller tank compared to Ohmsett and has the added feature of a full service laboratory on site.

  Trip Report: Oil Dispersant Meeting and Wave Tank Demonstration, August 25, 2004 by Lisa Ka'aihue.

- *Field Testing*
  In a report to the Council, Dr. Merv Fingas of Environment Canada identified important issues that must be considered when determining appropriate field tests of dispersants. These issues include the ability to determine a mass balance, the use of proper controls, sound analytical methods, and weathering of the oil. This report also explains experimental design, technology, and proper methodology necessary to conduct an accurate dispersant field test.

Review of Monitoring Protocols for Dispersant Effectiveness: Merv Fingas, Environment Canada. August 2003.
http://www.pwsrcac.org/docs/d0001800.pdf

Dr. Fingas also provided the Council with a paper that reviews field monitoring of the effectiveness of oil spill chemical dispersants and examines considerations related to monitoring dispersant use.

A White Paper on Oil Spill Dispersant Field Testing: Merv Fingas, Environment Canada. May 2002.
http://www.pwsrcac.org/docs/d0001900.pdf

- *Other Effectiveness Issues*
  In an effort to understand better how chemical dispersants work on Alaska North Slope crude oil in the waters of our region, the Council tasked Dr. Merv Fingas with providing a summary of the effects of water salinity on chemical dispersion. The resulting report concludes that salinity does play a role in dispersant effectiveness. There are geographic and seasonal areas in Prince William Sound where low salinities are prevalent. It is unlikely that the standard dispersants would work well in these areas.

  Dispersants, Salinity and Prince William Sound: Merv Fingas, Environment Canada. December 2004.
  http://www.pwsrcac.org/docs/d0002000.pdf

  As a result of the observations of the Ohmsett wave tank tests, resurfacing became a topic of interest to the Council. Recently, Dr. Merv Fingas finalized a white paper on resurfacing of chemically dispersed oil. Dr. Fingas reviewed the literature to develop this paper which concludes that on average, dispersed oil has a half life of 12 hours.

  Stability and the Resurfacing of Dispersed Oil by Merv Fingas, Environment Canada. November 2005.
  http://www.pwsrcac.org/docs/d0026200.pdf

  Dr. Fingas was tasked to provide a review of the Alyeska-commissioned report "White Paper on Emulsification of ANS Crude Oil Spilled in Valdez" by SL Ross. Dr. Fingas outlines more recent and relevant emulsification data that calls into question the results of the SL Ross white paper on the subject. The SL Ross report puts forth the concept that ANS crude is getting more difficult to emulsify and thus dispersible for a longer time frame.

  A Review of the Emulsification Tendencies and Long-term Petroleum Trends of Alaska North Slope (ANS) Oils and the "White Paper on Emulsification of ANS Crude Oil Spilled in Valdez" by Dr. Merv Fingas.
  http://www.pwsrcac.org/docs/d0024800.pdf

Is chemically dispersed Alaska North Slope Crude oil safe to the environment?
In addition to the effectiveness question regarding dispersants, the Council has expressed many concerns over the toxicity of chemically dispersed oil. The following research areas have been pursued by the Council.

- *Photoenhanced Toxicity*
  Photoenhanced toxicity is the increase in the toxicity of a chemical in the presence of ultraviolet light compared to a standard laboratory test conducted with fluorescent lighting. Since standard dispersants toxicity testing has traditionally been conducted in a laboratory setting with fluorescent lighting, the Council wanted to know how natural lighting might affect the toxicity of chemically dispersed oil. The first paper, by Ms. Elise DeCola, was a general review of photoenhanced toxicity research.

  Dispersed Oil Toxicity Issues: A Review of Existing Research and Recommendations for Future Studies by Elise G. DeCola, December, 1999.

  Dr. Mace Barron, an expert in photoenhanced toxicity, was tasked by the Council to develop a white paper on the issue as it could relate to our region. The author concluded that photoenhanced toxicity was a factor that needed to be considered when chemically dispersing oil into the waters of Prince William Sound and the Gulf of Alaska.

  Potential for Photoenhanced Toxicity of Spilled Oil in Prince William Sound and Gulf of Alaska Waters. Mace Barron. March 9, 2000.
  http://www.pwsrcac.org/docs/d0002100.pdf

  Dr. Barron, in conjunction with NOAA's Auke Bay Laboratory, completed a Council-sponsored research project into photoenhanced toxicity of Alaska North Slope crude oil to herring, an important commercial fish species in Alaska. The research found that undispersed oil was phototoxic—that is, it became more poisonous when exposed to ultraviolet light—and that dispersed oil demonstrated similar or greater phototoxicity.

