DRAFT

RESULTS OF THE ALASKA WORKSHOP ON OIL SPILL ECOLOGICAL DAMAGE ASSESSMENT

NOVEMBER 27-30, 1977

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ANCHORAGE, ALASKA

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ACKNOWLEDGEMENTS

The Workshop Coordinator expresses sincere thanks to each participant whose dedicated effort made the Alaska Workshop an exceptional success. The Alaska Workshop was the second in a series of Workshops aimed at developing regional response plans for oil spill damage assessment, and the Alaska Workshop participants have well used the experience of a previous Workshop to progress further toward the Workshop Program goal. The Alaska Workshop has been especially fruitful in identifying potential scientific resources and in refining contingency response mechanisms. Special appreciation is extended to officials of EPA Region X and NOAA for hosting the Workshop, and to Carol O'Toole and Carl Eidam for substantial assistance in Workshop planning and administration.

John Robinson
Workshop Coordinator

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INTRODUCTION

The imbalance between domestic oil production and demand has resulted in increased transportation of crude oil and petroleum products in United States coastal waters. This imbalance has also encouraged the development of oil resources previously considered to be unfeasible for economic or technical reasons. In Alaska, the development of North Slope and offshore oil resources has increased the frequency of occurrence of spill incidents in Alaska coastal waters and has also increased the probability of future exposure of Alaska marine and coastal ecosystems to oil pollution.

To date, the emphasis in national emergency spill response programs has been directed toward minimizing the exposure of natural systems to spilled oil. The National Oil and Hazardous Substances Pollution Contingency Plan, for example, provides a quick response interagency capability for identification, containment, mitigation, and restoration operations in the event of accidental discharges. Unfortunately, no parallel capability exists with respect to evaluation of the ecological consequences of oil spills. This was demonstrated by shortcomings in the scientific response to the Argo Merchant spill off Nantucket Island in December 1976.

The Alaska Workshop on Ecological Damage Assessment is part of a Workshop Program recommended to the National Response Team by a Task Force on Ecological Damage Assessment (Keystone, June 1977). The aim

of the Workshop Program is to produce a series of Regional Environmental Response Plans that will provide a quick response scientific support element composed of the most highly qualified experts from Federal, state, academic, and private sectors. Ultimately, the Workshop Program will lead to the incorporation of a scientific response capability in the National Contingency Plan. The first Workshop, held at Hartford, Connecticut during August 1977, made a valuable contribution to this effort by clarifying national aspects of scientific response and identifying scientific resources and response strategies pertinent to oil spills in the New England Region.

The Alaska Workshop is the second in the series, and treats environmental response to oil spills in the coastal waters of Alaska. The main body of the Workshop met at Anchorage during November 27-30, 1977. An Alaska Workshop Annex, consisting of three panels, was held in Seattle on December 1 and 2 in conjunction with a NOAA program review meeting. In total, 177 invited experts contributed to the Workshop (see Appendix F).

In developing an Alaska scientific response capability, the Workshop aimed to identify regional scientific expertise and resources, and to outline problems peculiar to Alaska coastal waters. Specifically, the Alaska Workshop addressed three scientific response goals:

(1) To provide On-Scene Coordinators with highly qualified scientific advice in mitigating environmental impact.

(2) To assess the environmental damage and socioeconomic impact resulting from oil spills.

(3) To maximize the research advantage offered by a spill situations, especially with respect to improving our capability for future response.

The main work of the program was entrusted to panels dealing with 13 scientific and technical subject areas. Plenary Sessions provided background on the Workshop Program, perspective on Alaska problems, explanation of existing contingency response plans and procedures, and review of Workshop progress. Executive Committee Meetings addressed organizational aspects of Alaskan scientific response and further considered national scientific response policies, including the development of recommendations to the National Response Team. The Workshop Schedule is shown in Appendix A.

The Alaska Workshop provides an excellent information base for the development of an Alaska Environmental Response Plan for Coastal Oil Spills. Such a plan will be prepared within the next several months.

PLENARY SESSIONS

Overview

All participants were invited to attend plenary sessions. These meetings were intended to provide overall guidance on Workshop objectives and procedures, to keep participants abreast of Workshop progress, and to facilitate the exchange of ideas among panels and between panels and the Executive Committee. Four plenary sessions were held: one at the start of the Workshop on the morning of November 28th; the second and third on November 29th; and a fourth at the close of the Workshop on November 30th.

First Plenary Session

The first plenary session (November 28th) included the following presentations:

- Introduction to the Workshop

  John Robinson (NOAA)
  Workshop Chairman

A brief review of Workshop objectives and background. The Anchorage meeting is the second of a series of workshops aimed at developing effective scientific response plans for oil spill emergencies. Major preceding events include the Argo Merchant incident, the subsequent recommendations of an NRT Task Force on Ecological Damage Assessment, and the Hartford Workshop for New England coastal waters held during August 1977.

- Welcoming Address

  Wilmot Hess
  Acting Deputy Administrator
  National Oceanic and Atmospheric Administration

Participants were welcomed on the behalf of the Administrators of EPA and NOAA. The end result of the Workshop program will be a national plan for scientific response to oil spills that will promote improved coordination and planning among Federal agencies and ensure state participation. The Workshop should conclude with the basic elements of a response plan completed. Three important needs are:

1) Identification of available scientific resources and their coordinated application.

2) A mechanism to match scientific capabilities to the characteristics of individual spills.

3) Improved quantitative ecological damage assessment capabilities.

- State of Alaska's Oil Spill Responsibilities

Ernst Mueller
Commissioner
Alaska Department of Environmental Conservation

Participants were welcomed on behalf of the Governor and State of Alaska. The Alaska Department of Environmental Conservation has emphasized prevention and contingency planning, rather than scientific aspects of oil spills. Key points that should be considered in response planning are:

1) Environmental restoration needs following cleanup operations. There is a basic underlying conflict between the extraction of non-living resources and the exploitation of living resources.

2) The need to objectively measure impacts of spills, including consideration of socioeconomic and legal aspects.

3) The need for flexibility in response activities to account for various Alaska environments and to readily modify the plan as required.

4) State of Alaska experience with oil spill contingencies, including cooperation with Federal agencies, should be useful in identifying requirements of a response plan.

- Federal Involvement in Assessing the Environmental Impact of Oil Spills

Kenneth Biglane
Division of Oil and Special Materials
U.S. Environmental Protection Agency
(Chairman, National Response Team)

A review of Federal activities on oil spill damage assessment. Comprehensive Federal efforts began in 1968 with the development of the first National Contingency Plan based on interagency agreements, and have evolved substantially since then. The Workshop program is

especially timely in view of proposed "superfund" legislation that will involve dollar evaluations of spill-related environmental damage. Scientific input will be required to make fair, just and rational assessments of damage. In another development, EPA will soon publish a list of about 300 hazardous substances to be covered under the National Contingency Plan. Important points that the Workshop should address include:

1) Long-term effects of spills on ecological systems.

2) Effects of spills on fisheries and other economic resources.

- Crisis Science: Investigations in Response to the Argo Merchant Oil Spill

Andrew Pollack
Reporter
Dallas Times Herald

A review with slides of the scientific response to the Argo Merchant spill of December 1976 that resulted in the discharge of 7.5 million gallons of No. 6 oil off Nantucket, Massachusetts. The scientific response was massive (e.g., at least 70 surveillance flights, 10 trajectory models, and more than 200 scientists, a cost of more than $1 M), but not generally effective or efficient due to both scientific and institutional problems. Among the major deficiencies were:

1) Untimely procurement and deployment of equipment

2) Lack of organizational leadership in the scientific response

3) Lack of sufficient communications

4) Insufficient funding arrangements.

Oil spill response is a complex activity and requires substantial pre-planning.

- Cleanup Operations and Equipment Needs

Ray Morris
Alaska Operations Office (Region X)
U.S. Environmental Protection Agency

and

Lt. Michael Macie
Marine Safety Office (Anchorage)
U.S. Coast Guard

Macie reviewed potential conflict and overall relationship of On-Scene Coordinator (OSC) needs and scientific activities. To fulfill his legal responsibilities, the OSC has three basic needs from the scientific community:

1) Sufficient data for an initial evaluation of the spill, including the types and amounts of material discharged, potential severity, and feasibility of removal.

2) In-depth assessment of response activities, particularly the effectiveness of measures undertaken by the discharger and the need for Federal intervention. Major concerns are cleanup and disposal operations.

3) Documentation of scientific and technical information collected.

There are three pre-designated Alaska Coast Guard OSCs--for Juneau, Valdez, and western Alaska. The Regional Response Team (RRT) is headquartered in Juneau and chaired by Capt. Cox, U.S. Coast Guard. The RRT is automatically activated for major spills to support the OSC who is the responsible Federal official. Scientific support should be tailored to the needs of the OSC and available on the regional and local level. Specific OSC needs include:

1) Information on the fate of discharged material

2) Pertinent meteorological and current data

3) Estimated effects of discharges, including location of landfall and impacts

4) Feasibility of recovering spilled oil

5) Documentation of scientific and technical information.

A single scientific contact is needed for the OSC to transmit advice and to make requests.

Morris reviewed response procedures for spills in Alaska inland waters and his responsibilities as OSC. EPA has an inland contingency plan, and specific response activities are decided on a case-by-case basis. The line of mean high tide defines the limit of EPA OSC jurisdiction, and the Coast Guard OSC assumes responsibility for inland spills that reach the coastal zone. Existing contingency mechanisms involve close cooperation with Alaska state agencies, and are effective for small spills. They are probably not adequate for large spills. The primary responsibility of the OSC is for life and property; cleaning and assessment may then be considered. Important considerations for contingency planning are: the need for adequate communications; the need to reduce the number of decisions to be made in the field; and the difficulty of logistics under Alaska conditions. Among the specific informational and related items that should be obtained in response to a spill are:

- Photographic records
- Data on spill volume
- Information on rate of movement, spread and direction of spilled oil
- Meteorological data
- Information on waves and currents
- Physical properties of spilled oil
- Biological properties of spilled oil
- Significant resources subject to potential impact
- Priority areas for protection
- Shoreline assessments of damage

The OSC is the focus for spill response activities for inland waters. EPA is now preparing an operations and spill response manuals.

- <u>State of the Art: Oil Spill Cleanup Equipment</u>

Lt. Gordon Marsh
Arctic Response Program
U.S. Coast Guard

A review with slides of the current state of oil spill countermeasures. For vessels in imminent danger, the response regime is based on off-loading of oil. The Coast Guard self-contained ADAPTS unit is a principal tool for off-loading; it is air deliverable, has a loading capacity of up to 1000 gals/min, and can operate in

high seas. Cleanup procedures in the event of a spill are much more difficult and complex and require an integrated system made up of various elements. These may include mechanical barriers, oil recovery equipment, and integrated skimmer/barrier systems. Capabilities for fast current conditions are now under development, and various techniques are being employed for oil removal under ice conditions (e.g., onshore vacuum trucks, special skimmers). Burning is a feasible alternative for removal under arctic conditions. Flaring with compressed air is utilized for disposal of recovered oil, and pit burners are used to destroy oil-fouled organic materials.

- Plan for the Workshop

John Robinson
Workshop Chairman

Panel Chairpersons were introduced, and Workshop organization and anticipated results were reviewed. The overall schedule provides for sequential treatment by the panels of each of the three Workshop objectives, beginning with the provision of scientific support to the OSC (except for the Legal Aspects and Facilities Panels). Identified categories on on-scene advice that should be addressed as appropriate are:

1) Trajectory modeling,

2) Spill behavior,

3) Extreme environmental conditions,

4) Cleanup strategies,

5) Identification of critical habitats, and

6) Fouling of marine birds and mammals.

The panels were requested to address questions such as: Who will respond? How will expertise be reached? What geographic constraints and environmental conditions apply? What pre-spill work is needed? What will be the cost? The role of the Executive Committee was reviewed, procedures for submission and typing of material were outlined and Carole O'Toole was introduced as the Workshop Administrator.

Second Plenary Session

The Plenary Session on the morning of November 29th included a presentation by the Legal Panel on legal guidance to scientists on natural resources damage assessment. There are no clear uniform scientific information requirements for use in legal actions, and the development of suitable information requires close interaction between scientists and lawyers on a case-by-case basis. Some general guidelines for evidence are as follows:

1) Civil cases are decided on the basis of the preponderance of evidence, not scientific or criminal standards of certainty.

2) Expert scientific opinion is valid and acceptable.

3) Full documentation of observation and findings is essential. Evidence must be fully developed: don't assume anything and don't rely on memory.

4) The body of information must stand on its own. Record all steps in data collection and analysis.

The following are legal elements that must be proven before liability can be attached and for which scientific evidence can be developed:

1) The spill occurred
   --photographs; oil and water analyses; physical evidence (e.g., fouled birds)

2) Party X caused the discharge
   --oil from source; suitable claim of custody procedures

3) There was an impact
   --baseline information; statistically reliable data collections; information on important resources and species

4) The spill caused the impact
   --develop best available information including expert opinion

5) The dollar value of the impact
   --includes: economic loss; value of property injured or destroyed; cost of restoration; loss of income; reduced value of resource; losses of taxes and royalties.

The area of environmental law is new and there is currently little case law or precedence dealing with damages to natural

resources. No major spill claims have yet been fully settled in court. The Panel addressed questions from the floor dealing with: the applicability of criminal law to natural resource damage cases; status of "superfund" legislation; potential Aleyeska liabilities; use of trajectory models and oil identification ("finger printing") as evidence; statutes of limitations; attorney's fees; attaching values to non-commercial species; handling of "soft" evidence; implications for publication of results; and assigning values to ecological systems versus number of organisms.

The session also included a slide talk by Frank R. Fisher, an Alaska fisherman, who reviewed inadequacies in previous Alaska oil spill response efforts and the lack of public confidence resulting therefrom. The Workshop was urged to approach scientific responsibilities in terms of achievement of harmony between man and the Alaska environment, and to make the best use of available knowledge for technological control.

Paul Lefcourt (Narragansett Environmental Research Lab., EPA) reviewed the 14-point project description format. Panels were urged to use the Hartford Workshop results to the greatest extent feasible and to consult the Canadian Beaufort Sea Response Plan in the case of the Arctic Panel.

Third Plenary Session

The afternoon plenary session of November 29th involved a brief review by each Panel Chairperson of progress and problems to date.

Fourth Plenary Session

The final plenary session of November 30 included:

1) A call for all panel reports.

2) A review of post-Workshop plans for the immediate future, including: the production of a draft Workshop report, preparation of a letter report to the National Response Team, and preparation of an interim Alaska response plan.

3) Results of the Executive Committee designating NOAA as the lead agency for Alaska coastal spills, and anticipated naming of a Scientific Coordinator by NOAA to assume this responsibility.

4) Suggestions by Michael Garcia of the Legal Panel regarding scientific assistance to the legal community in damage assessment actions.

5) Thanks to all participants by the Workshop Chairman for their contributions.

PANEL MEETINGS

Overview

The major scientific effort of the Workshop was carried out in panels organized according to the following topical areas:

- Microbiology/Biodegradation
- Laboratory Toxicity
- Chemical Analyses/Fates
- Physical Processes
- Supporting Facilities
- Arctic Spills
- Inland Spills
- Legal Aspects
- Histopathology
- Benthic Biology
- Water Column Biology
- Marine Birds and Mammals
- Socioeconomic Considerations

The panels concerned with Microbiology/Biodegradation, Laboratory Toxicity and Histopathology attended the Workshop Annex in Seattle; all the remaining panels met at Anchorage.

Panel meetings were chaired by authorities in the respective subject areas (see Appendix B). Panel Chairpersons were invited to attend a Workshop orientation session held in Seattle on October 25, 1977. Panels were directed to treat sequentially each of the following three Workshop subjects:

(1) Provision of expert scientific advice to the OSC in support of cleanup and containment operations.

(2) Assessment of environmental and socioeconomic damage resulting from oil spills.

(3) Identification of research opportunities afforded by major spills, primarily with the aim of improving existing assessment and operational capabilities.

The Workshop Schedule (Appendix A) allotted time for the panels to address each of the three support functions. To the greatest extent possible, recommended research projects were described according to a 14-point format which addressed cost, facility and personnel requirements, and feasibility as well as the practical and scientific payoff of a project (see Appendix C).

Results of the individual panels are presented in following sections.

MICROBIOLOGY/BIODEGRADATION PANEL

Participants

R. M. Atlas, Chairperson

G. Wolf	P. Griffiths
D. Westlake	D. Button
Y. Morita	R. Vestal

MICROBIOLOGY/BIODEGRADATION PANEL

General Information and Guidance

- General Considerations
- Objective 1: Support to the OSC
- Objective 2: Damage Assessment
- Objective 3: Recommended Research

GENERAL CONSIDERATIONS

The Microbiology/Biodegradation Panel felt it was fortunate to have access to the material produced at the Hartford and MESA/OCSEAP Workshops. The projects proposed by this panel are more comprehensive than those previously proposed at Hartford. In many ways an oil spill response program in Alaskan waters can benefit from background information developed by OCSEAP. The Panel also felt that the recommendations for Alaska could be applied to the Oregon and Washington coasts without major alteration (i.e., the program could be applied to the entire EPA Region X). Further the panel felt that terrestrial and fresh water ecosystems could be treated with only minor modifications of marine studies. The Panel emphasized the importance of the interactions of microorganisms and petroleum pollutants and thus the importance and relevance of carrying out these projects in response to and in preparation for inevitable oil spill incidents.

The Microbiology/Biodegradation Panel considered microbiological studies that might be performed to assist the On-Scene Coordinator, to aid in oil spill damage assessment, and studies that would be of a basic research nature. The Panel formulated five projects to address these areas.

OBJECTIVE 1: SUPPORT TO THE OSC

One proposed project (No. 3) deals specifically with assisting the On-Scene Coordinator. This project would be done in preparation for a spill emergency and constitutes an ongoing effort to deal with changes in oil spill cleanup technology. This preparation for OSC support applies to any coastal area of the United States, and could be performed by a number of microbiological groups not directly concerned

with Alaskan work. The project could be supported under existing EPA or NOAA programs and would not be contingent on outside sources of funding.

OBJECTIVE 2: DAMAGE ASSESSMENT

The panel recognized the importance of microorganisms in marine ecosystems and felt that microbiological studies were essential for ecologic damage assessment. There are several laboratories currently conducting projects for EPA, NOAA or ERDA which would have the capability of performing damage assessments. There is no assurance however that such laboratories would maintain the needed state of readiness.

