

**SUMMARY:**  
**ECOLOGICAL SIGNIFICANCE OF RESIDUAL EXPOSURES AND EFFECTS**  
**FROM THE *EXXON VALDEZ* OIL SPILL**

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**IV. INTRODUCTION: A HOLISTIC LOOK AT THE CONDITION OF PRINCE WILLIAM SOUND'S ECOSYSTEM TODAY**

The following is a summary of a scientific article that assesses the current state of the ecological system in Prince William Sound, Alaska, and evaluates any lingering environmental effects from the *Exxon Valdez* oil spill that occurred 17 years ago.

When the spill occurred on March 24, 1989, the oil had an immediate and devastating effect on wildlife and the environment. But, as the *Exxon Valdez* Oil Spill Trustee Council has noted, "As the years passed, it has become more difficult to distinguish the lingering effects of the *Exxon Valdez* spill from other potential sources of environmental stress or natural variations."

The study, conducted by two independent scientists who led the development of ecological risk assessment framework for the U.S. Environmental Protection Agency, differs from other scientific works as this is the first to evaluate the entire ecological system – as opposed to specific parts of it, such as the status of a single species, water quality or any lingering effects on the food supply found in locations close to the few remaining, isolated pockets of oil.

The article was presented Nov. 14, 2005 at the Society of Environmental Toxicology and Chemistry's 26<sup>th</sup> Annual Meeting in North America and is scheduled to be published.

The complete article is available at <http://www.valdezscience.com>. This website presents the scientific analyses of independent scientists who have been studying the fate and effects of the 1989 Exxon Valdez oil spill on the environment in Prince William Sound. These environmental scientists have years of experience studying oil spills throughout the world and have been following recovery in the Sound since their initial studies in 1990 and 1991. This work is supported by ExxonMobil Inc.

**V. BACKGROUND: A Framework to Assess Risk and Explanation of the Critical Issue of "Ecological Significance"**

The research is based upon the EPA's framework for ecological risk assessment, which has been adopted by the scientific community as a common approach to systematically assess and evaluate existing, potential, or anticipated risks to the environment from human activities.

The EPA framework, which the authors had the lead role in developing while working with the agency, uses multiple lines of evidence to gain an understanding of the magnitude and likelihood of adverse ecological effects from human activities in order to make informed decisions regarding environmental risk, based upon the best available scientific data and understanding.

The framework also is used to help answer the critical question of whether or not the environmental responses that occur or remain are *ecologically significant*, and to determine at what point in time after an event the residual responses are no longer ecologically significant.

This is important because ecosystems are complex, diverse, dynamic and continuously changing as they are subject to a range of both natural and human events or “stressors.” For instance, any human activity, from one person walking along a stream bank to a massive spill of crude oil, causes some biological response somewhere in the system. That response could be as insignificant as crushing a few sand fleas to as consequential as the killing of significant portions of fish and bird populations. The key is to distinguish those responses that are ecologically significant from all of the noise of natural variability, and to distinguish the effects from the *Exxon Valdez* oil spill from all the other stressors, whether natural or human-caused, that affect Prince William Sound.

In the end, the seminal questions addressed in the research by Dr. Mark Harwell and Dr. John Gentile were not whether sources of hydrocarbons from oil continue to exist, but whether they pose a significant risk today to the populations and communities comprising the Prince William Sound ecosystem, and to assess if any ecologically significant effects remain from the initial consequences of the oil spill and its clean-up activities.

### **III. STUDY: A HOLISTIC APPROACH**

Since ecosystems have so many different aspects, the EPA framework calls for identifying and then assessing the “health” of various attributes of an ecosystem that are considered important ecologically and/or societally. An example of an ecologically important attribute is a keystone species, such as the American alligator as a habitat-creating species. A socially important attribute would include endangered species or species that are economically important to a region, such as commercial or recreational fisheries. Once these so-called “valued ecosystem components” are identified, multiple lines of evidence are examined to interpret the information and assess the ecological significance of any lingering effects from the oil spill.

