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Exxon's Perspective of the Environmental Effects of Oil Spills

--Summary of a presentation by Don Malins to the Management Team on July 26, 1990--

Oil company "scientific" evaluations of oil spill effects on aquatic environments have evolved over several decades. The established concepts are cherished and any attempt to cast doubt on their credibility will be met with great resistance. This is especially true in the legal arena where precedence may be established which shatter the integrity of long-standing arguments.

Traditional arguments will be used in Exxon's legal defense; however, the longer term goal will be to defend and protect oil company doctrine on oil spill effects.

One of the first arguments is that hydrocarbons are present in all marine environments; thus, an oil spill simply increases hydrocarbon concentrations substantially above background. Hence, "recovery" represents a return to background concentrations. "Clean" is said to be a return to hydrocarbon concentrations that have no significant impact on the function of ecosystems.

Recovery of an ecosystem begins as soon as the hydrocarbon toxicity has declined to the concentration tolerated by "the most robust organisms." Recovery is said to occur even in the presence of residual oil. Thus, the stage is set for predicting recovery, even when oil is present at a variety of locations and has contaminated a wide spectrum of aquatic species.

How does one know when recovery has occurred? When there is "a healthy community" in which animals are "functioning normally." Nevertheless, it is recognized that recovered ecosystems "may not have the same composition of age structure." Thus, the door is left open to argue that recovery is not <u>literally</u> a return to pre-spill conditions.

Oil spills are only one of many events that alter ecosystems. Thus, it is difficult, if not impossible, to determine whether an ecosystem has recovered "in that it is the same or different from that which would have developed in the absence of the spill." Extrapolating even further, recognition is given to the fact that ecosystems are in a constant state of flux due to natural causes.

These fluctuations are said to be as great, or greater, than those arising from an oil spill. The "take home" message is that oil spills are akin to naturally occurring events.

Natural cleaning processes are high on the list of positive forces mitigating the effects of oil spills. It is argued that evaporation of "the most toxic" volatile components(e.g., naphthalene) is a major step toward detoxification of the spilled oil. So are microbial and photooxidative conversions which increase the water solubility of the oil and facilitate its dispersion and dissolution. The oxidation products in the oil are said to progressively leach from the oil surface and then rapidly diffuse to low concentrations in the water column. Thus, ecological impacts are unlikely to occur.

The toxicity of the water column under a slick is considered to be insignificant. This is because the concentration of hydrocarbons under the slick seldom exceeds 100 parts per billion (ppb). In fact, it is usually much less than 100 ppb. Moreover, the slicks themselves will ultimately form tar balls that sink to the ocean floor where they are essentially harmless to fish and shellfish.

Little concern exists about the impact of oil on "high energy rocks" in that these substrates do not tend to accumulate oil and are subjected to rapid "natural cleaning."

Oil may persist, buried in sediments; however, evidence suggests that this does not pose a significant threat to the survival of aquatic populations in the area.

Recognition is given to the visually obvious casualties of oil spills. No attempt is made to deny that diving sea birds, for example, suffer heavy mortalities. However, it is claimed that these mortalities are "not significantly different" from "natural" mortalities or those arising from fishing operations. Basically, oil spill-related impacts are put in the same category as recurring natural and human-induced perturbations in aquatic systems.

An important extension of the above arguments is the concept that no evidence exists to show that sea bird populations are declining as a result of oil spills. Often cited in support of this position are increases in bird populations in the North Atlantic which occur despite heavy losses of birds from oil spills.

A lack of demonstrable effects of oil spills on fish populations is emphasized. Basically, the only real casualties are claimed to be rockfish and other fish that inhabit occluded environments near shore where they can be entrapped, or otherwise exposed to high oil concentrations. Overall, the point is made that fish stocks fluctuate dramatically under natural conditions. In fact, the size

of the "catchable stocks" is largely determined by the practices of the fishing industry. Hence, "over-fishing" is singled out as being more influential in promoting the decline in fish stocks than oil spills.