Projects 1 and 2 would be useful in performing environmental damage assessment. For quick and effective implementation of these projects, it was suggested that a sampling group or technician be trained and on-call, and the necessary supplies for initial sampling be stockpiled at a convenient location. This necessitates the provision of funding to maintain fresh supplies (e.g., replacing media and chemicals on a semiannual basis).

With respect to both projects, no single laboratory exists that could meet all of the objectives described in these projects, therefore, a coordinated microbiological effort would be needed with different laboratories responding to different aspects of the required work within their own areas of expertise.

OBJECTIVE 3: RECOMMENDED RESEARCH

Projects 4 and 5 were proposed to enhance damage assessment capabilities with regard to microbiology and biodegradation. Project No. 4 is an extension of OCSEAP and MESA programs and is intended to generate important background information on microbial communities along oil transportation routes. Project No. 5 would develop a model for prediction of hydrocarbon concentrations in the water column. Information gained from these projects would make a significant contribution to the prediction of environmental damage resulting from spilled oil.

MICROBIOLOGY/BIODEGRADATION PANEL

Recommended Projects

1. The impact of spilled oil on the microbial community.[b]

2. Microbial degradation of contaminating oil.[b]

3. Recommendations for support to the On-Scene Coordinator.[a]

4. Reconnaissance of microbial communities in high risk areas and determination of biodegradability of oils likely to be spilled.[c]

5. Dissolved hydrocarbon concentration decay model.[c]

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[a]Support to the OSC

[b]Damage Assessment

[c]Research

PANEL: MICROBIOLOGY/BIODEGRADATION
PROJECT NO: 1
PRIORITY RANK: 2-3

1. Project Title: The Impact of Spilled Oil on the Microbial Community

2. Project Description:

This project will determine the impact of the oil on the microbial community by determining population changes, changes in metabolic activities and changes in food web relations. Normal functions of the microbial community are essential for maintaining fertility of seawater and ecological balance. Changes in the microbial community will affect higher organisms.

*A. Determine changes in bacterial populations

1. Biomass

a. Direct count

(1) Epifluorescent method

2. Viable Heterotrophs

a. MPN method

3. Viable hydrocarbon utilizers

a. MPN ^{14}C spiked oil method

**4. Taxonomic Shifts

a. Numerical Taxonomy (diversity, fitness)

b. Classical Taxonomy (specific taxa eg. pathogens)

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*We have considered methods from the Hartford meeting and MESA Technical Bulletin ERC-16, and recommend these methods.
**Costly and time consuming.

*B. Determine Changes in Metabolic Functions

1. Heterotrophic Potential

   a. Initial reaction (Hobbie-Wright heterotrophic potential measurements)

      (1) Use of high specific activity glucose, glutamic acid.

   b. Follow-up: Single subtrate concentration uptake measurements

2. Hydrocarbon biodegradation potential

   a. ^{14}C spiked crude oil as substrate for oxidation rate determinations for surface water, sediment and ice.

   b. Rates of utilization of low concentration ^{14}C labeled pure hydrocarbons for water column work, (eg. low molecular weight aromatics benzene, toluene, 1-10 g/liter range).

3. Mineral Cycling

   a. Chitin and/or cellulose degradation rates using ^{14}C *substrates and/or cellulace potentials*

   b. Nitrogen fixation rates (acetylene blockage)

   c. Sulfide generation capability using MPN method.

**C. Food Web Interactions

   a. Changes in cropping rates on bacteria by higher forms

   b. Concentration of hydrocarbons (crude oil) and crude oil degradation products by bacteria and

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*We have considered additional methods from the Hartford meeting and MESA Technical Bulletin ERC-16 and recommended these methods.
**Very difficult and time consuming, see Project No. 4.

the incorporation of these compounds into the rest of the food chain.

c. Effects on microbial chemotaxis

3. Performing Organizations:

A. Initial response (sampling only) - any trained person or organization

1. Initial response team could take first samples on-site and start simple "canned experiments from pre-established packages.

2. The team should be trained and supplied by PI's charged with the specific responsibilities listed below.

B. Follow-up Studies (initiated within 1-2 days after the spill).

1. Population studies

Dr. Ronald Atlas, University of Louisville, Louisville, KY
MPN Methods, Numerical Taxonomy

Dr. Don Westlake, University of Alberta, Edmondon, Alberta
MPN Methods

Dr. Don Button, University of Alaska, Fairbanks, Alaska
MPN Methods

2. Metabolic Changes

Drs. Griffiths and Morita, Oregon State University Corvallis, Oregon
Heterotrophic Potentials, Nitrogen Fixation, Cellulose, Chitin Degradation

Dr. Don Westlake, University of Alberta
MPN Methods, Classical Taxonomy

Dr. Robie Vestal, University of Cincinnati Cincinnati, Ohio
Heterotrophic Potentials

Dr. Ronald Atlas, University of Louisville
Hydrocarbon Degradation, Cellulose, Denitrification, Nitrogen Fixation

Dr. Don Button, University of Alaska
Soluble HC Studies

3. Food web interactions

Dr. Richard Morita, Oregon State University and Dr. Ronald Atlas, University of Louisville working with Dr. Howard Feder, IMS, University of Alaska
Accumulation in Food Chain, Cropping

Dr. Robie Vestal, University of Cincinnati
Cropping Studies

4. Applicable Habitats:

Near shore environments (water column, sediment, intertidal area, surface waters) for all microbiological studies.

Open Ocean Environments - only when the oil spill can be tacked. In open ocean environment only water column microbiology for population changes, metabolic changes. (No microbial work on food web, unless oil on bottom can be found).

Inland lakes and Terrestrial systems.

5. Applicable Conditions:

The main consideration will be the level and type of logistic support that might be available. See sections 9 and 10. If personnel, equipment and laboratory facilities can be brought to the spill site, the studies proposed can be conducted.

6. Applicable Oil Type:

Any petrochemical

7. Time Frame:

A full time effort on the part of all participating personnel for any significant spill. Should be multiyear up to 7 years.

8. Cost:

Spill of 100,000 barrels - all areas covered

1st year	$ 30,000	5th year	$125,000
2nd year	$240,000	6th year	$125,000
3rd year	$250,000	7th year	$125,000
4th year	$125,000		

9. Equipment Needs/Equipment Available:

Niskin Samplers
Sediment Samplers (Smith McIntyre, Box Corer)
pH Meter
Temperature Probe
Various types of Microbiological Glassware
Ice Chest
Incubators
Portable Sterilizer for Field Work
Colony Counter
Epifluorescent Microscope
Consumable Items (media, millipore and nucleopore filters, radioisotopes petri dishes, pipettes, etc.)
Freezers
Dry ice making capability
Sterilizers, Ice Machine

10. Facility Needs/Facilities Available:

A. The initial response studies (0-72 hr. post spill) could be made from small craft or helicopter.

B. Follow-Up Studies

1. Marine spill

a. Research vessel of the size of the NOAA ship Miller Fleenar with standard oceanographical capabilities

(1) Lab space of approximately 20 bench ft. with associated storage

(2) Living accomodations for 4-6 people

(3) Laboratory facilities at major institutions for full workup and analysis of data.

2. Terrestrial spill (land or fresh water)

a. Portable lab or any other facility having the above capabilities for lab space and living accomodations

b. Aircraft Support

(1) Minimum Requirement: Bell 205 helecopter or equivelant or:

(2) Fixed wing aircraft of twin otter size or larger, or float plane

11. Personnel Needs/Personnel Available:

Initial Response - 1 person trained to take samples immediately.

Secondary Response - Individuals from various laboratories with various areas of expertise, such as those current in OCSEAP and MESA microbiology programs

12. Support Services:

Data input from chemist (eg. analysis of hydrocarbons and nutrients).

Data from physical oceanographers (eg. currents, tides, etc.)

Various sample organisms from benthic biologists.

Data indicating areas impacted, and treatment of spill (eg. dispersants and type).

Support facilities (additional costs). (Data management and statistical analysis.)

13. Payoff:

This is an extension of OCSEAP studies currently underway and would give a unique opportunity to study the direct impact of crude oil on microbial community under in situ conditions. There is no other practical method currently available

that could be used to fully understand the impact of crude oil on essential microbial processes. If these studies show a significant alteration of transfer of bacterial biomass to higher trophic levels in response to an oil spill, this effect could be transfered into terms of economic loss to commercially valuable species. These studies may also be used to show whether an area was impacted in a way that biological systems could detect and respond to.

14. Limitations:

Available funds

Qualified personnel

Logistics

Available methodology

Conversion of results to dollar impact of spill

PANEL: MICROBIOLOGY/BIODEGRADATION
PROJECT NO: 2
PRIORITY RANK: 2-3

1. Project Title: Microbial Degradation of Contaminating Oil

2. Project Description:

To determine the microbial induced changes in the composition of the contaminating oil. Microorganisms are responsible for the ultimate degradative removal of the oil. This project will permit determination of the fate and persistence of the oil. Much of this project would be accomplished by providing microbiologists with data gathered by analytical chemical groups and having the microbiologists interpret the data.

A. Chemical analyses of residual oil in:

Surface slick, ice, sediment, beach areas; water column. Analyses should include packed column GC and spectrofluorometry for major changes GC-MS, etc. as done by the chemical group for detailed changes.

B. Biodegradation potential

1. Population determinations by MPN in project No. 1.

2. Degradation potential using spiked oil (^{14}C-16) and metabolism of small aromatics (^{14}C - benzene or toluence) at 1-10 μg/l concentrations).

C. Limiting factors

1. Surface slick - and solid water (ice)

a. Molecular size - chemical group

b. Physical state (e.g., viscosity) - observation

c. Mineral content

2. Water column

a. HC concentration (chemical group)

b. Temperature

c. Microbial predators

d. Nutrients

3. Sediment and/or beach or soil

a. Redox potential (O_2 availability)

b. Thickness of oil on sediment/beach

c. Nutrients

D. Analysis of treatment induced changes

1. Eutrophication - Chlorophyll Analysis

primary production ($^{14}CO_2$ uptake), microbial biomass

2. Extent of micellar formation due to treatment

E. Analysis of toxic substances produced

1. Toxicity assays for higher forms (toxicity panel)

2. Mutagenesis Assays (Ames test) for products in sediments/beach/soil and water column.

3. <u>Performing Organization</u>:

A. Chemical Analysis

- Bill MacLeod - National Analytical Facility NMFS Seattle

- Dave Shaw - IMS - University of Alaska

- Scott Warner - Battelle - Columbus, OH

- Energy Resources Company, Inc. - Cambridge, MA

B. Biological Potentials

- Dr. Robie Vestal - University of Cincinnati

- Dr. Ron Atlas - University of Louisville

- Dr. Dick Morita - Oregon State University

- Dr. Don Westlake - University of Alberta

- Dr. Don Button - IMS University of Alaska (Fairbanks)

C. Toxicity

- Dr. Jack Loper - University of Cincinnati (Ames test)

  - Toxicity group members

D. Nutrient Analyses

- Dr. Richard Morita - Oregeon State University

- Dr. Vera Alexander - Dr. Bob Barsdate - IMS, University of Alaska

- Dr. Mike Miller - University of Cincinnati

4. Applicable Habitats:

Lakes

Ponds

Soils

Coastal Marine - etc.

5. Applicable Conditions:

Any condition as long as logistics are available and oil concentrations can be located

6. Applicable Oil Type:

Any oil

7. Time Frame:

Parallel to Project No. 1

8. Cost:

For a spill of 100,000 gallons for Ames test alone -

1st year	$50,000
2nd year	$50,000
3-7 year	$50,000 plus inflationary increases/yr. (in 1977 dollars) plus logistics

Approach is to have chemists and toxicologists generate data except for Ames tests and supply data to microbiological group for synthesis and analysis.

Semiannual synthesis of chemical data microbiologists including computer $50 K - 75 K/yr.

9. Equipment Needs/Equipment Available:

GC

GC - MS

Spectrofluoremeter

Field Sampling Gear

Computer

10. Facility Needs/Facilities Available:

Lab facilities available for chemical analyses

Lab facilities needed for Ames tests

11. Personnel Needs/Personnel Available:

See Item 13

12. Support Services:

Logistics Capability

Computer

13. Payoff:

A. Knowledge of biodegradation of oil under catastrophic impact by oil - hard to simulate

B. How long environmental perturbation persists predicts length of time for "recovery"

C. Recommendations for minimizing impact of future spills

14. Limitations:

Money

Personnel - Chemists

Conversion of degradation to "recovery time" and dollars of impact damage.

PANEL: MICROBIOLOGY/BIODEGRADATION
PROJECT NO: 3
PRIORITY RANK: 1

1. Project Title: To Develop Recommendations for Assisting the On-Scene Coordinator

2. Project Description:

To develop criteria for assisting the OSC in selecting appropriate treatment actions that minimize the impaction of the microbial community and maximize microbial degradation.

A. Review of current literature

B. Supplement literature gaps with laboratory experiments to enhance knowledge of how response to oil spillage should proceed.

C. Continuing effort on A & B as new products, methods and knowledge become available.

Results would provide OSC with current knowledge of both short and long-term effects of particular cleanup action (i.e., dispersal of oil, sinking, fertilizer application, seeding, etc.)

Post Action - must evaluate cleanup actions after actions are implemented based on recommendations derived from the laboratory and literature efforts.

Actions must be specified to the environment; e.g., ice, open ocean, terrestrial, fresh water lakes depending on degree of cleanup, and the amount of oil remaining for microbial degradation ranging from that which is highly dispersed in the open ocean to that which is highly concentrated areas of soil contamination.

3. Performing Organization:

Dr. R. Atlas, University of Louisville; Dr. R. R. Colwell, University of Maryland;

Dr. R. Traxler, University of Rhode Island; Dr. D. Westlake, University of Alberta;

Dr. R. Bartha, Rutgers; Dr. R. Morita, Oregon State University;

Dr. D. Ahearn, Georgia State University;

Dr. D. Button, University of Alaska - Fairbanks;

Dr. J. McKendrick, University of Alaska - Fairbanks Soils Group;

Dr. J. Perry, North Carolina

4. Applicable Habitats:

Open ocean, estuarine, fresh water lakes, water column, ice sediments, soils, i.e., almost any system since these studies are not limited by the environmental conditions.

Sea states and location of spill would limit immediate application; however, much of these efforts are not climate and/or weather dependent and would require new methods for looking at streams and rivers.

5. Applicable Conditions:

No specific conditions; however, one must have completed the literature search and initiated laboratory research to fill gaps in knowledge prior to advising cleanup actions. This requires a continuing effort.

6. Applicable Oil Type:

All petrochemicals.

7. Time Frame:

A. Review current literature 4 to 6 months.

B. Continuing laboratory studies 1 to 3 years.

C. Field experiments 4 to 6 years.

8. Cost:

A.	Literature	$40 K (6 months)
B.	Laboratory Studies	$50 - 200 K/year
C.	Field Studies	$100 K/year

9. Equipment:

Analytical Support for GC etc.

Incubators

Scintillation Counter

Assorted Glassware

Most microialogical labs involved in this work will have the equipment, therefore maintenance and/or replacement costs should be considered.

10. Facility Needs/Facilities Available:

Microbiological laboratory involved in hydrocarbon studies should have most facilities.

Assess to computerized literature searches.

Field equipment such as boats, snow shoes and/or ATV vehicles for land.

11. Personnel Needs/Personnel Available:

See Item 3

12. Support Services (Concurrent or Associated Studies):

See Item 10

Input from industry and OSC (Coast Guard) as to new cleanup techniques available and which are proposed to be used for a particular spill.

13. Payoff:

Knowledge of the effect of particular cleanup technique will help minimize ecological damage.

14. Limitations:

Problems of extrapolation of laboratory data to spill conditions (oil type environmental variables, concentration effects, etc.)

Inability to carry out field studies to evaluate environmental parameters prior to spill situations.

PANEL: MICROBIOLOGY/BIODEGRADATION
PROJECT NO: 4
PRIORITY RANK: 2

1. Project Title: Reconnaissance of Microbial Communities in High Risk Areas and Determination of Biodegradability of Oils Likely to be Spilled: Development of Support Methodology for Projects 1-3

2. Project Description:

This project is designed to gain necessary background data for enhancing probability of making correct decisions in projects 1-3. In some areas this project is in reality already being carried out as part of other programs.

A. For community reconnaissance and items covered in project 1.

B. For biodegradability prior to spill ites in project 2 modified to allow laboratory studies,

C. Develop and evaluate methods proposed for projects 1-3.

3. Performing Organization:

As in projects 1 and 2.

4. Applicable Habitats:

Tanker routes

Near production wells

Pipeline cooridor

Near storage tank farms

5. Applicable Conditions

No restrictions

6. Applicable Oil Type:

All production oils

7. Time Frame:

2 year reconnaissance for high impact areas

1 year for each new production oil

8. Cost:

Oil biodegradability $10K per oil

Reconnaissance $250K/yr and logistic expenses

9. Equipment Needs/Equipment Available:

See Projects 1 and 2

10. Facility Needs/Facilities Available:

See Projects 1 and 2

11. Personnel Needs/Personnel Available:

See Projects 1 and 2

12. Support Services (concurrent or assorted studies):

See Projects 1 and 2

13. Payoff:

Knowledge of needed background for increased confidence in making conclusions from project 1-3.

Increased predictive capability with knowledge of reference areas for comparative purposes after spill.

Increased ability to advise on scene coordinator of consequences of particular actions.

14. Limitations:

No way of knowing exact conditions under which a spill may occur. No guarantee of having surveyed the right areas.

PANEL: MICROBIOLOGY/BIODEGRADATION
PROJECT NO: 5
PRIORITY RANK: 3

1. Project Title: Dissolved Hydrocarbon Concentration Decay Model

2. Project Description:

Result will be a computer program cast from kinetic and dispersal equations that describe hydrocarbon concentrations after dissolving from the oil phase as they decay to pre-spill levels.

A. A physical oceanographic description of the spill area is required with boundaries and current data. This is obtained from existing data.

B. Population data are required from the effects of microbial community projects.

C. Dissolved hydrocarbon concentration/rate kinetic data are obtained that relate rates of biodegradation to concentration.