During the course of their study, Dr. Harwell and Dr. Gentile:

- Reviewed more than 500 published scientific reports on the status of more than 20 “valued ecosystem components,” including bald eagles, clams, cormorants, Harlequin ducks, mussels, Pacific herring, pink salmon, sea otters, black oystercatchers, common murre, harbor seals, marbled murrelets, orca, pigeon guillemots, river otters, and sockeye salmon. Similarly, they looked at studies conducted on intertidal communities, subtidal communities, the food chain structure of Prince William Sound and the Gulf of Alaska, water quality, designated wilderness areas, and the landscape mosaic of habitats.

- Applied the *ecological significance* criteria to determine any significant or lasting effect on the ecosystem.
- Factored into their evaluation the effects of other human and natural forces affecting the ecosystem of Prince William Sound, such as climate and oceanographic variability; rapidly expanding tourism and shipping in Prince William Sound; over-fishing in the Northern Pacific; natural oil seeps; and the 1964 Alaska earthquake, which caused extensive habitat alteration and releases of stored oil into the Sound.

## **VI. KEY FINDINGS: *PRINCE WILLIAM SOUND'S ECOSYSTEMS HAVE RECOVERED FROM THE OIL SPILL***

Based upon their study, the authors concluded:

- There are no significant or lasting effects from the spill on the ecosystem today, with the exception of one pod of orcas and possibly of one subpopulation of sea otters. Delays in the recovery of that one pod of orca are attributable to the low birth rate and long life span of killer whales rather than any continuing exposures from the oil spill. The one subpopulation of sea otters may or may not be reduced from pre-spill levels, but other factors, such as new predation by transient orcas, are more likely causes of current numbers at that one location. However, in both cases, the Prince William Sound-wide populations have fully recovered.
- The extent and volume of residual oil from the spill is restricted to a few small, isolated deposits totaling about 27 acres scattered throughout the Sound's 3,000-mile shoreline. In much of those remaining areas, the residual oil sources were either highly weathered or were covered by sediments and thus are released into the coastal environment only episodically (otherwise, the residues would long since have left the system).
- Analyses of multiple sources of evidence indicate that residual concentrations of polycyclic aromatic hydrocarbons (chemicals known as PAH found in crude oil and many other sources which can be harmful under some circumstances), in the sediment, water, food chain, and wildlife have declined steadily over the past decade and no longer represent a significant ecological risk to Prince William Sound.
- The PAH concentrations in the intertidal food sources (e.g., mussels) of a range of animals and birds are not significantly different today in spill and non-spill areas and have returned to background levels.
- It is difficult – if not impossible – to determine the exact source of low-level hydrocarbon contamination in fish or mammals because there are so many sources of hydrocarbons in Prince William Sound. These range from natural oil seeps into the eastern Gulf of Alaska (that may migrate in the water into the Sound) to pollution from roads, boats, and abandoned industrial facilities.

“The *Exxon Valdez* oil spill in 1989, and especially the associated clean-up activities, clearly caused significant ecological effects in PWS at that time and for months to a few years thereafter,” wrote Dr. Harwell and Dr. Gentile. “However, at present both natural variability and the occurrence of multiple (human) stressors not associated with *Exxon Valdez* oil spill overwhelm any potential residual ecological effects of the spill. The physical stressors from (the spill) are completely gone. The chemical stressors from (the spill) are essentially gone, with the few remnant (oil spill) source areas having comparable magnitude to other human activity sites, with the chemical releases from those remnant sites incapable of affecting the Prince William Sound ecosystem in an ecologically significant way. The only arguably residual significant effect appears to be for one pod of orca, but not for the Prince William Sound population as a whole; this continuing effect does not derive from continuing direct or indirect toxic chemical exposures, but rather appears to relate to long-term dynamics of altered social structure caused by the loss of key matriarchs, partly as a result of *Exxon Valdez* oil spill effects and partly as a result from preceding mortality from human conflicts over fish. All of the other endpoints listed by the Trustees as not having recovered in fact either have attained recovered conditions based on ecological significance criteria, or are responding to other natural and/or (human) stressors that have nothing to do with the *Exxon Valdez* oil spill or its cleanup activities.”