A variety of laboratory studies have clearly documented the sensitivity of early developmental stages of fish and shellfish to oil exposure. This fact is not contested; however, the claim is made that even substantial losses of eggs and larvae do not have a significant effect on populations of fish and shellfish because massive mortalities are a natural occurrence with early developmental stages. Once again, the concept is put forth that only <u>population</u> effects are relevant measures of oil-related ecological injury. This is convenient because population changes are extremely hard to quantify.

Oil spill effects on plankton are conveniently explained away. While deaths of these organisms may occur in abundance, the contention is that no evidence exists to suggest that ecosystems are affected, at least in open waters--although they may be affected for "several months" in closed waters. Again, if an effect cannot be demonstrated at the population or ecosystem level it is of little importance as far as oil spills are concerned.

The claim is made that there is virtually no data on the effects of oil spills on marine mammals. Thus, implications to populations, the main focus of the oil company's concerns, are not possible to assess. On this basis, impacts on marine mammals are given little consideration.

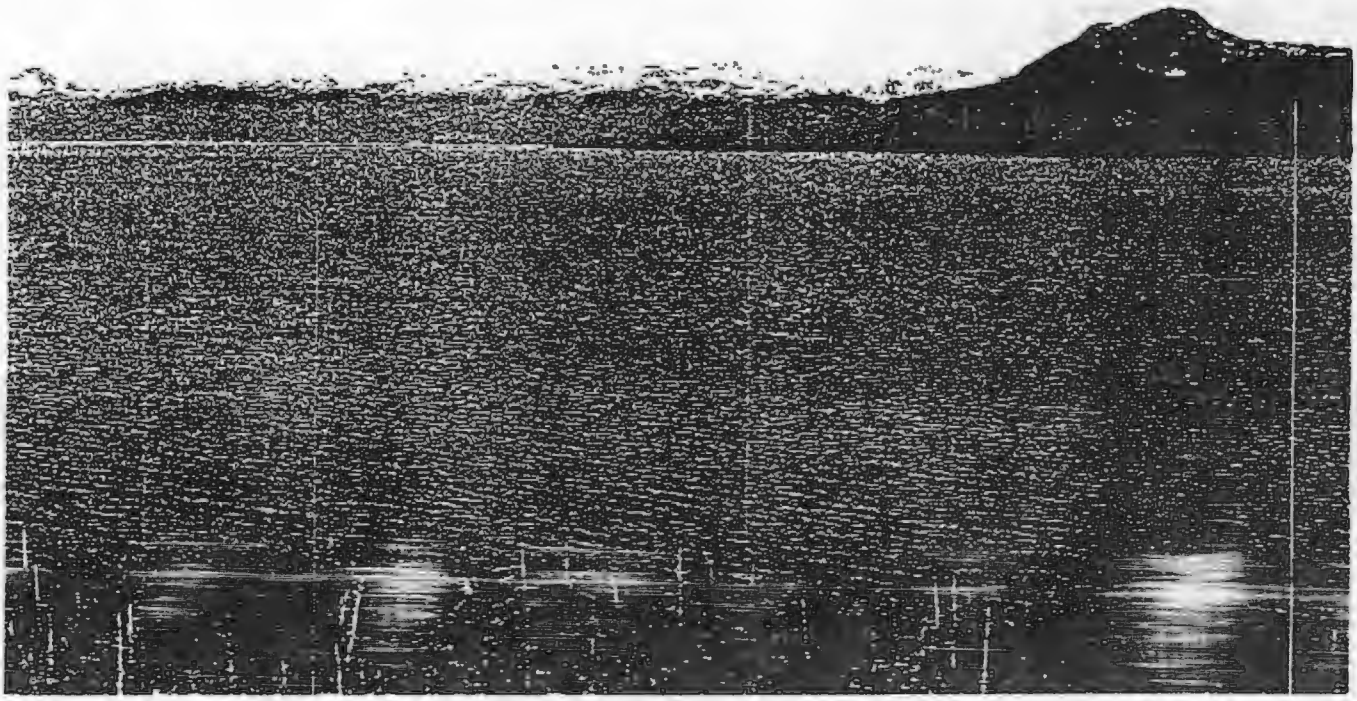
The active recovery process, which is pivotal to the oil company's case, is believed to vary in relation to various biotic and abiotic factors: Exposed rocky shores may recover in two to three years, whereas marshes and sheltered, highly productive areas, may take as long as ten years. It is important to recognize that an oil spill-related "down time" in the viability of aquatic ecosystems is accepted by Exxon.