D. Temperature effects data are required from laboratory studies.

E. Pilot programs will be written for an enclosed estuary (Port Valdez) and an open spill site (Gulf of Alaska).

3. Performing Organizations:

Dr. D. K. Button, IMS - University of Alaska

Kinnetics Consultants - Santa Cruz, California

Pacific Marine Engineering Labs, Seattle, Washington

Dr. John Hobbie - Woods Hole, MBL

4. Applicable Habitats:

No restrictions

5. Applicable Conditions:

The low molecular weight fraction of oil spills is always incorporated into the water column.

6. Applicable Oil Type:

Oils containing a low molecular weight fraction, light fuels, petroleum.

7. Time Frame:

Simple programs are quickly generated with necessary polishing consistent with accuracy desired. Polishing should continue throughout the duration of the project.

8. Cost:

P.I.	$ 5,000
Programmer	$ 6,000
Lab Studies	$20,000
Travel/ Consultation	$ 5,000
Computer Time	$ 2,000
First Year (with overhead)	$38,000
Second Year	$40,000
Third Year	$42,000
Fourth Year	$15,000

9. Equipment Needs/Equipment Available:

None

10. Facility Needs/Facilities Available:

Computer Facilities

11. Personnel Needs/Personnel Available:

See Item 3

12. Support Services:

Data from Projects 1 and 4 including heterotrophic potentials and biomass/population data are required.

13. Payoff:

The value of the program is that if a spill is lost in the volatile Alaskan environment, then hydrocarbon concentrations that probably existed in the water column are predictable as a function of time. Secondarily quantifying the decay mechanism forces an understanding of key elements that set water column biodegradation rates.

14. Limitations:

Predictions about anticipated levels will only be realistically available for a few key hydrocarbon components.

LABORATORY TOXICITY PANEL

Participants

D. A. Wolfe, Chairperson

J. W. Anderson
D. Costa
K. Fucik
C. R. Grau
L. Killewich
E. Long
S. Morrell
B. Morris
S. D. Rice
T. Yocum
J. Kineman

LABORATORY TOXICITY PANEL

General Information and Guidance

- OBJECTIVE 1: SUPPORT TO THE OSC
- OBJECTIVE 2: DAMAGE ASSESSMENT
- OBJECTIVE 3: RECOMMENDED RESEARCH

OBJECTIVE 1: SUPPORT TO THE OSC

With regard to laboratory toxicity studies, the most valuable scientific advice for the OSC will be available from qualified investigators working on continuing base programs. Information directly relevant to decision-making for a particular spill may or may not be available; it is very unlikely to be generated in response to the spill. Persons closely associated with the laboratory toxicity measurements potentially relevant to spills in the Alaskan region are listed below:

Dr. S. D. Rice
NOAA/NMFS/AUKE
P.O. Box 155
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(907) 789-7231

Dr. D. C. Malins
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Point Reyes Bird Observatory
Stinson Beach, CA 94970
(415) 868-1221

OBJECTIVE 2: DAMAGE ASSESSMENT

For approaches to damage assessment, the panel examined the outputs recommended by the laboratory toxicity panel which convened August 28-31, 1977 in Hartford, Connecticut. Each of these 9 projects (listed below) was considered for potential real-time damage assessment value in response to a potential spill in Alaskan waters.

Laboratory Toxicity Projects recommended as a result of the Hartford, Connecticut Workshop and considered for merit at the Alaskan Oil Spill Response Workshop

1. Parallel benthic bioassay for single species or natural benthic assemblage (box core).

2. Standardized toxicity testing of petroleum and oil-dispersant mixture to marine biota.

3. Damage effects of oil-dispersant mixtures under simulated field conditions: use of large assay containers.

4. *In situ* acute toxicity tests.

5. Time dilution bioassay on holoplankton and meroplankton.

6. Sublethal effects of chronic exposure to low levels of petroleum hydrocarbons in zooplankton.

7. Effects of oil tainting of prey on food selectivity and feeding behavior of two predatory fish species.

8. Effects of oil-spill contaminated sediment on reproduction of winter flounder, *Pseudopleuronectes americanus* (Walbum).

9. Effects of chronic exposure to oil on representative marine animals.

In considering the Hartford Panel project recommendations, our Panel reached consensus the following main issues:

- It was felt the recommended projects should not be confined to laboratory toxicity measurements per se but should apply laboratory bioassay techniques wherever possible to the actual field circumstances accompanying a spill. This approach was deemed most suitable for damage assessment.

- All of the Hartford recommendations have merit for generating impact assessment information relevant to an oil spill. However, several of the proposed studies are long-term continuing efforts which must be conducted totally independent of any accidental spill. The results of these long-term studies would only provide implications for impacts in a specific spill instance. Funds earmarked for oil-spill response and damage assessment should not be diverted into long-term laboratory toxicity studies. Our panel achieved a consensus that recommendation numbers 2, 6, 7 and 9 from the Hartford meeting were of a long-term nature inappropriate for oil-spill response. These projects should be incorporated into a base research program initiated and conducted independently of a spill response, but the results of which are made available through the local experts to the OSC when and if he needs it. Especially important in this base effort is Hartford recommendations No. 2: that systematic and standardized testing of various oil types and oil-dispersant mixtures be conducted on a suite of representative organisms under representative conditions of temperature, etc., to form an a priori basis for decision-making in the event of a spill.

- The remaining Hartford recommendations should be modified and incorporated into a spill response plan for damage assessment. The plan ultimately should identify the specific contingency conditions required for implementation of each project. It was felt that, as written, the projects did not adequately address the short-term problems of damage assessment of oil spills.

- No additional projects were recommended by the panel for the purpose of impact assessment; the following mix of projects (based on Hartford recommendations) represented an appropriate spill response in terms of laboratory toxicity studies.

OBJECTIVE 3: RECOMMENDED RESEARCH

The panel had insufficient time to give adequate consideration to Objective No. 3 - that of the research potential offered by a spill situation. Of the 6 recommended projects that follow, the first 5 are considered useful approaches for damage assessment. The last project (No. 6) is viewed as a research objective which should be pursued under spill conditions in order to improve methodology for future laboratory toxicity measurements. Also, Project No. 5 (Effects of spill-contaminated sediment) has considerable research potential associated with its design.

LABORATORY TOXICITY PANEL

Recommended Projects

1. Correlation of hydrocarbon contents of biota subjected to an accidental oil spill with toxic manifestation.[a]

2. Standardized bioassay on organisms using spilled oil, dispersants, and weathered products from the spill site.[a]

3. *In situ* bioassays of water from various depths below an oil slick at the time of the accident.[a]

4. Time-dilution bioassays of marine organisms exposed to a regime of petroleum hydrocarbons predicted to occur during and after an oil spill.[a]

5. Effects of oil spill contaminated sediments on survival and physiology of benthos.[b]

6. Observations of the mode of oil fouling of organisms under spill conditions.[b]

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[a] Damage Assessment

[b] Research

PANEL: LABORATORY TOXICITY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Correlation of Hydrocarbon Contents of Biota Subjected to an Accidental Oil Spill with Toxic Manifestation

2. Project Description:

Living and dead organisms representative of each level of the food web (benthic, plankton communities, fish, birds, and mammals) will be collected at several sites in an oil spill area at specified time intervals after the spill and returned to the laboratory for study. Sediments, water, and oil samples will be collected. If possible, samples will also be collected from areas that can be expected to be oiled as the spill advances, to assess baseline contamination. Appropriate samples will also be collected from a similar unimpacted control area.

All samples will be transported to the laboratory for determination of tissue hydrocarbon contents, for gross behavioral and morphological effects and for histopathological effects. During transport, live organisms will be held in tanks of water from which they were collected, to prevent uncontrolled depuration. In the laboratory, tissue content of hydrocarbons will be determined in dead organisms as well as surviving ones maintained in uncontaminated flowing water and sacrificed at increasing times after exposure. This will enable determination of the rate of depuration of hydrocarbons from the tissues selected for analysis.

The significant aspect of this study is that the responses of organisms and the hydrocarbon compositions of the specimens will be those resulting from real and uncontrolled doses of spilled oil occurring at the spill site.

3. Performing Organizations:

NMFS-NWAFC and Auke Bay laboratories

NARL and University of Alaska laboratories

Closeness to the spill site is important.

4. Applicable Habitats:

All Alaskan habitats.

5. Applicable Conditions:

- Repeated access to the same study sites is desirable. Ice conditions could be a factor at some times of year.

- Study sites (impacted area and control) must be large enough to tolerate repeated sampling.

- Weather must be suitable for sampling.

- Methods must be devised for getting samples from below the slick up through the slick without further contamination.

- The presence of spilled oil must be verified by visual and/ or analytical evidence prior to the collection of specimens from the "impact" area.

6. Applicable Oil Type:

All

7. Time Frame:

Field sampling and lab analysis should continue until each species under study from the impacted area has returned to pre-spill status (by comparison to unexposed control). Length of time will probably vary for different species, but a period of several years seems possible for intertidal organisms repeatedly exposed to oil which has come ashore. The time required for organisms in the water column would more likely be a matter of several weeks.

8. Cost:

a. Logistics

b. Personnel $5,000

c. Per species, 4 samples taken, at $200

(1) Initial 24-48 hour post-spill (as soon as possible)

(2) Toward end of spill

Chemical analysis would be $500/sample.

9. Equipment Needs/Equipment Available:

Benthic samples; box core samples; water samples. Containers for live specimens, sediments, and water and oil samples.

Complete facilities for holding marine organisms - both invertebrates and vertebrates - alive and lab facilities for doing chemical analyses.

Collection and maintenance of organisms may not be done by the same groups as chemical and tissue analyses, due to unavailability of all facilities at the same location.

10. Facility Needs/Facilities Available:

Vessel (probably NOAA or University of AK) large enough to navigate outer continental shelf in Alaska and deal with special climatic conditions found there, including severe storms and ice. Vessel should have facilities for collection of both live and dead organisms, sediment, H_2O, and oil samples, and maintenance of the samples during transport to an onshore laboratory.

Complete laboratory facilities for chemical tissue analysis. At a minimum, this should include instrumentation for hydrocarbon analysis (GC, MS). A system for maintaining live specimens during depuration periods would also be necessary.

11. Personnel Needs/Personnel Available:

The key personnel are marine biologists with extensive experience in collecting live and dead organisms for laboratory observations, and in collection of sediment, water, and oil specimens for analysis. They need to be available on short notice, preferably within 12 hours of the report; hence more than one ready team needs to be available.

Chemists for lab analyses.

12. Support Services:

- The chemistry of the spilled oil should be determined at the time of the spill and as the oil weathers. The chemistry and chemical changes of petroleum fractions in the sediments and water column at the study sites (both impacted and control) should also be documented and monitored throughout the study by coordination with other components of the Response Team.

- The impact area must be delineated. Maps must include not only the water surface area directly exposed to petroleum but also areas exposed to water soluble fractions, volatile fractions, etc. Therefore, water and air currents must be mapped in detail during the spill.

13. Payoff:

Determination of the extent of initial and long-term damage to some species. This would provide the basis for an estimate of the overall impact to the biological community in an area. Accuracy of the estimate would improve as the number of species studied increased.

14. Limitations:

No limitations except those covered above.

Proximity to laboratory facility and ease of transporting live organisms from spill site.

PANEL: LABORATORY TOXICITY
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Standardized Bioassays on Organisms Using Spilled Oil, Dispersants, and Weathered Products from the Spill Site

2. Project Description:

Bioassays employing standard procedures in flow through systems will be conducted to assess the potential impact of a spill in Alaskan waters. Spilled oil and dispersants used in cleanup operations will be tested singly and in combination for their effects on organisms which are common in the area of the spill or which are of commercial or ecological importance. Samples of the oil weathered for varying periods of time will also be used in toxicity tests.

Besides the effects of the oil on producing mortalities, additional testing could provide information on the uptake of hydrocarbons as well as histological effects. The effects on the reproductive potential of the organisms following exposure could also be considered.

It is anticipated that the results of these experiments will provide guidelines for establishing the impact of the spill and possible cleanup operations on marine organisms, and provide a standardized basis for comparing potential toxicity from the spill with previously available bioassay results on oil-dispersant mixtures.

3. Performing Organizations:

NWAFC - Auke Bay Labs	S. D. Rice and J. F. Karinen
NWAFC - Seattle	D. C. Malins
University of Alaska	D. G. Shaw
Battelle-Sequim	J. W. Anderson
NARL?	

4. Applicable Habitats:

All habitats

5. Applicable Conditions:

A basic knowledge of possible impacted organisms is needed. Some knowledge of distributions, and life cycles could also prove valuable.

Proximity of facilities to spill site, and ease of transporting live organisms from spill to lab.

6. Applicable Oil Type:

All oils

7. Time Frame:

6 months - 1 year depending on the extent of the studies. One bioassay per week could be completed.

8. Cost:

$200/bioassay.

$300/sample for analysis of organisms and water for hydrocarbon content.

Additional expense for histological studies $200/sample.

Ship time for collecting organisms could approach several thousand dollars per day.

Costs for shipping organisms to available research facilities must also be considered.

Bioassays should be conducted on 3-5 representative species at standard realistic temperatures using fresh oil, weathered oil, dispersant and dispersant-oil mixtures, if applicable. Thus, there could be 40 bioassay (5 species x 2 temp x 4 treatments) and 25 chemical analyses per spill, for total cost of $15,500.

9. Equipment Needs/Equipment Available:

Flow through aquaria (minimum of 4).

Chemical analytical facilities (GC for hydrocarbon content).

Field collecting equipment including holding facilities for various species of organisms.

Cold weather gear for scientists.

Histological supplies (stains, dissecting equipment, microscopes, etc.).

10. Facility Needs/Facilities Available:

Capabilities for shipping collected specimens to laboratories where bioassays could be performed.

Boats for collecting animals.

Analytical laboratories capable of analyzing organisms for hydrocarbon content.

11. Personnel Needs/Personnel Available:

- For this experiment, there could be a lag in the response time since it is primarily a laboratory exercise.

- Personnel are available in the Alaskan area who have had extensive experience with these types of experiments (primarily at Auke Bay Labs).

12. Support Services:

- Need analyses of hydrocarbon levels in water, sediments, and organisms impacted by the spill.

- Dispersant concentrations in the field.

- Need histopathological examination of bioassayed organisms for comparison to field observations.

- Chemical analyses may be performed under contract by separate organization.

13. Payoff:

a. Hydrocarbon levels required to produce toxicity.

b. Effects of dispersants on organisms.

c. Information on the effects of weathering on the toxic potential of oil.

d. The availability of hydrocarbons from weathered oil to organisms.

e. Potential effects of the spill in increasing pathological conditions and reducing reproductive success.

14. Limitations:

The availability of animals from the spill vicinity would be the biggest limitation as well as obtaining samples of the spilled oil in suitable quantities.

The major flaw is that the experiment requires extrapolation from the lab to the field; actual field conditions are difficult to duplicate in the lab.

PANEL: LABORATORY TOXICITY
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: In Situ Bioassays of Water from Various Depths Below an Oil Slick at the Time of the Accident

2. Project Description:

Two possible experimental designs - both require non-exposed animals to start with (several species), and supporting chemical analyses.

A. Suspended Live Boxes - live boxes, presumably with compartments for different species, would be towed under the slicks and left to drift with the slick. They would be checked at the end or possibly at time intervals with the use of divers or TV cameras.

1. Would require vessel initially and terminally.

2. Towing could be stressful and precautions needed.

3. Need control sites.

B. Suspended Submersible Pumps - Submersible pumps would be suspended from a floating platform, and towed under the slick. Several pumps would allow pumping from different depths - a "flow through" system of aquaria would receive the water, presumably compartmentalized to have several species. Fish, shrimp, larvae, phytoplankton, etc. - could all be tested and observed easily - target groups - fish, crustacea, mollusc -

Anticipated Results - The upper most layer will be toxic while a slick is present, lower depths will not be acutely toxic.

3. Performing Organizations:

Floating platform -

a. NOAA vessels

b. Charter boats - 50-60 ft fishing vessels

Bioassay people -

a. NMFS - Auke Bay Lab - S. D. Rice

b. ADF&G

c. University of Alaska - D. G. Shaw

4. Applicable Habitats:

Open water -

Inshore intertidal will preclude the use of the boat, yet an on-shore facility will not likely be available.

5. Applicable Conditions:

Weather - season - heavier the weather, the larger the vessel required. For fall, winter, larger vessels are recommended.

Bioassay equipment - aquaria, live boxes, target organisms must be available on call in order to be in place during the spill. Otherwise, experiment should not be done.

6. Applicable Oil Type:

No limitation.

7. Time Frame:

Pre-spill -

a. 1 man-month of ordering, receiving, packing pumps, portable aquaria, etc.

b. 1 man-month - run a test set up - (dress rehearsal) to see if you have all the fittings.

During the spill -

a. Need test organisms - 3-4 people - 1 day - 1 week

b. Run the test - 2 people - 1 month

Post-spill -

a. 1 man-week cleaning, packing test equipment

b. 1 man-month writing reports, etc.

8. Cost:

Per Floating Platform and Spill

A.	Equipment - 6 pumps, lines, 12 aquaria Miscellaneous	= 2K
B.	Animal collection - salary, charters, ? from existing lab stocks?	= 2K
C.	Travel and shipping to spill site	= 2K
D.	Salary - 6 man-months	= 15K
E.	Chemical analyses	= 15K
F.	Plus overhead	?
G.	Plus vessel charter during the tests	= 25K

On a large spill, more than one floating laboratory (platform) may be available - if so, multiply the number proportionately.

Probably a good idea to stockpile duplicate equipment at several sites (it is not that costly) - e.g., Seattle, Anchorage, Cordova, Juneau?

9. Equipment Needs/Equipment Available:

A. Exposure equipment - 6 pumps, transmission lines, 14 exposure aquaria (with separations - compartments).

B. Chemistry - sampling, extracting, glassware and solvents.

C. The animal collection gear can be borrowed from existing facilities.

This would have to be packed and stockpiled for future use.

Items 1 and 2 - packed and stockpiled - after being tested before a spill (to make sure you have all the plumbing - how will you drain the test water from the test, etc.?).

D. Water quality measurements should be made - temperature, salinity, pH and O_2 - since the different depths will differ - these will require instruments that could be borrowed or may exist on research vessels.

10. Facility Needs/Facilities Available:

Facilities -

A. Floating platform - with "wet lab" space - could be on the deck.
Diving accommodations for 2 people - large NOAA vessel would be ideal.
Experimental design requires that the platform stay in the area of the slick where the highest concentration could be expected.