  Photoenhanced Toxicity of Aqueous Phase and Chemically-Dispersed Weathered Alaska North Slope Crude Oil to Pacific Herring Eggs and Larvae Final Report. Mace Barron, Mark Carls, Jeffrey Short, Stanley Rice. February 11, 2002.
  http://www.pwsrcac.org/docs/d0002200.pdf

  Dr. Barron in collaboration with Auke Bay Laboratory and researchers from Duke University was then asked to determine if weathered Alaska North Slope crude oil would be phototoxic to juvenile pink salmon under conditions of short-term exposures to high levels of oil that may occur during an oil spill, and environmentally relevant levels of ultraviolet light in natural waters. The results of this study indicated that pink salmon are at less risk from photoenhanced toxicity compared to early-life stages of several other Alaska species. Thus, additional research with dispersants in this area was not recommended or pursued.

Assessment of the Phototoxicity of Weathered Alaska North Slope Crude Oil to Juvenile Pink Salmon Final Report. Mace Barron, Mark Carls, Jeff Short, Stanley Rice, Ron Heintz, Michelle Rau and Richard Di Giulio. December 2, 2003.
http://www.pwsrcac.org/docs/d0002300.pdf

In support of photoenhanced toxicity research/issues, the Council started a UV monitoring program in Prince William Sound beginning in 2002. The last seasonal measurement was just taken in January 2006, although routine monitoring will continue in Port Valdez. Dr. Barron is preparing a manuscript for journal submission. Exxon supported scientists embarked on their own UV monitoring project subsequent to the hiring of Dr. Barron and presented results at a recent SETAC conference, including their own herring photoenhanced toxicity testing. Their results were quite different than the work of Dr. Barron and Auke Bay Laboratory.

- *Toxicity Testing Recommendations*
  To begin addressing toxicity concerns beyond photoenhanced toxicity, the Council commissioned a white paper that reviews standard toxicity testing protocols developed by the Chemical Response to Oil Spills: Ecological Research Forum (CROSERF). CROSERF is made up of university researchers, petroleum company representatives, and government representatives. This white paper outlines refinements to the CROSERF protocols to make them useful for subarctic chemical dispersants testing.

  Critical Evaluation of CROSERF Test Methods for Oil Dispersant Toxicity Testing under Subarctic Conditions: Dr. Mace Barron, January 29, 2003.
  http://www.pwsrcac.org/docs/d0002400.pdf

Other Dispersants Related Reports

- *Weather Windows for Oil Spill Countermeasures*
  Weather is the single most important factor in choosing and obtaining success with oil spill countermeasures—mechanical recovery, chemical dispersants, and in-situ burning. To better understand the "windows of opportunity" associated with each countermeasure, the Council contracted with Dr. Merv Fingas of Environment Canada to prepare a white paper describing the weather limitations of the countermeasures. The two most important factors described by Dr. Fingas are wind and wave height. Other weather factors of importance include current speed and temperature.

  Weather Windows for Oil Spill Countermeasures: Merv Fingas, Environmental Technology Centre, Environment Canada. January 2004.
  http://www.pwsrcac.org/docs/d0002500.pdf

- *Oil Spill Response Techniques Efficiency Review*
  In an attempt to better understand the various nearshore oil spill response technique efficiency rates, the Council commissioned Elise DeCola of Nuka Research and Planning, LLC to review moderately sized spills in the United States between 1993 –

2000. The review included categorizing the responses by types and estimating, based upon the available response information, efficiency rates for the various techniques used including dispersants mechanical recovery.

Review of Oil Spill Response Techniques on Moderately-Sized Spills in US Waters from 1993 – 2000. Elise DeCola, Nuka Research and Planning, LCC. March 2004. http://www.pwsrcac.org/docs/d0002600.pdf

- *Dispersant Literature Reviews*
  To aid the Council in its investigation of dispersants, two literature reviews were commissioned. The reviews are focused on the question of efficacy in cold waters. The most recent review, written by Dr. Merv Fingas of Environment Canada, reviews literature between 1997 and 2000. The earlier report, by SL Ross Environmental Research, reviews literature prior to 1997.

  A Review of Literature Related to Oil Spill Dispersants Especially Relevant to Alaska: Merv Fingas, Environmental Technology Centre, Environment Canada. March 2002. http://www.pwsrcac.org/docs/d0002700.pdf

  A Review of Dispersant Use on Oil Spills of North Slope Crude Oil in Prince William Sound and the Gulf of Alaska" by S.L Ross Environmental, May 1997. Not on the website.

Summary

Since 1997, the dispersants research program has primarily focused on effectiveness issues, with a lesser emphasis on toxicity (primarily photoenhanced toxicity).