Most of the oil company's arguments are based on effects observed at oil spill sites. Accordingly, sublethal effects (and laboratory studies in general) are believed to provide no substantive indication of "long-term" ecological injury and are thus not worthy of much consideration.

What is the overall message? Perhaps it is this: There are visually obvious oil-related impacts on coastal shorelines; however, effects on populations of organisms--the truly significant, if not the <u>only</u> relevant measure of injury to the

biota--are seldom evident in the aftermath of oil spills. Moreover, any ecological changes that may occur tend to mirror those occurring naturally or as a result of human activities, thus diminishing their overall ecological significance. It is within this framework that Exxon will attempt to limit its responsibility for the Prince William Sound oil spill. Thus, the federal-state legal/scientific teams need to consider Exxon's arguments very carefully in formulating a coherent legal theory.

NOTE: Attached is a copy of "Water Quality in Prince William Sound": A Summary of Findings from the Report by Jerry M. Neff, Ph.D (April 1990). Neff is a consultant for Exxon.



Water Quality in Prince William Sound

April, 1990

A summary of findings from the report by

Jerry M. Neff, Ph.D.
Senior Research Leader
Battelle Ocean Sciences
Duxbury, Massachusetts

Battelle
Putting Technology To Work

WATER QUALITY IN PRINCE WILLIAM SOUND

Within six days of the oil spill in Prince William Sound, Alaska, independent contract research organizations (Arthur D. Little Marine Sciences, Battelle Ocean Sciences, Kinnetic Laboratories, Inc. and the Alaskan firm, America North, Inc.) were engaged by Exxon to monitor the distribution, concentrations, and changes over time of petroleum hydrocarbons in the water column (the area between the ocean surface and above the sea floor) throughout Prince William Sound.

The studies ran from March through October of 1989. During that period, more than 2,300 offshore and nearshore water samples were taken from 61 locations throughout the Sound (Figure 1). Sampling sites included three of the most heavily oiled areas at Smith Island, the Bay of Isles, and Herring Bay. Both state and federal agencies were involved in the selection of sample stations, and state representatives were present on most of the field surveys.

Battelle Ocean Sciences used the findings of the four firms, along with extensive scientific research on the effects of previous oil spills, to compile a report entitled Water Quality in Prince William Sound. The report was written by Dr. Jerry M. Neff, Senior Research Leader of Battelle Ocean Sciences. This brochure presents and explains the primary conclusions from Dr. Neff's report.

WHAT ARE THE SCIENTIFIC FACTS?

- It is extremely unlikely that hydrocarbon concentrations resulting from the spilled oil have had or will in the future have any adverse effects on plants and animals living below the surface in the water column of Prince William Sound, including commercial fishery species.

- Despite initial damage to plants and animals occupying the ocean surface or living on heavily oiled shores, there have been no verified reports of mortalities or adverse effects on animals living in the water column.

- Concentrations of petroleum hydrocarbons below the water surface in the water column have remained consistently low since early April, 1989 (Figures 2 and 3). In most cases, they are 10 to 1000 times below the concentrations found to cause harm to marine animals.

- Throughout most of the open waters of Prince William Sound, the concentrations of potentially toxic components of oil -- volatile aromatic hydrocarbons (VOA), such as benzene, toluene, and xylene, and polycyclic aromatic hydrocarbons (PAH), such as naphthalene and phenanthrene -- returned to essentially background levels by May, 1989, and have remained there ever since (Figures 2 and 3).

- Remaining microscopically-thin surface sheens of weathered crude oil in several heavily oiled bays contain only traces of potentially toxic PAH, and do not pose a hazard to water column organisms or to wildlife occupying the sea surface.