B. Shore facility - logistics site for collection and holding of test organisms prior to tests.

11. Personnel Needs/Personnel Available:

Appropriate personnel are currently available at specified institutions. Commitments for their involvement would have to be made prior to any spill.

12. Support Services:

A. Detailed chemical analyses of the exposure solutions.

B. Detailed chemical analyses of tissues for uptake on hydrocarbons.

C. Histopathological examination of the exposed organisms.

13. Payoff:

A. Describes what depth and for how long the sub-slick waters are toxic, if at all.

B. The study is unique.

14. Limitations:

A. Readiness of equipment, people and test animals.

Test animals are particularly important. Unhealthy animals at the start voids the test. Picking up significant quantities of small test organisms can be difficult at different times of the year (commerical fisherman are equipped to get commercial species, usually large (crab, salmon) and usually in a destructive manner (trawl, gillnet).

I suggest Brine shrimp as a "standard" organism that will permit some comparisons between tests (e.g., 1978 spring, 1979 fall) when the same life stages are not available.

B. Weather - spills in January will be difficult to test.

C. Vessel - the vessel has to be committed to stay in the slick. It can't be running around the other areas - or it will interrupt the exposure. This would be a big commitment of a large NOAA vessel, so a charter would be needed - cost of charter would include deoiling, fouling of vessel. Safety problem? Using a buoy to suspend pumps -

PANEL: LABORATORY TOXICITY
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: Time-Dilution Bioassays of Marine Organisms Exposed to a Regime of Petroleum Hydrocarbons Predicted to Occur During and After an Oil Spill

2. Project Description:

Objective is to utilize actual spill dispersion information to assess the adverse biological effects that might have occurred from that oil spill. Chemical analyses taken before (if possible), during, and after an oil spill impacts a site(s) will be used to develop a dispersion for a continous-flow dosing apparatus.

Organisms exposed to the predicted regimes of petroleum hydrocarbon concentrations will be assessed for adverse effects. These effects may be manifested in altered behavior, metabolism, histopathology, or death. Particularly vulnerable organisms or life stages will be included in the bioassays.

3. Performing Organizations:

Would include NMFS Auke Bay, Seattle, or Tiburon, Battelle-Northwest.

4. Applicable Habitats:

All

5. Applicable Conditions:

Conditions necessary for the success of this study:

A. Detailed chemical analyses of petroleum hydrocarbons in the water column, on the surface, or in sediments as a result of a spill.

B. Accurate assessment model or continuous field data recorded during and after a spill that reflect temporal changes in hydrocarbon concentration and composition within an impacted habitat sampling station.

C. If good in situ bioassays have been conducted it may not be desirable to conduct this study.

6. Applicable Oil Type:

All. Oil most likely to be spilled in Pacific Northwest to sub-Arctic waters of the Pacific Ocean: Prudhoe Bay crude, Cook Inlet crude, ...

7. Time Frame:

Bioassay duration would be dependent upon actual or time-dilution data for spills of given magnitude, location, and season. Testing and measurement would continue 14 to 30 days following acute or latent studies.

8. Cost:

If no major gearing up is necessary (i.e., laboratory is presently equipped to handle research outlined herein...see Item 11), the cost of this research can be defined largely by personnel costs.

It is estimated that a single bioassay (or a series of bioassays conducted simultaneously) would require 3 professionals working full time. A 30-day study would require roughly 6 to 9 man-months of work to produce a finished report at a total cost of $8-25K.

Such costs are dependent upon the dosing duration (time-dilution model), the amount of gearing up necessary, and the type of chemical analyses necessary. Under some conditions the estimated costs presented above would be inadequate.

9. Equipment Needs/Equipment Available:

A. A continuous-flow dosing apparatus that can be easily adjusted to vary the concentration and composition of petroleum hydrocarbons flowing into test aquaria yet remain stable with regard to concentration and composition between such adjustments.

B. Adequate flow (or small enough water volume in test aquaria) to allow rapid equilibration when system is adjusted.

C. Seawater supply that is free of contaminants and conditons in which temperature, salinity, and photoperiod can be maintained at ambient.

D. Chemical analytical equipment for determining dosing concentrations and uptake of hydrocarbons by test organisms.

E. Sample organisms for testing recovered from the habitat or similar habitat and type as from the spill site.

F. Sample oil and oil dispersants from the spill site.

G. Oil samples taken at different times from the spill site to be used in the time dilution apparatus.

10. Facility Needs/Facilities Available:

Facilities include analytical laboratory with bioassay facilities. Access to histopathology laboratories may be desirable for analysis of tissue damage.

11. Personnel Needs/Personnel Available:

Reputable personnel are available within NMFS laboratories as well as within private contracting firms and academic institutions.

If not currently occupied and if available for contract, the following personnel are among those qualified to conduct this research.

A. Dr. Stanley D. Rice, Auke Bay Fisheries Laboratory (NMFS), Auke Bay, Alaska

B. Dr. Jack W. Anderson, Battelle Northwest Laboratories, Sequim, Washington

C. Dr. Jeannette A. Whipple, SWFC, Tiburon Laboratory, Tiburon, California.

12. Support Services:

Collection of field samples (water and/or sediment) and their analyses for petroleum hydrocarbons is a necessary prerequisite. Time-dilution modeling will also be needed if actual spill data is not available.

Additional support services include analytical chemistry, field collection of test organisms, and life history information relative to the selected test species in the habitats of interest.

13. Payoff:

Such a study may predict adverse effects of potential spills or may indicate acute or sublethal damage to populations impacted by an actual spill. Such predictions will require that an effect is measured during the bioassay and that that effect is evaluated with regard to life history information for the test species.

14. Limitations:

A. Dosing animals to predictably decreasing concentrations of hydrocarbons may be difficult, especially if the relative composition of components must also vary. Conducting bioassays with sediment exposure may be impossible.

B. Experimental organisms that may be best (most sensitive) for assessment of effects may be difficult to maintain in the laboratory.

PANEL: LABORATORY TOXICITY
PROJECT NO: 5
PRIORITY RANK:

1. Project Title: Effects of Oil-Spilled Contaminated Sediments on Survival and Physiology of Benthos

2. Project Description:

The purpose of this project is to assess the effects and persistence of spilled oil in sediments from a spill site by both field and laboratory experimentations with a few representative benthic species. The specific objective of this research is to determine the effects of the oiled substrate on the level of tissue contamination, survival and condition of selected benthic organisms. The specific tasks are as follows:

A. Delineate test plots within the oiled intertidal zone and a suitable control site, which possess characteristics (not considering the presence of oil) suitable for the survival and growth of 2 or more macro-benthic species. Introduce at least 50-100 individuals of each species (presumably a bivalve and a polychaete or sipuncuid) into the oiled and clean sediments. These populations should be sampled at intervals between 2 weeks and several months to determine factors listed below.

B. Oiled sediment and sediments from the control site should be transferred to fiberglass trays with mesh bottoms, with care to not mix upper and lower depths. Both control and exposed trays of sediment should be transported to a laboratory with a flowing seawater system and placed in a condition simulating the natural habitat (temperature, tidal flushes, salinity, etc.) as closely as possible. The same test species should be placed within these trays and measurements taken as described below. There should also be a transplant portion of this experiment which involves installation of trays with clean sediment and organisms within the oiled site and oiled substrate with clean organisms in the control site.

C. The condition of test organisms should be measured by the percent survival, but additional information may be gained by examining the "condition index" of bivalves and the free amino acid content of both bivalves and polychaetes. Other valid methods of determining the energy budget of the species may also be utilized.

D. A significant aspect of all phases of this study is the detailed chemical analysis of tissue and sediment samples. Initial and periodic samples should be analyzed for content of 2-5 ring aromatic compounds and these values correlated with effects on organisms.

E. Anticipated Results:

(1) Survival and condition of benthic species exposed in various ways to oil-contaminated sediment as measure of spill impact.

(2) The extent of contamination of tissue from various exposure routes may be evaluated as a result of the exposed and control treatments recommended above.

F. References to use of sediment trays and "condition index" and free amino acid analyses:

Andersen, J.W., R. Riley and R.M. Bean, 1978. Halifex, N.S. Symposium Paper, Recruitment of benthic animals as a function of petroleum hydrocarbon concentrations in the sediment.

Anderson, J.W., L.J. Moore, J.W. Blaylock, D.L. Woodruff, and S.L. Kiesser, 1977. Bioavailability of sediment-sorbed naphthalenes to the sipunculid, Phascolosoma agassizii. Pp. 276-285. In: Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.). Pergamon Press, Oxford.

Bayne, B.L., D.R. Livingstone, M.N. Moore, J. Widdows, 1976. A cytochemical and biochemical index if stress in Mytilus edulis L. Mar. Pollut. Bull. 7:221-224.

de Wilde, P.A.W.J., 1975. Influence of temperature on behavior energy metabolism, and growth of Macoma balthica (L.). Pp. 239-256. In: Ninth European Marine Biology Symposium. H. Barnes (ed.). Aberdeen University Press, Great Britain.

Roesijadi, G., D.L. Woodruff, J.W. Andersen, 1978a. Bioavailability of nephthalenes from marine sediments artificially contaminated with Prudhoe Bay crude oil. Environmental Pollution (in press).

Roesijadi, G., J.W. Anderson, J.W. Blaylock, 1978b. Uptake of hydrocarbons from marine sediments contaminated with Prudhoe Bay crude oil: Influence of feeding type of test species and availability of polycyclic aromatic hydrocarbons. J. Fish. Res. Bd. Canada (in press).

Roesijadi, G., and J.W. Anderson, 1978. Condition index and free amino acid content of Macoma inquinata exposed to oil-contaminated marine sediments. In: 1977 Symposium on Pollution and Physiology of Marine Organisms. Georgetown, W.C., ed. by Winoma and F.J. Vernberg, Academic Press, New York (in press).

3. Performing Organizations:

*NOAA Lab, Auke Bay
*Univ of Alaska investigators
**NOAA Lab, Seattle
**Battelle Northwest Lab, Sequim Bay

* = biological capability
** = both biological and chemical capabilities

4. Applicable Habitats:

- Intertidal mud, sand, or cobble are the most suitable, but some variation of this technique could be used in the rocky intertidal (perhaps with mussels).

- Subtidal habitats are more difficult to work with, and the chances of success are less likely. If the habitat has suitable conditions (calm and shallow), it may be possible to conduct these studies successfully in subtidal regions where oil is present in the sediments.

5. Applicable Conditions:

Measurable oil must be detected in the sediments. A site must be available which will support the benthic species placed in both contaminated and control sediments.

6. Applicable Oil Type:

Any oil which remains associated with the sediment for more than a few days is applicable for this type of study.

7. Time Frame:

One should be able to detect changes in the "condition index" of bivalves within 2 months, but such factors as growth will require several months. Sampling should be on a monthly basis for the first 3-4 months, and further sampling determined in light of the earlier findings. Loss of "significant" levels of aromatic hydrocarbons from the sediments should guide the time frame for biological studies. Of course, the maintenance of laboratory exposures is a constant activity, while field sampling will be periodic.

8. Cost:

The area of the impacted site will not influence the magnitude of the study, but the number of different types of intertidal substrates studied will dictate the costs. It may be that only one of the possible habitats is selected for study and therefore the costs will be equal for any spill. The following estimates are for one type of substrate which could be either mud, sand or cobble.

Activity	Lowest Approx. Cost (k)
Collection of Organisms (not in Alaska)	0.5
Collection and transport of substrate	2.5
Maintenance of Lab - sediment trays	10.0
Field collections (without travel)	2.0
Chemical analyses (20 tissue and 20 sediments)	20.0
Biological analyses	10.0
Travel and support (versus to get to sites, etc.)	10.0
(6-12-month study) Total	55 k

9. Equipment Needs/Equipment Available:

Sediment trays and shovels are perhaps the only field gear needed. The significant equipment is that related to detailed hydrocarbon analyses of tissues and sediments which include:

IR, capillary GC, GC/MS, HPLC with UV and fluorescence detectors and all normal glassware and columns used to prepare samples for analyses.

10. Facility Needs/Facilities Available:

Marine laboratory with flowing seawater system receiving water of characteristics similar to spill site or capable of altering water to meet these needs. A system for simulating tidal fluxes will be required to keep sediments from turning anoxic.

An analytical laboratory for hydrocarbon determinations using the equipment noted under (9) above.

11. Personnel Needs/Personnel Available:

Personnel should include a senior marine scientist with at least one marine biologist (B.S. level), an analytical chemist and a lab tech. As noted in Section 3, least four labs have the biologists and 2 have the chemical expertise.

12. Support Services:

Project should be coordinated with studies of benthic diversity and histopathology of benthos from the impacted zone.

13. Payoff:

A. The project will provide sound evidence of the magnitude and duration of effects of oiled sediments on the survival, health, and tissue contamination of benthic species, as direct input to spill impact assessment.

B. Since bivalves are often commercially important species, one will be able to accurately determine the loss of organisms from the habitat and the length of time required for tissue depuration of field populations.

14. Limitations:

Ice covering of the intertidal zone would obviously limit this project. Even periods of ice scouring of the zone might destroy in situ experiments.

PANEL: LABORATORY TOXICITY
PROJECT NO: 6
PRIORITY RANK:

1. Project Title: Observations of the Mode of Oil Fouling of Organisms Under Spill Conditions

2. Project Description:

To describe the ways in which organisms might come in contact with oil under an oil spill situation:

Objectives - Make analytical observations of the way in which organisms come into contact with:

(a) Surface raw fraction of the spill.

(b) The water soluble structure (water soluble fraction).

(c) Particulate matter in the water column (aggregates, "marine snow") which may have absorbed significant amounts of volatile and non-volatile hydrocarbons.

These results are important in designing laboratory toxicity studies, so they will better simulate field conditions, but the project has little utility in damage assessment for a particular spill.

3. Performing Organizations:

These studies should be broken down into

A. Surface crude

(1) Marine mammals
Ancel Johnson
U.S. Fish and Wildlife Service
Anchorage, AK

Daniel Costa
Scripps Institute of Oceanography
University of California, San Diego
La Jolla, CA

Dr. Bud Fay
University of Alaska
Fairbanks, AK

John Burns
Alaska Department of Fish & Game
Fairbanks, AK

(2) Birds
Point Reyes Bird Observatory

(3) Water Column
Fish

Aggregates:
Dr. Mary Silver
Coastal Marine Lab
University of California, Sant Cruz
Santa Cruz, CA

4. Applicable Habitats:

All

5. Applicable Conditions:

The type of experiments done depend on location and water conditions. Surface slick effects could be observed under any conditions where boat, plane, or shore observation is possible. Water column studies would require underwater observations by divers.

6. Applicable Oil Type:

All

7. Time Frame:

As long as spill is present and detectable.

8. Cost:

9. Equipment Needs/Equipment Available:

Boat, plane or helicopter to observe animals entering slick.

Divers and diver support boat and equipment to observe water column effects.

In open ocean this should be conducted only by a team familiar with "blue water diving" and associated safety procedures.

Underwater camera equipment.

35 single lens camera equipment.

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

Detailed chemical analytical capability must be available to characterize the compositions and concentrations of oil in various sample matrices observed and collected at the scene of the spill.

13. Payoff:

Unique exposure conditions accompanying an oil spill will be described to form a basis for more realistic design of laboratory toxicity experiments.

14. Limitations:

Research personnel and equipment must be committed and ready to go well in advance of the spill to assure success.

CHEMICAL ANALYSES/FATES PANEL

Participants

W. D. MacLeod, Jr., Chairperson

D. W. Brown
D. G. Shaw
D. G. Friis
L. S. Ramos

CHEMICAL ANALYSES/FATES PANEL

General Information and Guidance

- General Considerations
- Objective 1: Support to the OSC
- Objectives 2 and 3: Damage Assessment and Research

GENERAL CONSIDERATIONS

A. Joint Session with Physical Processes Panel

In a joint session the Physical Processes Panel requested the Chemical Analyses/Fates Panel to recommend ways to predict the physical behavior of oil in a spill situation according to its chemical composition. The chemists pointed out the complexities in the chemical composition of oil, plus the fact that oils are not generally analyzed prior to shipment. Therefore, the various factors believed to influence oil behavior in the multitudinous varieties of spill situations are largely unknown. Furthermore, there is no evidence that all the important parameters which determine the behavior of spilled oil are well understood or even identified. If this problem is to be dealt with on a cost effective basis, empirical engineering studies which relate physical behavior to fairly simple physical and chemical properties may offer the best approach. Since this is a specialized research problem, the Panel suggested that it be referred to experts on the physical properties of crude oils for further study and recommendations.

B. Panel Discussion

In order to satisfy the charge given it, the panel relied on information generated at the Hartford Workshop. The many differences between the East Coast and Alaskan situations--the unique character of the Alaskan environment, its relative isolation, and the scarcity of support facilities--were considered.

The laboratory resources in Alaska for the chemical analysis of spilled oil are limited. Even including laboratories outside the state which have traditionally made measurements in Alaska, the number is small. It is probable that in the event of a major oil spill, the resulting analytical load would exceed the capacity of these laboratories. Commercial analytical laboratories should

probably be used for the bulk of routine analytical work. However, the background of experience with Alaskan samples which has been accumulated over the years by the laboratories traditionally concerned with the State is a valuable asset which should not be disregarded in sample design and the specification of analytical protocols.

C. Weathering of Oil

Determining the fate of spilled oil is a very complex problem. Weathering is a term used to describe the changes undergone by oil as it is exposed to the environment. Weathering is a very complex process depending on many variables such as the chemical composition of the oil and the environmental conditions (e.g., temperature, wave action, amount of sunlight, microbial activity). Volatile compounds are susceptible to loss to the atmosphere and water soluble compounds may be partitioned between the water column and the oil. Spilled oil can form an emulsion with a water content as high as 80 percent. These concepts are not new but are presented to emphasize some of the problems affecting chemical analyses and interpretation of results.

D. Survey of Facilities

The Hartford Workshop panel developed a questionnaire that was used to gather information on potentially available laboratories. The Panel decided to adopt this questionnaire for use in Alaska (see Table 1). Results of the survey of facilities are included in the Addendum to the Chemical Analyses/Fates Panel report.

OBJECTIVE 1: SUPPORT TO THE OSC

A. Interpretation of data from chemical analyses is not usually reported in a time frame or in a manner that is of utility to the OSC or physical process persons. However, the potential exists for supplying the OSC with important and useful data on a short (24-hour) time scale if the logistical difficulties of obtaining samples and transportation to a suitable equipped laboratory can be overcome.

B. Chemical analyeses to characterize the spilled oil should be done on the (non-weathered) cargo oil, where possible. These analyses should include:

1. Quantitative data for the n-alkanes C_{12} through C_{32} and some 15-20 selected aromatic hydrocarbons of different ring sizes.

TABLE 1

OIL SPILL RESEARCH AND LABORATORY QUESTIONNAIRE

Name and Address:

_____

_____

_____

Bus. Phone: ( )_____

Home Phone: ( )_____

Alternate person to be contacted, and address:_____

_____

_____

Bus. Phone: ( )_____

Home Phone: ( )_____

Sponsoring Agencies:_____

_____

ANALYTICAL EQUIPMENT: If more than one, insert number.

Infra-red ( ) Make _____

Gas Chromatography:

packed column _____ glass capillary _____ Mass spec _____

UV Fluourscence:

Type _____

Microbalance _____

GENERAL DESCRIPTION OF EXTRACTION TECHNIQUES:

TYPES OF SAMPLES ANALYZED: Sediment _____ Tissue _____ Seawater _____

Tarballs _____ Cargo _____ Other _____

OTHER LAB CAPABILITIES: Ecosystem tanks, weathering, etc.

FIELD WORK CAPABILITIES: Sediment, water column, surface, doplet size and distribution, etc., please list filed equipment.

RESPONSE CAPABILITY:

(1) How many people can you muster in 24 hours?

(a) to obtain samples _____

(b) to analyze samples _____

(2) Do you need sponsoring agency approval?

Yes ____ No ____ Recommended ____

(3) Are you part of an oil spill research team? Yes ____ No ____

(4) If so, what is the expertise of the team and individual members? Please list: _____

_____

_____

(5) Can the whole team response? Yes ___ No ___ Not applicable ___

(6) Are there other people or laboratories in your organization that can respond? Yes ___ No ___. If yes please list names and addresses. _____

_____

_____

(7) Under what conditions can you respond? (or cannot respond)

(8) What is your primary interest? Oil spill research ____ Impact assessment ____ Other, please explain _____

_____

Please return to:

Dr. W. D. MacLeod
NOAA-NMFS
2725 Montlake Bldv., E.
Seattle, Washington 98112

2. Gravimetric data should be gathered to define the concentration of saturated hydrocarbons, unsaturated hydrocarbons, and hetero-atom compounds.

3. A judgment of the volatility should be made.

4. Conclusions that could be drawn from these data.

   a. Whether the oil is relatively high or low in aromatic content. This might bear on its toxicity and effect on impacted areas.

   b. A judgment of whether the oil is a high asphaltine content type or high in volatile components.

C. Analysis of the spilled oil should be performed to determine:

1. The extent of emulsion.

2. Some effects of weathering (i.e., loss of volatiles).

3. Knowledge of these parameters should help the OSC with decisions related to trajectory, cleanup operations, etc.

D. To be of use to the OSC, these analyses must be performed on an immediate response basis. The samples would be collected by the OSC designate as specified by the laboratory responsible for the analyses and shipped by priority air freight to the laboratory. The laboratory would respond to the OSC designee by phone within 24 hours with the requested information. Limited numbers of samples could be processed on a priority basis for immediate response to the OSC at a cost of $500.00 each.

This will require pre-spill contractual arrangements with an analytical laboratory; plans for rapid sample acquisition (i.e., caches of collection paraphanalia in locations of high spill probability) and plans for rapid transfer of samples from the spill site to the analytical laboratory. Without this groundwork, a timely analysis is not possible.

OBJECTIVES 2 AND 3: *DAMAGE ASSESSMENT AND RESEARCH*

Chemists should interface with other research groups to determine what analyses should be done with respect to each spill incident to obtain the maximum use of resulting data from an optimum number of

samples. With this in mind, projects were described according to the 14-point guideline. Some of these projects would be done in response to a spill, but others should be done now to develop an information base.

Detailed sample collection instructions should be the subject of a field manual and should be available for distribution before a spill occurs.

CHEMICAL ANALYSES/FATES PANEL

Recommended Projects

1. Development of methods for rapid chemical characterization of spilled oil.

2. Chemical analysis of spilled oil and adjacent impacted substrates for immediate spill assessment.

3. Chemical analyses for monitoring immediate impact of oil dispersants on spilled oil.

4. The physical-chemical weathering of oil at sea.

5. The physical-chemical weathering of beached or stranded oil.

6. The chemical fate of biologically assimilated oil.

7. Fate of spilled oil on ice covered seas.

8. The monitoring of aryl hydrocarbon hydroxylase enzyme system in sessile teleost fish and selected benthic infauna.

9. Products of weathered oil.

10. Identification of key marker compounds in petroleum and its products.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Development of Methods for Rapid Chemical Characterization of Spilled Oil

2. Project Description:

This project will provide qualitative and semi-quantitative data for use directly by the OSC in predicting the relative toxicity and physical behavior of oil and by trajectory modelers in predicting spreading, emulsification, and volitazation behavior of oil.

3. Performing Organizations:

NOAA/NAF

4. Applicable Habitats:

All habitats

5. Applicable Conditions:

All spills

6. Applicable Oil Type:

All oils

7. Time Frame:

Short term - while OSC is functioning

8. Cost:

Roughly $10,000 per use

Perhaps $40,000 for development

9. and 10. Equipment, Facility Needs/Availability:

Simple chemical laboratory apparatus, probably pre-packaged as field kit to be taken to and used at field site.

11. Personnel Needs/Personnel Availability:

Measurements can be made by any on-scene personnel

12. Support Services:

Need collaboration with modelers to identify their data needs.

13. Payoff:

Big increase in real time understanding of characteristics of oil slick

14. Limitations:

A development effort is required to produce a usable package for field experiments responsive to need of OSC and modelers.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Chemical Analysis of Spilled Oil and Adjacent Impacted Substrates for Immediate Spill Assessment

2. Project Description:

To provide OSC with rapid qualitative and quantitative information on characterization of spilled oil (as opposed to cargo oil). To analyze impacted substrates to determine extent of contamination. Only a few limited number of samples would be analyzed so as to minimize turnaround time. Samples to be obtained at earliest time possible and shipped immediately for analysis and characterization. Response to OSC should occur within 12 hours following receipt of samples. Substrates applicable besides floating oil: water column below spill; rocks, beach sediments, biota.

3. Performing Organizations:

NOAA/NAF

4. Applicable Habitats:

All habitats, including pelagic and shore.

5. Applicable Conditions:

All conditions applicable

6. Applicable Oil Type:

All oil types applicable

7. Time Frame:

Immediate. Samples collected as soon as possible after spill event. Daily afterwards according to needs of OSC and status of spilled oil.

8. Cost:

Analysis	-	$ 5,000--10,000
Sampling and transport	-	5,000
		$10,000--15,000

9. and 10. Equipment, Facility Needs/Availability:

Water sampler for hydrocarbons
Sample jars
Sample packaging and transport
Marine vessel
Laboratory
  GC
  GC/MS
  Fluorimeter

11. Personnel Needs/Personnel Availability:

Crew shipboard for sampling: 1 chemist, 1 technician (Available NOAA/NAF)

12. Support Services:

Field crew transport

13. Payoff:

Provide OSC with information as to extent of spilled oil. Should help OSC and other lead agencies to forecast impact of remaining spilled oil.

14. Limitations:

Accessibility to oil slick and immediate transport of collected samples, both dependent on weather.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: Chemical Analysis for Monitoring Immediate Impact of Oil Dispersants on Spilled Oil

2. Project Description:

To provide OSC with immediate indication of effectiveness of dispersants applied to spilled oil. Assuming prompt sampling and shipment, response to OSC should occur within 12 hours of receipt of samples. Would require analysis/characterization of dispersant itself, as well.

3. Performing Organizations:

NOAA/NAF

4. Applicable Habitats:

Any pelagic or coastal water

5. Applicable Conditions:

All conditions applicable

6. Applicable Oil Types:

All oil types applicable

7. Time Frame:

Immediate. Samples collected immediately prior to and following application of dispersant and hourly for 15-30 hours.

8. Cost:

Sampling and logistics	$ 5,000
Analysis	10,000
	$15,000

9. and 10. Equipment, Facility Needs/Availability:

Water sampler for hydrocarbons
Sample jars
Sample packaging and transport
Marine vessel
Laboratory
  GC
  UV

11. Personnel Needs/Personnel Availability:

Crew shipboard for sampling: 1 chemist
(Available NOAA/NAF)

12. Support Services:

Logistical. Aerial reconnaissance

13. Payoff:

Will show effect of dispersants on distribution and concentration of petroleum hydrocarbons in an oil-on-water system. Will provide OSC with knowledge of effectiveness of dispersant as an oil spill response tactic.

14. Limitations:

Heavy seas may minimize quality of information.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: The Physical and Chemical Weathering of Oil at Sea

2. Project Description:

To study the changes in hydrocarbon and non-hydrocarbon (NSO compounds) composition of (1) the spilled oil, (2) of the adjacent water, and (3) of the air mass.

We do not know how spilled oils partition and are altered immediately following a spill. Weathering studies have never addressed the combined questions relating to hydrocarbon as well as metabolite (i.e., phthalates, fatty acids, phenols) chemistry. The bacterial metabolites and photo-oxidation products are more soluble and potentially more toxic than are the hydrocarbon compounds.

The study to be carried out by continually sampling a given patch of oil, monitoring the water below and air above the patch, thereby establishing a realistic mass balance.

This information, in addition to being fundamental to our chemical understanding of oil spills, is essential for toxicological investigations and links to microbiological degradation studies and physical processes.

3. Performing Organizations:

University of Alaska/IMS
NOAA/NAF

4. Applicable Habitats:

Pelagic, salt pond, estuarine

5. Applicable Conditions:

A. All spilled oil containers.

B. Weather conditions must permit accurate sampling as far as depth under oil slick.

6. Applicable Oil Type:

All, although fuel oils and light crudes are more apt to results in good data sets due to more rapid dissolution and evaporation rates.

7. Time Frame:

Start immediately and continue as long as oil mass can be traced; probably on the order of a week to several weeks. Sample every hour, perhaps.

8. Cost:

Analytical	25,000
Ship Time	15,000 (time shared with other groups)
Total Cost	50,000 (open ocean)
	30,000 (near shore)

9. Equipment Needs/Equipment Available:

A. Sampling bottles for hydrocarbons (Bodmans, Niskens)

B. Air sampling gear

C. On-board sample extraction capability

D. Sample containers

E. GC and GC/MS; UV and IR capability

10. Facility Needs/Facilities Available:

A. Ship or small boat

B. Analytical lab

11. Personnel Needs/Personnel Available:

Crew shipboard for sampling and analysis: 1 chemist and 3 technicans

12. Support Services:

Physical process group must interact. Logistical and aerial reconnaissance support.

13. Payoff:

Our knowledge of chemical alterations of spilled oil is meager. This knowledge is fundamental to any ecological assessment.

14. Limitations:

A. Good sampling weather is needed.

B. Good analytical schemes in identifying especially non-hydrocarbon secondary products is essential.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 5
PRIORITY RANK:

1. Project Title: The Physical-Chemical Weathering of Beached or Stranded Oil

2. Project Description:

An immediate and long-term study following the chemical changes in stranded oil and the chemical recovery of a given environment.

It is carried out by sampling polluted shoreline substrate as well as tarry residues from beached oil. Also, short cores should be taken.

This includes hydrocarbons as well as NSO compounds.

Ref: Blumer: The Environmental Fate of Stranded Crude Oil (Deep Sea Research?)

3. Performing Organizations:

University of Alaska/IMS
NOAA/NAF

4. Applicable Habitats:

Applies to any habitat where oil has reached the bottom or shoreline, excludes pelagic habitats.

5. Applicable Conditions:

All conditions applicable although offshore bottom would pose problems in rough weather.

6. Applicable Oil Type:

Any oil type applicable.

7. Time Frame:

Start immediately. Sample daily for 2 weeks; then weekly for 6 months; then monthly for 5 years.

8. Cost:

100 samples x $500 = 50,000

onshore sampling = 5,000

offshore sampling = 50,000

Total = 55,000 - 100,000

9. Equipment Needs/Equipment Available:

- GC, GC/MS
- Grab sampler or hand-held sediment corers
- Available soon after spill; however, immediate analyses not needed
- Jars needed

10. Facility Needs/Facilities Available:

A. Onshore: sampling and analytical equipment and instrumentation

B. Offshore: small or large boat depending on distance offshore

C. Facilities are available on short notice

11. Personnel Needs/Personnel Available:

Crew shipboard for sampling: 1 chemist, 1 technician

12. Support Services:

Must interface with microbiology program and benthic biologists, and intertidal biologists.

13. Payoff:

A. Short and long-term weathering of stranded oil, from both the hydrocarbon and non-hydrocarbon perspective, is sorely needed using glass capillary GC.

B. Can relate chemical changes directly to changes in microbial and faunal populations.

14. Limitations:

Must carefully select sampling areas and preserve them from disturbance (i.e., cleanup operations).

Offshore station revisitation may be tricky and sediment resuspension and physical disruption of study may occur.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 6
PRIORITY RANK:

1. Project Title: The Chemical Fate of Biological Assimilated Oil

2. Project Description:

This project is designed to trace the chemical changes that occur in biological assimilated oil over a long period of time. Clean organisms, shellfish (Mytilus or Macoma), are kept in a controlled area (lab or field) and are completely characterized chemically. After a spill, and as oil approaches land, these organisms are either marked or are put in cages and deployed near shore before the oil's landfill.

The initial chemical uptake of oil is monitored by sampling this deployed population; subsequent samples reveal further uptake, degradation or depuration for the months following the landfill or oil. Individual tissues should be monitored chemically and histopathologically throughout the study.

Ref: D. Salvo et al: Environmental Science and Technology (1975?)

3. Performing Organizations:

A. Biological Deployment

B. Chemical Analysis

University of Alaska/IMS

4. Applicable Habitats:

Oyster-Mussel Reef
Rocky Shore
Salt Marsh
Salt Pond
Clam Flat

5. Applicable Conditions:

A. All conditions applicable. In fact, this experiment is designed for massive dosing (direct) or indirect via the water column.

B. Need controlled, chemically-characterized organisms.

6. Applicable Oil Types:

All types of oil could be studied.

7. Time Frame:

Starts immediately before landfall and can continue for several years. Should sample immediately and continue weekly for 2 months, then monthly for 5 years.

8. Cost:

A. Modest total cost = $50,000 - 75,000

B. Analyses, deployment and maintenance of test animals

Analyses	= $50,000
Maintenance deployment	= 10,000
Test animal maintenance	= 10,000

9., 10., and 11. Equipment, Facility, Personnel Needs/Availability:

A. Need facility for storing animals prior to deployment; flow-through tanks, etc.

B. Analytical equipment (GC, GC/MS) and large facility

12. Support Services:

Must interface with histopathologists. Individual tissue analyses essential.

13. Payoff:

This is a very critical type of study. Chemical impacts and histopathological studies for the first time can be interfaced and cause-and-effect relationships established under careful monitoring of these deployed animals. Behavioral and biochemical responses of adjacent communities then can be more fully understood.

14. Limitations:

Animals may not react naturally in cages; therefore, marking organisms and deploying them in a marked area may be necessary.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 7
PRIORITY RANK:

1. Project Title: Fate of Spilled Oil on Ice Covered Seas

2. Project Description:

Present information about the behavior of spilled oil on seasonal sea ice comes primarily from simulation studies involving either small intentional spills, flume experiments or numerical models. This project will augment that information by following the dispersal and degradation of oil spilled on seasonal ice.

3. Performing Organizations:

University of Alaska/IMS
NOAA/NAF

4. Applicable Habitats:

Nearshore Beaufort Sea. Shore fast ice.

5. Applicable Conditions:

Following any spill occurring on ice.

6. Applicable Oil Type:

Any

7. Time Frame:

Less than one year; from time of spill through breakup.

8. Cost:

Sampling and logistics	$15,000
Analysis	25,000
Total	$40,000

9. and 10. Equipment and Facilities/Availability:

A. Aircraft for sampling

B. GC and GC/MS

11. Personnel Needs/Personnel Available:

2 people for field work
1 analyst

12. Support Services:

Logistics base (NARL?)

13. Payoff:

This work will verify (?refine) our understanding of the behavior of oil on ice.

14. Limitations:

Project Addresses physical and chemical fate only; nothing on biological impact.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 8
PRIORITY RANK:

1. Project Title: The Monitoring of Aryl Hydrocarbon Hydroxylase Enzyme System in Sessile Teleost Fish and Selected Benthic Infauna (e.g., *Nephtys*)

2. Project Description:

The AHH system has been studied recently by Gruger et al (Bull. of Environ. Cont. and Toxicol.) and Payne (Science, 1977). AHH activity is induced by exposure to polynuclear aromatic hydrocarbons. Assaying for this enzyme can be of great importance in assessing subtle impacts of spilled oil and may precede more important and obvious effects.

3. Performing Organizations:

4. Applicable Habitats:

All habitats where appropriate species are available.

5. Applicable Conditions:

All conditions; this may be a good indication of oil dispersion and the extent of impact of a certain spill event.

6. Applicable Oil Type:

Better for large quantities of aromatic hydrocarbons (e.g., fuel oil, Venezuelan crude), but can apply to all spill events.

7. Time Frame:

Days to several weeks; the exact time frame is unknown. Research has not yet indicated the response lag of the enzyme system to PNA stress.

8. Cost:

$25,000 - 30,000 (80-100 assays at $300 apiece)

9. and 10. Equipment, Facility Needs/Availability:

A. Needs:

Trawling and dredging for fish and invertebrates

Ship for trawl/dredge operations

Analytical facilities - enzyme assay system

11. Personnel Needs/Personnel Availability:

Shipboard for sampling and lab technician. Should be readily available.

12. Support Services:

Should correlate with chemical analyses of PNA and histopathology.

13. Payoff:

May be the pollution monitoring mechanism that we need to spot early biochemical changes in marine systems exposed to oil (PNA).