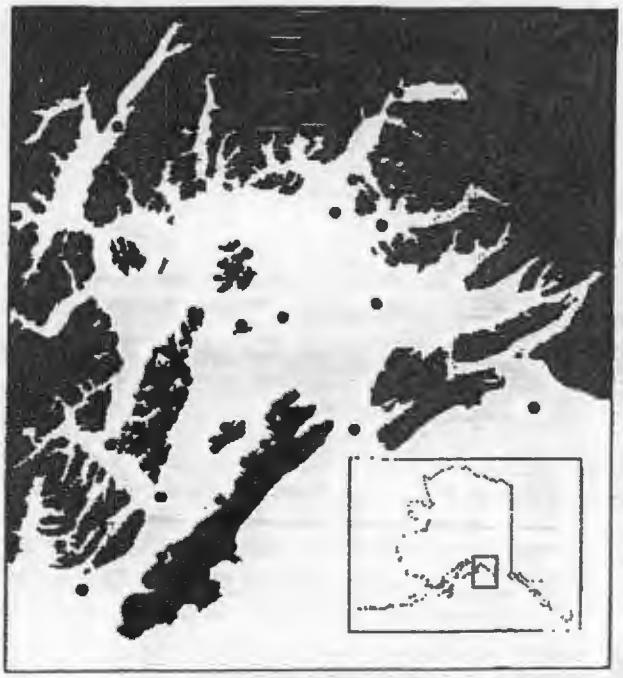


Figure 1: Offshore Sampling Stations in Prince William Sound

SOME IMPORTANT QUESTIONS AND ANSWERS

Q. *What assurances can citizens have that the study was thorough and accurate?*

A. The Prince William Sound water quality study is the most comprehensive water study of its kind in history. To ensure that water quality was tested accurately, frequent sampling was begun soon after the spill. Over 2,300 samples were collected through October, 1989. Well-documented and audited procedures were used during both sampling and analysis. Independent laboratories were used for all sampling and analysis. In addition, representatives of the State of Alaska were present as observers during field surveys.

Q. *What did the scientists find?*

A. Scientists found that for a brief period in April-May, 1989, in regions of the Sound where the oil spread, there was an increase in the upper water column in the average concentration of aromatic hydrocarbons -- the potentially toxic components of crude oil. However, these slightly elevated average concentrations were always well below the State of Alaska standard for aromatic hydrocarbons in marine waters. In May, they returned to background levels.

Q. *Will the levels of aromatic hydrocarbons found in the water column of Prince William Sound make fish sick, and will they cut down on fish production?*

A. Average water column concentrations of aromatic hydrocarbons, the toxic fraction of oil, are now and have consistently remained below levels that are known to be harmful to plants and animals, such as phytoplankton, zooplankton, and fish larvae. Adult species of fish are even more resistant to harmful effects, since they have the ability to rapidly break down aromatic hydrocarbons and excrete them.

Q. *How can studies predict the long-term effect of a major oil spill on water column plant and animal life, including commercial fish species?*

A. In making predictions, scientists are able to draw upon the findings of other research into the short and long-range effects of other oil spills, such as the Amoco Cadiz, which was six times larger than the one at Valdez. The Cadiz study, for example, showed that potentially toxic hydrocarbon concentrations did not persist in the edible tissues of fish. Based on this and other studies, there is no reason to anticipate any harmful effects in 1990 and beyond of the remaining spilled oil on water column organisms, including commercially-important herring and salmon populations.