14. Limitations:

Enzyme may be activated by PCB and other aromatic compounds as well. More lab research is needed to complement field studies.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 9
PRIORITY RANK:

1. Project Title: Products of Weathered Oil

2. Project Description:

Limited work has been done to identify compounds that result from weathering of oil. Laboratory investigations should be conducted in conjunction with field sampling of an actual spill. Several analytical techniques should be utilized to isolate possible constituents.

3. Performing Organizations:

NOAA/NAF

4. Applicable Habitats:

All habitats applicable

5. Applicable Conditions:

All conditions applicable

6. Applicable Oil Type:

Any oil type

7. Time Frame:

Short- to long-term. Sampling monthly for 3-5 years.

8. Cost:

Sampling and logistics	$ 5,000-10,000
Field monitoring	5,000
Analysis	60,000
	$70,000-80,000

9. and 10. Equipment, Facility Needs/Availability:

Sample containers
Marine vessel
Laboratory
- GC
- GC/MS
- IR
- HPLC
- Fluorimetry

11. Personnel Needs/Personnel Availability:

2 chemists, 2 technicians
(partially available NOAA/NAF)

12. Support Services:

Logistical. Interface with intertidal biologists and histopathologists

13. Payoff:

Knowledge of products of weathering of oil is meager. Characterization of weathered components would add to our understanding of the weathering processes and their significance in the marine and coastal environments.

14. Limitations:

Capabilities to develop appropriate experimental designs and to develop appropriate and sensitive analytical techniques that can discriminate between the hundreds of compounds in oil and the resulting products.

PANEL: CHEMICAL ANALYSES/FATES PANEL
PROJECT NO: 10
PRIORITY RANK:

1. Project Title: Identification of Key Marker Compounds in Petroleum and its Products

2. Project Description:

Until very recently, saturated hydrocarbons have been monitored to indicate presence of oil in the environment. However, these can degrade rapidly leaving the analyst to try relating a complex mixture of compounds to the presence of oil. More recently, aromatic hydrocarbons have been used, but, as yet, this technique is not standardized. The utilization of glass capillary GLC, with its high resolution capability, coupled with isolation techniques now being developed, should help in the search for reliable marker compounds.

3. Performing Organizations:

NOAA/NAF

4. Applicable Habitats:

All habitats

5. Applicable Conditions:

All conditions

6. Applicable Oil Type:

Any oil type

7. Time Frame:

Long term. Sample monthly or bimonthly for 3-5 years.

8. Cost:

Sampling and logistics	$ 5,000
Analysis	30,000
	$35,000

9. and 10. Equipment, Facility Needs/Availability:

Sampling devices and containers
Laboratory
- GC and glass capillary GC
- GC/MS
- HPLC
- Fluorimetry

11. Personnel Needs/Personnel Availability:

2 chemists, 2 technicians
(partially available NOAA/NAF)

12. Support Services:

Other analytical facilities

13. Payoff:

Stable marker compounds could be used to more effectively monitor the extent of and recovery from an oil spill incident.

14. Limitations:

Analytical capabilities and techniques to determine presence of stable, unique compounds in the complex oil matrix.

OIL SPILL RESEARCH AND LABORATORY QUESTIONNAIRE

Name and Address:
Dr. Wm. L. MacLeod
NOAA National Analytical Facility
2725 Montlake Blvd. East
Seattle, WA 98112

Bus. Phone: (206) 442-4240
Home Phone: ( )

Alternate person to be contacted, and address: Donald W. Brown
Same

Bus. Phone: ( ) Same
Home Phone: ( )

Sponsoring Agencies: NOAA/National Marine Fisheries Service

ANALYTICAL EQUIPMENT: If more than one, insert number.

Infra-red (1) Make P-E

Gas Chromatography:

packed column 1 glass capillary 3 Mass spec 2

UV Fluourscence:

Type 1

Microbalance 2

GENERAL DESCRIPTION OF EXTRACTION TECHNIQUES:

TYPES OF SAMPLES ANALYZED: Sediment x Tissue x Seawater x

Tarballs x Cargo x Other

OTHER LAB CAPABILITIES: Ecosystem tanks, weathering, etc.

FIELD WORK CAPABILITIES: Sediment, water column, surface, doplet size and distribution, etc.

RESPONSE CAPABILITY:

(1) How many people can you muster in 24 hours?

(a) to obtain samples possibly 1-2

(b) to analyze samples possibly 4

(2) Do you need sponsoring agency approval?

Yes x No Recommended

(3) Are you part of an oil spill research team? Yes _x_ No ____

(4) If so, what is the expertise of the team and individual members?
Please list: _____

_____

_____

(5) Can the whole team response? Yes ___ No _x_ Not applicable ___

(6) Are there other people or laboratories in your organization that can respond? Yes _x_ No ___. If yes please list names and addresses. Dr. Donald C. Malins, Director, Environmental Conservation Division (same address)

_____

(7) Under what conditions can you respond? (or cannot respond)

(8) What is your primary interest? Oil spill research _x_ Impact assessment ____ Other, please explain Analytical Methods Development

Please return to:

Dr. W. D. MacLeod
NOAA-NMFS
2725 Montlake Bldv., E.
Seattle, Washington 98112

OIL SPILL RESEARCH AND LABORATORY QUESTIONNAIRE

Name and Address:

David G. Shaw
Institute of Marine Science
University of Alaska
Fairbanks, AK 99701

Bus. Phone: (907) 479-7723

Home Phone: (907) 479-6339

Alternate person to be contacted, and address: _____

Bus. Phone: ( ) _____

Home Phone: ( ) _____

Sponsoring Agencies: _____

ANALYTICAL EQUIPMENT: If more than one, insert number.

Infra-red (1) Make PE 621

Gas Chromatography:

packed column 1 glass capillary 2 Mass spec 1

UV Fluourscence:

Type _____

Microbalance 2

GENERAL DESCRIPTION OF EXTRACTION TECHNIQUES:

TYPES OF SAMPLES ANALYZED: Sediment x Tissue x Seawater x

Tarballs x Cargo x Other _____

OTHER LAB CAPABILITIES: Ecosystem tanks, weathering, etc. 44,000L

FIELD WORK CAPABILITIES: Sediment, water column, surface, doplet size and distribution, etc., please list ~~fixed~~ field equipment.

RESPONSE CAPABILITY:

(1) How many people can you muster in 24 hours?

(a) to obtain samples 2

(b) to analyze samples 2

(2) Do you need sponsoring agency approval?

Yes x No ____ Recommended ____

(3) Are you part of an oil spill research team? Yes ____ No X

(4) If so, what is the expertise of the team and individual members? Please list: _____

_____

_____

(5) Can the whole team response? Yes ___ No ___. Not applicable ___

(6) Are there other people or laboratories in your organization that can respond? Yes ___ No ___. If yes please list names and addresses. _____

_____

_____

(7) Under what conditions can you respond? (or cannot respond)

(8) What is your primary interest? Oil spill research ____ Impact assessment ____ Other, please explain _____

_____

Please return to:

Dr. W. D. MacLeod
NOAA-NMFS
2725 Montlake Bldv., E.
Seattle, Washington 98112

THE PHYSICAL PROCESSES

PANEL REPORT WILL
BE INCLUDED IN
THE FINAL VERSION
OF THIS REPORT

SUPPORTING FACILITIES PANEL

Participants

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J. Coan
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M. S. Macie
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M. Butcher
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B. Simpson

T. Hall

SUPPORTING FACILITIES PANEL

General Information and Guidance

- Overview of Panel Activities
- Facilities Survey
- Data Management Aspects

OVERVIEW OF PANEL ACTIVITIES

The Supporting Facilities Panel formed two sub-panels to address the following topics more effectively:

- Facilities Survey
- Data Management Aspects.

The Facilities Survey Sub-Panel made progress toward compilation of a listing of available facilities. The Data Management Aspects Sub-Panel attempted to better define procedures for preservation of data for scientific and legal purposes.

FACILITIES SURVEY

A. The following tasks were accomplished with respect to performing a facilities survey:

- Developing a revised reporting format for facilities (*see Section C*).
- Determination of the availability within major agencies of inventory lists that were developed in conjunction with Regional Response Plans.
- Delegation of lead members within representative agencies to obtain the above information for incorporation into our plan.
- Identification of sources for obtaining facilities data from those organizations not present.
- Discussion of the inclusion of Coast Guard Report: Logistics Requirements and Capabilities for Response to Oil Pollution in Alaska for the Alaska Plan.

B. It was generally agreed that a small panel does not have the resources necessary to compile a comprehensive listing of available facilities. Therefore, the panel members concentrated on identifying specific sources previously accumulated information and determining how the information could be acquired for our use. Potential sources that we will be contacting include:

1. Federal

    a. Coast Guard

    b. NOAA-NWS, NMFS, NOS

    c. EPA

    d. BLM

    e. Fish & Wildlife Service

    f. Forest Service

    g. Department of Defense

    h. USGS

    i. Office of Aircraft Services

2. State

    a. Department of Environmental Conservation

    b. University of Alaska

    c. Alaska Department of Fish and Game

    d. Alaska Department of Public Safety and Transportation

    e. Department of Natural Resources

3. Private Industry

    a. Contracting firms

    b. Consulting firms

    c. Industry (i.e., Alyeska, B.P. Arco, etc.)

C. Reporting Format for Facilities*

In developing this reporting format, the panel considered two basic scenarios: (1) emergency scientific support to the On-scene Coordinator (OSC) and (2) longer term (or after-the-fact) environmental assessment studies. The reason for this delineation centered mainly around the availability of funding for emergency OSC support through the Federal revolving fund, and the present lack of dedicated funds for longer term studies. The first topic covered was fixed and mobile laboratory facilities. The panel initially separated this topic into two groups, but after considerable discussion, the panel felt that mobile laboratories are essentially a support function of fixed laboratory facilities and, therefore, decided to identify mobile labs as a support category under fixed laboratories.

The following is an outline of the reporting format which was agreed on by the panel to describe fixed laboratories facilities in accordance with the guidance document.

1. Fixed Laboratories

   a. Location

   b. Operating Organization

   c. Contact Person: Name, Bus. Tel., 24-hour Tel.
      Alternate: Name, Bus. Tel., 24-hour Tel.

   d. Capabilities

      (1) Physical Oceanography
      (2) Biological Oceanography
      (3) Chemical Oceanography
      (4) Geological Oceanography
      (5) Current Research/Operational Activities
      (6) Maximum Sample Output (1 day, 1 week, etc.) by category of hydrocarbon analysis, oil identification, etc.
      (7) Mobile Laboratory

   e. Availability

      (1) Emergency Support - categorize high or low
      (2) Longer Term Studies - categorize high or low

*Rewritten from Hartford Workshop Report.

*2. Portable Laboratories (Independent)

A number of issues were discussed in arriving at this reporting format. Most notably, the issue of funding and analytical costs was the question. It was the consensus of the panel, based on advice from Coast Guard representatives, that funding of emergency support services to the OSC was available through the Pollution Revolving Fund, and, therefore, was not a constraint. While this is true if the fund is activated, there will be a number of incidents in which the responsible party will be taking proper cleanup actions, thus not allowing use of the fund at times during which the OSC might still need scientific support. In these cases, the considerations pertinent to longer term studies will apply.

This panel recognized that the availability of laboratories for longer term studies would be dependent on a number of factors. Federal laboratories, for example, might be willing to undertake longer term studies if they fell within the criteria of already funded research activities. The availability of private laboratories, however, would probably be based on the results of bid invitations and the acceptance of some form of basic ordering agreements (BOA) for the specific projects required.

3. Command/Coordination Centers

The NOAA-SOR Team has established operating guidance which includes criteria for command/coordination centers. This document was made available to the panel by the SOR Team director. If possible, identical or similar criteria will be used by the panel to ensure maximum compatibility.

4. Fixed Wing Aircraft

The following criteria were established by the panel to describe fixed wing aircraft.

a. Aircraft Type

b. Operating Organization

c. Contact Person: Name, Bus. Tel., 24-hour Tel.
Alternate: Name, Bus. Tel., 24-hour Tel.

d. Remote Sensing Capability

e. Range

*Indicates change from Hartford Workshop Report.

f. Load and Passenger Capacity

g. Navigation Capability

h. Operating Costs

i. Other Capabilities: e.g., over water, water landing capability

5. Rotary Wing Aircraft

The same criteria as applied to fixed wing aircraft apply to rotary wing aircraft.

6. Nearshore Oceanographic Vessels

These were subdivided by the panel into short endurance work platforms (i.e., no overnight capabilities) and longer endurance nearshore craft. The following criteria will be used to describe these vessels.

*

a. Vessel Type

b. Operating Organization

c. Contact Person: Name, Bus. Tel., 24-hour Tel.
Alternate: Name, Bus. Tel., 24-hour Tel.

d. Range

e. Endurance

f. Sampling Capabilities - Including fish and plankton travels, benthic sampling (both geological and biological) water column sampling, instrument emplacement and meteorological capabilities

g. Scientific Party Capacity

h. Draft

*i. Other Capabilities (aircraft)

7. Offshore Oceanographic Vessels

Same as a-i above. Other capabilities - include satellite support (i.e., work boats, helo landing and refueling capabilities, etc.).

*Ibid.

8. Radio Communications

a. Operating Organization

b. Location

c. Contact Person: Name, Bus. Tel., 24-hour Tel.
Alternate: Name, Bus. Tel., 24-hour Tel.

d. Frequency Assignments - other frequencies

e. Types of Equipment: Base, Mobile, Hand held

f. Range

(1) Base - mobile
(2) Base - hand held
(3) Mobile - hand held

g. Equipment Available

(1) Base
(2) Mobile
(3) Hand held

h. Availability

i. Daily Time of Operation

j. Mobile Operator Interface - yes, no

*Land line communications and satellite and ham operations, including telephone and TWX/TELEX/TELEFAX capability will also have to be inventoried for all participating organizations.

*9. Submersible and Diving Services

The following criteria were established for submersibles:

a. Vessel Name

b. Operating Organization

c. Location

*Ibid.

d. Contact Person: Name, Bus. Tel., 24-hour Tel.
Alternate: Name, Bus. Tel., 24-hour Tel.

e. Depth Capability

f. Sensing/Sampling Capability

g. Speed

h. Endurance

i. Surface Support Requirements

j. Transportability

k. Scientific Compliment

l. Lock-out Capabilities

m. Operating Costs

n. Availability

o. Communications

p. Navigation Capability

q. Safety Equipment

*10. Subsistence and Amenities

a. Housing

b. Food

c. Clothing

B. Funding for Facilities

The panel discussed various alternative mechanisms which might be utilized to fund the use of facilities. It was recognized that the normal contracting procedures used by the Federal Government are much too lengthy to be effectively utilized to fund private sector response. The panel, therefore, recommends that the following mechanism be investigated bythe executive committee as possible funding means:

*Ibid.

- Basic ordering agreements (BOA's)
- Letter contracts
- Procedures used by the Coast Guard for funding cleanup contractor emergency response.

The use of interagency agreements was felt to be a viable method of transferring funds among Federal agencies for reimbursement of facility costs, if needed. It was recognized, however, that all Federal agencies have statutory responsibility for oil spills, and, therefore, should be encouraged to commit their own resources to this problem.

C. Follow-up Work on Facilities

The panel has been tasked with obtaining further information from agencies and organizations. Inclusion of specifics will depend on the response of these groups. The panel does recommend that the Coast Guard report, Logistic Requirements and Capabilities for Response to Oil Pollution in Alaska, P. L. Peterson, et al, Battelle Pacific Northwest Laboratories, be included in our final plan. It is definitely the most comprehensive facilities document available. Further, the panel recommends that this document and any other facilities information be systematically, i.e., annually reviewed and updated.

DATA MANAGEMENT ASPECTS

A. General Considerations

A great deal of environmental data will probably be collected at the scene of an oil spill. These data could be in the form of field notes or log sheets, photographs or digital records. It is important that these data be assembled both for the possible immediate use of the on-scene coordinator, as a basis for comparative use in later environmental assessments, or to be used for possible legal determinations. It is important that ancillary information such as methodology, data collector, etc., be recorded to make each data set as complete as possible. The designation of a data coordinator and his responsibilities as well as guidelines for a Response Team Data Management Plan to implement these ideas follow. These guidelines are intended to provide orderly and concise information to assist in the scientific response to an oil spill.

Data products, or the final form of all the data collected should be the driving force behind data management. If the data are not useful in reaching the stated objectives of the program, they should not be collected.

B. Data Coordinator Responsibilities

A data management plan shall be an integral part of this proposed organization of the scientific response program and, as such, shall include within its framework the necessary elements of data management. The data in this context shall be defined as the results, measurements or calculations made at the site or as the end product of laboratory analysis. The meaning shall be limited so that the data excludes the sample proper or its chain of custody.

The responsibilities of managing the data will be executed by the data coordinator. This person will be an assistant to the scientific coordinator. This individual would:

- Plan the necessary data handling activities in advance of any oil spill.
- Ensure all material supporting data management are in order and in adequate supply.
- Respond immediately in support of the response team to regional spills for the purpose of implementing the data handling procedures.
- Interact with all scientific components and contractors to ensure that data and the necessary data tracing procedures are carried out.
- Keep records and inventories of data collected.
- Report the status and availability of data to the scientific coordinator or the on-site coordinator.
- Disseminate scientific information between and among the scientific personnel and the laboratories as required.
- Prepare special data reports for the on-site coordinator as required. Such reports should summarize the information in a clear, concise style.
- Reviews the data management plan.
- Monitors the data collection effort for compliance with established guidelines and responds to the scientific coordinator. Documents any variances from the established guidelines.

- Transmits the records to a national and/or a regional archive upon completion of the response team effort.

There are four main points to emphasize in the data management plan:

- Designation of a data coordinator.
- Establishment of data handling procedures.
- Establishment of data transmission and dissemination procedures.
- Designation of a national and/or regional archive.

C. Guidelines

The following outline proposes activities and responsibilities of the Data Coordinator and suggests guidelines for a response team data management plan.

1. Data Coordinator

a. Planning Phase

- Familiarization of existing data and potential data products from historical baseline studies that are currently archived with other agencies (OCSEAP, ADF&G, USF&WS, USGS, etc.).
- Familiarization with desired data products as determined at regional workshops.
- Advance preparation of the data products to be provided as required on the scene of the oil spill. This would facilitate the immediate response to the requests for data products of the OSC and scientific coordinator.
- Development and production of necessary forms and maintenance of an adequate supply.

b. Operational Phase

- On-site briefing of scientific personnel as to data handling requirements.

- Maintenance of specific data inventories as data collection proceeds.

- Dissemination of information between and among scientific personnel.

- Documentation of any variances from the Data Management Plan as developed previous to the response.

c. Analysis Phase

- Preparation of reports on status of data sent to be analyzed.

- Preparation of special data reports at the direction of the OSC or scientific coordinator.

- Responsibility for the transmittal of records to a national and/or regional archive.

2. Data Management Plan Guidelines

The Response Team Data Management Plan will:

- Document data parameters to be collected (units and precision to be specified).

- Document media and format, if applicable.

- Identify procedures to be used in collecting, analyzing, and filtering raw data.

- Define minimum sample sizes, sampling density, or volume (or replicates).

- Document data products that will be produced from the data, and how they will be produced and disseminated.

As the Data Coordinator will be ultimately responsible for the documentation of data, it would seem beneficial for the Data Coordinator to seek legal counsel relative to what kinds of documentation are legally sufficient to stand up in a court of law.

D. Chain-of-Custody Aspects

A well organized, previously agreed upon, logical, simple, and most importantly, legally sufficient chain-of-custody procedure must

be established. Several chain-of-custody procedures have been identified including EPA Region I and State of Alaska procedures. In general, these procedures provide for the security of samples from the time they are collected until their use in a court of law. At each stage along the way, an individual is responsible for the integrity of the sample. Each new individual along the chain must sign for custody of the samples.

The person responsible for initiating chain-of-custody procedures will be designated by the SSC. Procedures and guidelines for gaining access to collected samples must be determined before a spill contingency situation. The on-scene coordinator has final authority over all samples collected.

The following page is an example of a chain-of-custody record.

BRIEF DESCRIPTION OF SHIPMENT CONTENTS: _____

_____

_____

SHIPPED TO: Name _____

Address _____

_____

SHIPPED BY: Name _____

Date _____ Time _____

I hereby certify that I received the attached package in good condition with binding seals intact and disposed of it as shown below:

RECEIVED BY: _____ Date _____ Time _____

AFFILIATION: _____

COMMENTS: _____

_____

RECEIVED BY: _____ Date _____ Time _____

AFFILIATION: _____

COMMENTS: _____

_____

RECEIVED BY: _____ Date _____ Time _____

AFFILIATION: _____

COMMENTS: _____

_____

RECEIVED BY: _____ Date _____ Time _____

AFFILIATION: _____

COMMENTS: _____

_____

RECIEVED BY: _____ Date _____ Time _____

AFFILIATION: _____

COMMENTS: _____

ARCTIC SPILLS PANEL

Participants

G. Weller, Chairperson

R. Gleason
G. Marsh
J. Mach
N. Kavanagh
R. Morris
D. Chamberlain
W. Sackinger
J. Di Falco
T. Bunite
B. Wondzell
D. Murphy
G. Parkins

J. Janssen
L. Gratt
B. Schoof
T. Hall
W. Woodruff
N. Maynard
J. Kreitner
A. Kegler
B. Mansfield
D. Wright
D. Norton
R. Johnson

D. Dooley

ARCTIC SPILLS PANEL

General Information and Guidance

- General Considerations
- Objective 1: Support to the OSC
- Objective 2: Damage Assessment
- Objective 3: Recommended Research

GENERAL CONSIDERATIONS

The bulk of economic impacts from oil spills will be felt by subsistence lifestyles. Since there are few, if any, commercial species or biota in the Arctic which may be affected by the spills, assessing spill damage in terms of dollars may prove difficult. Other means of quantifying damage assessment should be considered: Btu's (energy) or protein values.

Long-term effects of spilled oil on ecosystems on a global scale (birds, whales) should also be considered. However, very little is known about the effects of spilled oil on individual key species of the Arctic trophic system, and much less is known about the overall effects on the Arctic ecosystem.

OBJECTIVE 1: SUPPORT TO THE OSC

When a spill occurs, trajectory forecasts will determine when and where the oil will be deposited. A biological impact assessment team* should complete survey studies as soon as possible after the spill in the areas likely to be affected by the oil. We realize that during the spill there may be heavy competition for available logistics, but we emphasize that if a proper biological impact assessment is to be completed, pre-spill and post-spill conditions will have to be compared. The maps and calendars of critical habitats and biological events that are currently available will not be adequate to assess the natural year-to-year availability of conditions just

*Mechanisms for establishing this team (action plan, members, telephone numbers, etc.) need to be put together. Volunteers from our group are: D. W. Chamberlain, ARGO, and D. Norton, University of Alaska. The projects identified by us generate surequisite information for the job of this response team.

prior to the spill. Populations, densities, and habitats for birds, mammals, benthos/plankton, littoral biota, and fish should be examined in spill impact areas (including control areas outside the spill impact areas) prior to, during, and after the spill. For information and assistance in performing these studies, contact the following institutions:

- Nalco Environmental Sciences
- Institute of Marine Sciences, University of Alaska
- Department of Environmental Consultants
- USFWS (Reid)
- ADFEG (Grundy, Bendock)
- OCSEAP Investigations
- Woodward Clyde
- Dames and Moore

OBJECTIVE 2: DAMAGE ASSESSMENT

The fragile nature of the Arctic system, including a critical short foodchain, may make substantial impacts by spilled oil very probable.

One problem that should be addressed is the minimum frame (number of years) over which effects of oil spills operate on the Arctic ecosystem. We can not now go beyond our recommendations for further studies in trying to assess actual impacts, however, this will resolve itself over time.

OBJECTIVE 3: RECOMMENDED RESEARCH

Listed below are possible impacts that need to be considered by the appropriate experts:

- Change in biota migration routes
- Change in biota feeding patterns
- Change in hunting of whales and seals
- Effects on employment

- Effects on commercial fisheries
- Effects on foreign commercial fisheries (Japan, U.S.S.R., Korea)
- Effects on cottage industries (ivory carving)
- Effects on available logistics
- Effects on local charter logistics (boat, aircraft)
- Effects on barge freighted supplies to villages during summer (OSC could requisition all available lightwing craft)

ARCTIC PANEL

Recommended Projects

1. Determine the characteristics of the oil.
2. Aerial reconnaissance of oil extent and sea ice.
3. Tracking of oil and sea ice by buoy.
4. Satellite reconnaissance of the oil extent.
5. Detect oil under the ice.
6. Effects of surface currents and winds on movement of oil.
7. Effects of subsurface currents on oil dispersion.
8. Effects of ice movement, ice dynamics.
9. Oil in the water column.
10. Oil deposition in the sediments.
11. Weathering and degradation of oil under ice.
12. Oil burning.
13. Use of dispersants and sinking agents.
14. Oil disposal.
15. Selection of staging areas.
16. Disturbance of biota by cleaning crews.
17. Cleanup on beaches.
18. Identify critical habitats and processes for all biota.
19. Identify cricial coastal ecosystems and biomes.
20. Assess rise and effectiveness of methods to keep birds and mammals away from a spill.
21. Cleaning of oiled birds and mammals.

ARCTIC PANEL
PROJECT NO: 1
PRIORITY RANK: 1

1. Project Title: Determine the Characteristics of the Oil

2. Project Description:

In order to determine how to respond to a spill, it is very important to determine the oil characteristics first: whether the oil is sweet or sour (H_2S); gas/oil ratios; pour points; viscosity; specific gravity; and spreading coefficient; etc. Take adequate physical quantities for future reference and use standard physical and chemical analysis. Studies prior to and during a spill are not required.

3. Performing Institution:

- U.S. Bureau of Mines
- API
- University of Alaska (David Show)
- Chemical and Geological Labs of Alaska, Anchorage Alaska
- Chevion Research, Southern California
- Oil companies ans oil shippers (at least with coarse resolution)

4. Applicable Habitats:

All affected by the spill.

5. Applicable Conditions:

6. Applicable Oil Type:

Any.

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

See No. 3. Performing Institutions

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 2
PRIORITY RANK: 1

1. Project Title: Aerial Reconnaissance of Oil Extent and Sea Ice

2. Project Description:

3. Performing Institutions:

Naval Arctic Research Lab, Barrow
(C-117 remote-sensing aircraft: SLAR photography, etc.)

U.S. Army, Ft. Wainwright, Alaska
(Mohawks: SLAR, photography, etc.)

U.S. Air Force, Elmendorf & Eielson AFB
Alaska (photography)

NASA-Coast Guard, Cleveland
(C-130 with SLAR, etc.)

Canada: Lockheed Orion aircraft (Dept. of Defense)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Type:

Any.

7. Time Frame:

(Frequency of reconnaissance over spill duration:)

1) For spills under fast ice - no reconnaissance.

2) For spills on fast ice - one time only (unless the ice breaks up).

3) For spills in open water - at least once daily, move frequently if slick moves fast (photography and visual observations).

4) For a blowout in a moving pack - SLAR and photography daily.

8. Costs:

Between $400-600/hr flying time, including ferrying the aircraft to the spill.

9. Equipment Needs/Equipment Available:

- At the minimum, photography and SLAR are required (the latter because the frequency of low cloud cover in summer is very high).

- Develop remote-sensing techniques of detecting oil at the surface (either on water or ice) in bad weather/low visibility. Use and assess technology developed prior to spill. (CRREL, Hanover, N.H. (A. Kovacs) Department of Defense, Canada Canadian Center for Remote-Sensing, Ottawa).

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 3
PRIORITY RANK: 1

1. Project Title: Tracking of Oil and Sea Ice by Buoy

2. Project Description:

3. Performing Institutions:

Polar Research Labs, Santa Barbara (Ice buoys--construction)

NARL or from charter Twin Otter (Deployment)

NOAA, Miami (Hansen) (Drogue buoys)

Orion Electronics Ltd., Nova Scotia (Radio-tracked buoys)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

All types.

7. Time Frame:

(Frequency during spill duration:)

a) For spills under fast ice - one buoy for positioning.

b) For spills on fast ice: None (or one, for navigating to it in bad weather).

c) For spills in open water: NOAA drogue buoys (Hansen) released at regular intervals, depending on velocity of slick.

d) For a blowout in a moving pack ice: ADRAM buoys, released at regular intervals, depending on velocity of slick.

8. Costs:

$5-6K/buoy (ADRAM)
$200/buoy (radio-tracked)

9. Equipment Needs/Equipment Available:

   a) Drifting buoys are required to track the slick in bad weather.

   b) ADRAM buoys on the ice - air-droppable, continuous satellite interrogation.

   c) Similar buoys with drogues in the water.

   d) Radio-tracked buoys.

   e) Drift cards and dye markers during good weather.

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 4
PRIORITY RANK: 2

1. Project Title: Satellite Reconnaissance of the Oil Extent

2. Project Description:

Analysis of routine satellite photos during good weather. The oil slick (unless very large) can probably not be seen from satellites, but the ice conditions in the vicinity of the slick can be (leads, polynyas, ridges, etc.).

3. Performing Institutions:

NASA

Gilmore Creek Tracking Station

NOAA, Fairbanks, Alaska

NEWS Office, Fairbanks Alaska

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Type:

All types.

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

a) NOAA and LANDSAT satellites.

b) SEASAT all-weather high resolution imagery could be a very useful tool with high priority.

10. Facility Needs/Facilities Available:

A quick-look facility in Alaska is highly desirable for this (does not presently exist for LANDSAT)

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 5
PRIORITY RANK: 1

1. Project Title: Detect Oil under the Ice

2. Project Description:

Simple drilling at many different spots with a hand auger. Under-ice topography by impulse radar Gas-shifting sniffing.

3. Performing Organizations:

CRREL (U.S. Army)

CRREL (A. Kouacs)
Hanover, N.H.

NARL
Barrow, Alaska

Crowley Maritime (Allen)
Anchorage, Alaska

Hydroproducts
San Diego, California

Benthos, Inc.
Massachusetts

Schlumberger
Anchorage, Alaska

Soelye Martin
University of Washington

Russ Peters
Mem. University of New Foundland

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Type:

All types.

7. Time Frame:

8. Costs:

   a) Drilling--no equipment cost, salary for crews

   b) Television--$3K/month for rental of gear

9. Equipment Needs/Equipment Available:

   a) Impulse radar--equipment at hand

   b) Television cameras and submersibles

   c) Logging techniques, radioactive tracers

   d) Develop remote-sensing techniques which can detect oil under ice (no remote-sensing techniques are available now, although experimental developments continue).

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 6
PRIORITY RANK: 1

1. Project Title: Effects of Surface Currents and Winds on Movement of Oil

2. Project Description:

For predicting spill trajectories in water and moving pack ice, winds at the surface must be known to a better degree than that given by the 2 weather stations along Alaska's arctic coast. Air pressure, wind speed and direction at 3-4 points in the vicinity of the spill (on land) must be measured. The Alaskan interagency meteor-burst telementary network is the most suitable real-time system for this. Also measure surface currents by using Richardson probes.

3. Performing Organizations:

National Weather Service, NOAA, Fairbanks and Anchorage (Tome Bowers) - meteorology

Coast Guard - Richardson - probes

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Type:

All types.

7. Time Frame:

8. Costs:

$5K station, plus sensors for meteorology
$60 per Richardson probe

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. <u>Payoff</u>:

14. <u>Limitations</u>:

ARCTIC PANEL
PROJECT NO: 7
PRIORITY RANK:

1. Project Title: Effects of Subsurface Currents on Oil Dispersion

2. Project Description:

While the movement and dispersion of oil in the water column may be important in its final effect on biota, it was not considered to be important in the context of giving advise to the USCG on trajectories and behavior of oil, the stated objectives of this section.

3. Performing Organizations:

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 8
PRIORITY RANK: 1

1. Project Title: Effects of Ice Movement, Ice Dynamics

2. Project Description:

Ice, which is present for most of the year in the Arctic, will be the prime mover of spilled oil in most cases. Ice dynamics processes on a large scale and on a small scale need to be known in order to predict the movement and destination of spilled oil.

Determine ridging processes and lead formations, as well as lateral bulk displacement of sea ice by observation (satellites, radar) and modeling. Determine small-scale oil-ice interactions (incorporation of oil in ridges, etc.).

3. Performing Organizations:

AIDJEX, University of Washington (Britchard)

CRREL, Hanover, New Hampshire (Hibler)

University of Alaska (Echon) - satellite observations

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 9
PRIORITY RANK: 1

1. Project Title: Oil in the Water Column

2. Project Description:

Butterfly sampler, but contamination problems may exist when sampling through a thick layer of oil under the ice. It is important to know which of the fractions of the oil go into the water column.

3. Performing Organizations:

University of Alaska, Fairbanks (David Shaw) is closest site for adequate chemical analysis.

Arco/BP Lab - at Prudhoe Bay? (probably insufficient)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 10
PRIORITY RANK: 1

1. Project Title: Oil Deposition in the Sediments

2. Project Description:

   Similar to Project No. 9.

3. Performing Organizations:

   Similar to Project No. 9.

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 11
PRIORITY RANK: 3

1. Project Title: Weathering and Degradation of Oil under Ice

2. Project Description:

Weathering and biodegradation of oil under ice is considerably slower than in open water, but the rates are now fairly well known. This information has already been generated and will be adequate in the case of a spill to help the OSC making decisions.

3. Performing Organizations:

Similar to Project No. 9.

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 12
PRIORITY RANK: 1

1. Project Title: Oil Burning

2. Project Description:

This is a somewhat controversial issue insofar as environmental effects of burning are not adequately known. Burning of oil on the ice in the Arctic may well be one of few available methods for effective cleanup.

3. Performing Organizations:

- Ron Atlas
  University of Louisville
  Louisville, Kentucky

- Doug Wolfe
  NOAA
  Boulder, Colorado

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 13
PRIORITY RANK: 2

1. Project Title: Use of Dispersants and Sinking Agents

2. Project Description:

As in Project 12, this is a controversial issue about which insufficient information is available, particularly for the Arctic where different mixing ratios, quantities, etc. are needed.

On-scene assessment is needed by a representative from EPA, which has control for use of all dispersants.

3. Performing Organizations:

- EPA
  Anchorage, Alaska
  (Ray Morris)

- AOGA

- API

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 14
PRIORITY RANK: 1

1. Project Title: Oil Disposal

2. Project Description:

Burning of residues may or may not be permitted; environmental impacts are unknown but probably small. Landfills are an important method of disposal. A study is presently underway to predetermine possible sites. Other methods of disposal have to be considered also.

3. Performing Organizations:

Department of Environmental Conservation
Fairbanks, Alaska
(Doug Lowrey)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

On-site inspection by one person who will decide whether to use landfills (depends on type and volume of material, time of year, etc.).

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 15
PRIORITY RANK: 1

1. Project Title: Selection of Staging Areas

2. Project Description:

Staging areas for cleanup operations may have to be located in undisturbed areas along the beach or on a barrier island. A number of agencies may have to be contacted, depending on ownership of the land. These agencies will presumably have to give the permits for cleanup staging areas to be set up on their land (see also next task). Sites need to be predetermined in as much detail as possible for major accidents. Guidelines need to be written for expected minor accidents. The method of obtaining permits needs to be determined in advance.

3. Performing Organizations:

Private land owners, including the North Slope Burrough (Mayor Eben Hobson, Barrow) or other coastal communities.

Division of Lands (Bill Copeland, Fairbanks) for all state lands

BLM (Jim Cohen, Anchorage), all federal lands (including NPR-4?)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

On-site inspection by representatives of the various agencies, or advice by telephone.

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 16
PRIORITY RANK: 2

1. Project Title: Disturbance of Biota by Cleaning Crews

2. Project Description:

   Noise made by cleanup operations was not considered to be a major impact, but disturbance of habitat, etc., might well be, depending on the time of year.

3. Performing Organizations:

   - CRREL (Jerry Brown, IBP experiences)

   - ADF&G (Scott Grundy, Fairbanks)

   - Arctic Wildlife Refuge (Ave Thayer, Fairbanks)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

    On-site inspection and advice by representatives of various agencies. Some of this information can be generated prior to the spill.

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 17
PRIORITY RANK: 1

1. Project Title: Cleanup on Beaches

2. Project Description:

   Again, as in Project 15, political boundaries determine who should be approached to give advice to the USCG on cleanup operations on thier land.

3. Performing Organizations:

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 18
PRIORITY RANK:

1. Project Title: Identify Critical Habitats and Processes for All Biota

2. Project Description:

It is very important to determine all critical habitats and biological processes (seasonal) prior to a spill. Maps of habitats and calendars of critical events at 10-day intervals should be constructed.