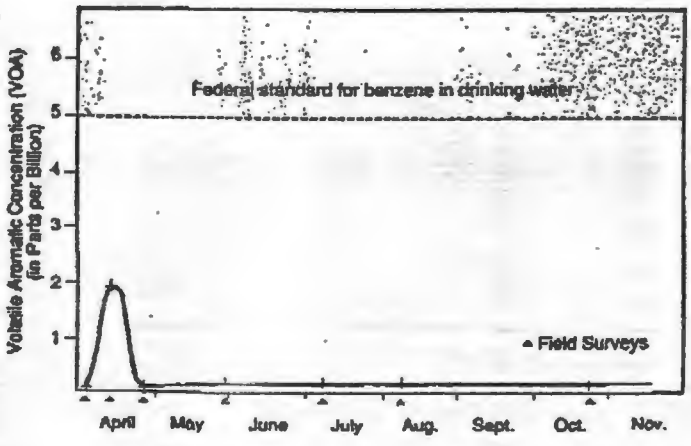


Figure 2
Average Volatile Aromatic Concentrations
for Primary Sites

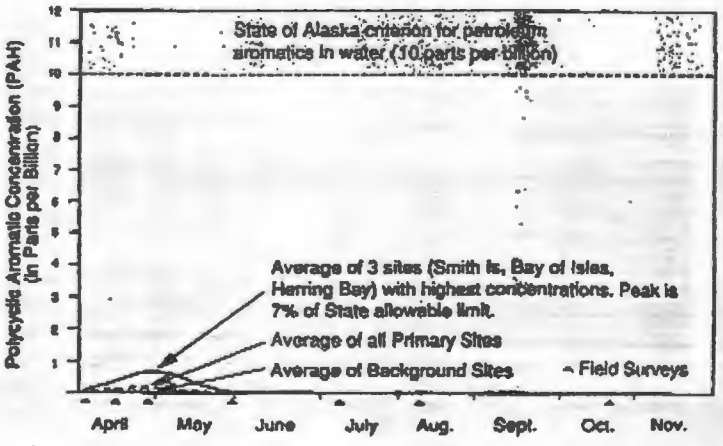


Figure 3
Average Polycyclic Aromatic Concentrations

About Battelle

Battelle Memorial Institute is one of the world's largest independent research organizations with a staff of over 7,500 research and support personnel in four major research centers and other specialized facilities around the world. At its Ocean Sciences' marine research facility in Duxbury, Massachusetts, Battelle provides contract research and management services to government and private industry in the areas of marine chemistry, toxicology, and biological and physical oceanography. Battelle brings state-of-the-art science to bear on the development and analysis of information required for the effective management of ocean resources.

About Arthur D. Little

Arthur D. Little, Inc. (ADL) is a multinational technology and management professional services company with headquarters in Cambridge, Massachusetts. Its 2,500 staff members undertake consulting assignments in some 60 countries through its international network of offices and laboratories. ADL's internationally recognized Marine Sciences Unit conducts complex field and laboratory assignments that include oil spill natural resource damage assessments, offshore oil production and exploration issues, harbor and coastal management, and pollution monitoring.

About America North, Inc.

America North, Inc. is an Alaska-based environmental consulting/management company. Areas of specialization include site investigation, environmental sciences, health and safety, and database management. Employing a staff of 50 professionals, America North offers clients a full range of services backed by a wide range of experience. America North is familiar with Alaska, having worked throughout the state from Prudhoe Bay on the North Slope to the temperate Southeast.

About Kinnetic Laboratories, Inc.

Kinnetic Laboratories, Inc. is a specialized firm offering oceanographic and environmental science services in the biological, chemical, and physical disciplines. Their expertise in the biological sciences is particularly comprehensive and widely recognized. Kinnetic has extensive experience in studying trace pollutant problems in marine systems. Kinnetic also has a long history in Alaska, and has the logistical and field capabilities to obtain high quality data.

About the author

Dr. Jerry M. Neff, Senior Research Leader with Battelle Ocean Sciences, is an internationally recognized authority on the fate and effects of pollutants in marine and freshwater environments. During the past 20 years he has participated in or managed more than 100 basic or applied research projects dealing with the effects of pollutants on estuarine and coastal marine ecosystems. Dr. Neff is author or co-author of over 120 articles and reports and has written two books dealing with petroleum and aromatic hydrocarbon pollution of aquatic environments as well as a major literature review on recovery of pollution-damaged marine ecosystems. He has been a member of three review panels of the U.S. National Academy of Sciences, one of which dealt with petroleum in the marine environment.

Copies of the full report may be obtained by writing:
Dr. Jerry M. Neff, Battelle Ocean Sciences
Duxbury Operations
397 Washington Street, P.O. Drawer AH
Duxbury, Massachusetts 02332-0601