3. Performing Organizations:

Habitat Protection Section, ADF&G (Scott Grundy, Fairbanks and Lance Trosky, Anchorage)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

An on-site advisor representing all these institutions and having all the information readily available is necessary at the spill site.

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 19
PRIORITY RANK: 1

1. Project Title: Identify Critical Coastal Ecosystems and Biomes

2. Project Description:

Very little is known about arctic coastal ecosystems, and considerably more research needs to be done before effects on coastal ecosystems are known and advice on whether and how to protect them can be given rationally. This identification may prove difficult as Arctic biomes are frequently associated with zones that cannot be uniquely located spatially (e.g., ice edge, lead systems, etc.)

3. Performing Organizations:

LGL
Edmonton
(Joe Truet and Alan Birdsall)

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 20
PRIORITY RANK: 2

1. Project Title: Assess Use and Effectiveness of Methods to Keep Birds and Mammals Away from a Spill

2. Project Description:

Studies of scare devices have been made, but other methods may be available in the Arctic to keep birds and mammals away from a spill. There may be regulatory requirements to use these in some instances. Decisions on what to use and when are needed.

3. Performing Organizations:

LCL
Edmonton
(John Ward)

FAA

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

ARCTIC PANEL
PROJECT NO: 21
PRIORITY RANK: 3

1. Project Title: Clearing of Oiled Birds and Mammals

2. Project Description:

   This has already been determined to be largely futile biologically but may be politically important and probably necessary.

3. Performing Organizations:

   USFW
   Anchorage, Alaska
   (Cal Lensink and Skip Ladd)

   Institute of Bird Rescue Service
   Berkley, California

4. Applicable Habitats:

5. Applicable Conditions:

6. Applicable Oil Types:

7. Time Frame:

8. Costs:

9. Equipment Needs/Equipment Available:

10. Facility Needs/Facilities Available:

11. Personnel Needs/Personnel Available:

12. Support Services:

13. Payoff:

14. Limitations:

INLAND SPILLS PANEL

Participants

R. Latimer, Chairperson

J. McKendrich
T. Lognachen
J. Vestal
J. LaPerriere
L. Schalloch
P. McCort
G. McCoy
E. Buck
J. Webb

INLAND SPILLS PANEL

General Information and Guidance

- General Considerations
- Objective 1: Support to the OSC
- Objective 2: Damage Assessment
- Objective 3: Recommended Research

GENERAL CONSIDERATIONS

The Inland Spills Panel recognized its unique role in addressing the question of environmental damage associated with oil spills in the freshwater and terrestrial systems of Alaska. Because the subject was too broad to treat in its entirety within the allotted time period, the panel chose not to consider chemical analyses; supporting facilities; legal; histopathology; waterfowl and shore birds; and socioeconomic considerations. The Inland Spills Panel recommended that panels covering these subjects in the marine environment also consider any freshwater aspects. The Panel also recommended that the refinement, extension, and application of this Panel's efforts be handled through a separate workshop that would provide for several other panels to consider specified aspects fof environmental damage from oilspills on the terrestrial and aquatic systems of Alaska.

OBJECTIVE 1: SUPPORT TO THE OSC

Oil Movement and Behavior

Seasonal conditions and spill locations effect support in spill description and movement prediction. Winter conditions require special procedures and additional information such as snow pack conditions (depth, density, water equivalent), thicknesses of river and lake ice, water velocities under the ice, and detection of oil under snow and ice cover using visual observation, bore holes, remote sensing, etc. For information regarding oil movement and behavior under specific conditions for particular locations, the following individuals and agencies may be contacted:

SUMMER	WINTER
TERRESTRIAL: Terry McFadden Cold Regions Research and Engineering Laboratory Fairbanks, Alaska Phone: 353-8114	SNOW PACK CONDITIONS George Clagget Soil Conservation Service PREDICTION AND MOVEMENT OF OIL Carl Benson Geophysical Institute Fairbanks, Alaska GENERAL INFORMATION Terry McFadden Cold Regions Research and Engineering Laboratory Fairbanks, Alaska Phone: 353-8114
RIVERS AND STREAMS: National Weather Service River Forecast Center Anchorage, Alaska Phone: 265-4716	FLOW CONDITIONS UNDER ICE Ray George USGS Anchorage, Alaska PREDICTION OF MOVEMENT OF OIL UNDER ICE Arctic Columbia, Maryland

SUMMER	WINTER
RIVERS AND STREAMS (continued):	
	ICE THICKNESS National Weather Service River Forecast Center Anchorage, Alaska Phone: 265-4716
LAKES AND PONDS:	
WIND AND TEMPERATURE DATA AND FORECAST INFORMATION Natonal Weather Service River Foecast Center Anchorage, Alaska Phone: 265-4716	Ray George USGS Arctic Columbia, Maryland National Weather Service River Forecast Center Anchorage, Alaska Phone: 265-4716

Environmental Impact of Cleanup Operations

Direct removal of spilled oil while still in liquid form is the most desirable. When this is not possible, considerations should be given to sorbents; burnings, physical removal of contaminate snow, ice, or vegetation; disperants; and just leaving the oil where it lies.

- SORBENTS

  Sorbents have little environmental impact if properly selected and utilized. Some sorbents like 3-M products tend to deteriorate under use and create few environmental problems. Other sorbents, however, have nylon backings that produce a residue harmful to fish and other wildlife. For advise on sorbents contact Crowley Environmental in Anchorage; Frank Fisher, Alyeska, Anchorage; or Larry Dietrich, Alaska Department of Environmental Conservation, Fairbanks, 452-1714.

- BURNING

  Burning can be an effective way to dispose of spilled oil with little adverse environmental impact under proper conditions. However, burning can cause additional damage to terrestrial systems and create unacceptable air pollution in

local areas. Permission to burn must be obtained from Regional Office of Dept. of Env.-Conservation. For advice or assistance in burning operations, contact W. W. Mitchell, Agricultural Experiment Station, 745-3257; Bob Nichols, U.S. Coast Guard, Anchorage,----or Bureau of Land Management, Fire Control, Office.

- PHYSICAL REMOVAL

  Physical removal of contaminated snow, ice, vegetation, and soil can have serious environmental effects if proper disposal is not possible or if the thermal equilibrium of permafrost is disturbed. For advice contact Arlon Kohl, Alaska , 272-3422; John Williams, USGS, Geological Division, ----; Sam Reizer, Soil Conservation Service, Anchorage, Terry McFadden, CRREL, Fairbanks, 353-8114, Joe Webb, BLM, Fairbanks, 452-4725.

- DISPERSANTS

  Dispersants should only be used in those rare situations where the known adverse impact on aquatic systems is compensated by the value of wildlife saved by such an action. It is recommended that only on the North Slope where rare or important waterfowl may be nesting should any consideration be given to the use of dispersants. For advice contact Howard Metsker, U.S. Fish and dWildlife Service, Anchorage, 265-4895; Alan Townsend, ADF & G, Fairbanks, 452-1531.

Identification of Critical Habitats

Identification of critical habitats requiring extraordinary protection was not possible under the time limitations and other constraints on the panel. There has been no comprehensive or systematic cataloging of critical habitats in Alaska. The lack of this information will make any decisions to control or cleanup oil spills equivocal, thereby creating a lack of confidence in any damage assessment studies that would follow a spill. The panel identified this lack of data as one of the most critical problems it faced.

Some data is available, however, for certain areas or certain species of wildlife. For example, the terrestrial systems in the Trans Alaska Pipeline corridor have been classified. For advice and information concerning the pipeline corridor contact Lew Pamplin, Fish and Wildlife Service, Les Verich, University of Alaska, Fairbanks, or Alaska Pipeline Offices, Anchorage, 224-9561. For terrestrial and aquatic habitats outside the pipeline corridor contact the Alaska

Department of Fish and Game, Reg. 1, Rick Reed, Juneau, 465-5107; Reg. 2, Anchorage, Tom Trent, 344-0541; Reg. 3, Fairbanks, Scott Gundy, 452-1531; Bureau of Land Management, Anchorage, 277-1561; Fish and Wildlife Service, Anchorage; 265-4896.

Fate of Oil Spilled on Terrestrial and Freshwater Systems

Advice on this extremely complex problem will have to come from many different sources depending on location of spill (terrestrial, aquatic, lake, river, arctic, or subarctic); season (summer or winter); and factors affecting the dissipation and degradation of the oil (physical, chemical, and biological). Individuals providing advice and information on the fate of spilled oil must know the volume of the spill and the physical and chemical properties of the oil. In addition, analytical chemical services must be available. The following individuals and organizations can provide advice and information:

	Terrestrial	Aquatic
Physical:		
	Terry McFadden CRREL Fairbanks, ---------	Paul Deslauries, Arctic, Inc., Columbia, MD (301) 730-1030
Chemical:		
	CRREL (same as above)	Robert Barsdate & Dave Shaw IMS, Fairbanks, Mike Miller, Univ. Cincinnati
Biological:		
	Ron Cordon, EPA Fairbanks, 479-7232 CRREL (same as above)	Ron Cordon, EPA, Fairbanks Dirk Dirkson, RWS, Anchorage Robie Vestal, Univ. Cincinnati

OBJECTIVE 2: DAMAGE ASSESSMENT

The Panel identified 3 general programs which contribute to assessing environmental damage caused by oil spills on inland areas of Alaska (see Recommended Projects No. 1-3).

These general programs involve current state of the art techniques of damage assessment and the very limited knowledge of Alaskan terrestrial and aquatic ecosystems. They have been designed to address oil spills in the three major climatic zones of Alaska

(Arctic, Subarctic, Temperate) and in various habitats. Implementation of these programs will require expertise in a large number of scientific and engineering disciplines. Coordination, communications, transportation, and basic support functions will play a major role in the measure of success achieved by any oil spill response.

OBJECTIVE 3: RECOMMENDED RESEARCH

The Panel identified 8 research projects that can be implemented to take advantage of the opportunities presented by a major oil spill or that can be conducted under laboratory or controlled field conditions (see Recommended Projects No. 4-11).

These projects have been designed to provide better technical information to support the OSC; to provide better methods, techniques, and knowledge in assessing the effectiveness of spill cleanup operations and environmental damage; and to fill some of the critical scientific gaps relating to the fate and effects of oil spills on cold climate ecosystems.

In trying to address the many critical questions of research relating to oil spills in the Terrestrial and Aquatic Systems of Alaska, the Panel recognized the general lack of interest and support for research by Federal Agencies having natural resource management and protection responsibilities. A consistent level of support for this type of research must be maintained and coordinated through a single organization. The Panel, therefore, strongly recommends that a National Oil Pollution Research Laboratory be established to address the critical problems of Terrestrial and Freshwater spills. Since this problem is more acute in Alaska than in other states and will become even more so in the future, such a research facility should be located within the state.

INLAND SPILLS PANEL

Recommended Projects

1. The impact of oil spilled on terrestrial systems.[a]
2. The impact of oil spillage in lake and pond systems.[a]
3. The impact of oil spills on river and stream systems.[a]
4. Detection of oil under ice and snow cover.[b]
5. Fate of oil under various conditions in the aquatic environment.[b]
6. Identification of critical (sensitive) terrestrial and aquatic habitats.[b]
7. Effects of an oil spill on primary and secondary production in lakes and ponds systems.[b]
8. Effects of oil on the behavior of various life cycle stages of selected Alaskan fishes.[b]
9. Extent and persistence of oil contamination of water course.[b]
10. Behavior and movement of oil through snow, ice and perma frost.[b]
11. Techniques for assessing damage and toxicity mechanisms of terrestrial oil spills.[b]

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[a]Damage Assessment

[b]Research

PANEL: INLAND SPILLS
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Impact of Oil Spilled on Terrestrial Systems

2. Project Description:

This project assesses oil damage to soil, flora, and fauna. The immediate observation should include: (1) Spill conditions including spatial distribution (a map of the area would be most useful); periodic staking location of surface spill border and recording time for each observation period. (2) Observers should record any containment and cleanup activities as well as patterns of travel on the site by crews, including field camp site, equipment depots, etc. (3) Oil temperatures should be periodically recorded along the spill gradient. (4) The area's physical conditions should be recorded, i.e., slope, aspect and general topographic and geomorphic conditions.

A. Soil-immediate.

1. Samples ought to be collected to measure oil content (within current state of art)

2. Measure oil penetration into profile along spill gradient.

B. Soil-long term.

1. Soil type - to add to general site classification. This would not change over time. Chemical and physical properties - this would add to the general site classification, and these would change over time; therefore, uncontaminated control samples would be necessary.

2. Measure presence/absence of permafrost.

3. Depth to water table.

4. Long-term soil temperature changes.

5. Long-term albedo changes.

6. Ultimately the percent of the area actually flooded or otherwise contacted by soil.

7. Long-term and spatial microbial population characteristics.

C. Vegetation-immediate.

1. Establish permanent general and close-up photoplots in affected and control area.

2. General community classification.

3. Document method of oil contract on vegetation--flood, spray, capillary action.

D. Vegetation-long term.

1. Detailed community changes spatially and temporally, indicating relative responses among species, not invasion of new species onto area.

2. Measure oil contact on vegetation (i.e., percent of aerial ports contacted).

3. Note rate and methods of vegetation recovery through periodic reconnaissance and retaking photoplots.

E. Fauna-immediate.

1. Record species present.

2. Record oil contact on species, including mode of contact.

F. Fauna-long term:

- Response to oil and rate to recovery of long-term community composition.

3. <u>Performing Organization</u>:

W. W. Mitchell
University of Alaska, Palmer 745-3257

Larry Johnson
CRREL, Fairbanks

Gary Laursen
NARL, Barrow, AK

D. W. S. Westlake
U. of A. Edmonton, Alberta (403) 432-3279

Larry Bliss
U. of A. Edmonton, Alberta (403) 432-3484

M. F. Mohtadi
U. of Calgary, Calgary Alberta

Ross Wein
Univ. N. Brunswick (506) 453-4584

Randy Gossen
Imperial Oil Ltd., Calgary (403) 267-1110

J. J. Duffy
Hudson's Bay Oil & Gas Ltd., Calgary (403) 231-3711

Don Mackay
U. of Toronto, Dept. Chem.
Eng. and Applied Chem.
Toronto, Canada M5S 1A4

Tom Hutchinson
Dept. Botany, U. of Toronto (416) 978-3537

Seppro Niemela
U. of Helsinki, Helsinki, Finland

Thomas Lognachan
Iowa State University, Ames, Iowa.
Agronomy Department

Bill McGrill
U. of Alberta, Soil Science Department.

Ron Gordon
EPA, Fairbanks, Edmonton, Alaska

4. Applicable Habitats:

All terrestrial habitats.

5. Applicable Conditions:

Spill must occur on a terrestrial site.

6. Applicable Oil Type:

Crude oil or any petroleum derivative.

7. Time Frame:

Immediate on-site assessment is necessary by those in specific disciplines dealing with terrestrial impacts. The immediate impact assessment may require several hours to several days depending upon the nature of the spill. Then bi-weekly observations for a period of 2-4 months to identify long-term effects. The site should be monitored at decreasing intervals of time for possibly decades, depending on the natural recovery of the site. A 1-3 year observation period would require at least 4 weekly visits, with 8 weeks per year devoted to data analysis. The scientific group should include: (1) a soil scientist with oil spill background and interests in chemistry, microbiology and water relations; (2) plant ecologiest with background in oils spills and familiar with boreal and arctic plant communities; and (3) biologist with oil spill and arctic experience.

8. Cost:

3 scientists at 3 mos/yr	$31,500
Travel 4,000/yr	12,000
Laboratory and services	9,000
Supplies	1,000
Subtotal	$53,500
Estimated overhead U. of Alaska Agr. Exp. Station (.129) (31,500)	$ 4,144
Total	$57,644 ± 10%

9. Equipment Needs/Equipment Available:

Several organizations have equipment available for this type of work as far as the state of the art is developed; recognizing there are very serious limitations to oil-damage assessment techniques now:

- University of Alaska, Agricultural Experiment Station.
- University of Edmonton, Department of Microbiology, Soil Science and Botany.

10. Facility Needs/Facilities Available:

Transportation to spills in Alaska along rail belt, pipeline, or drill site might necessitate only water vehicle or could require helicopter and fixed-wing aircraft.

11. Personnel Needs/Personnel Available:

See Item 3 for performing organizations.

One discipline not adequately addressed in research or damage assessment of oil spills in cold regions is soil physics, in terms of water and aeration environments of plants. A soil physicist should be recruited to work in Alaska. Much of the engineering data already collected by CRREL and others could form a basis for that scientist.

12. Support Services:

Techniques for assessing degree of damage immediately is severely lacking. Outlined here is a best-guess of useful data. But it must be recognized that the predictive value of these data are limited.

13. Payoff:

These data could provide validation for proposed research directed at developing a system to assess degree of damage from oil spills. If one could predict the number of years (range of years at least) necessary for a site to recover, it would provide a basis to economic assessment. If the affected area could be stratified by these data into relative degrees of damage i.e., severe to slight, that would provide a quantitative assessment which could have been otherwise unavailable. If the data showed that the site was hopelessly damaged, then the reclamation efforts could be determined logically. Is it needed or not? Limited experience has shown in some instances, reclamation and cleanup activities have aggravated damages in northern (cold) habitats.

14. Limitations:

Availability of impact assessment personnel who must be dedicated to respond in a timely fashion. A review of terrestrial cold regions oil spill researchers would reveal that people have drifted away from the research as short-term funding expired. Most of the scientists were primarily obligated to research

areas other than oil spill work, anyway. It would be helpful to have some agreements with institutional administrations to insure keeping the expertise available and active. Periods of inactivity severely restrict competence.

Should a major spill occur during winter in Alaska, limitations of light for field operations could be a significant factor.

PANEL: INLAND SPILLS
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Impact of Oil Spillage on Lake and Pond Systems

2. Project Description:

Analysis of biotoxicity of petroleum products on phytoplankton, zooplankton, periphyton, benthic macroinvertebrates, and fish mortality. The project will be carried out by studying primary production ($^{14}CO_2$ uptake), phytoplankton and periphyton species diversity, zooplankton species diversity (composition) benthic invertebratef diversity and fish mortality as a function of time after the spill. It is anticipated that there will be species composition changes due to oil toxicity and that the altered diversity may or may not return to normal (pre-spill) levels.

3. Performing Organization:

M. C. Miller 513-475-6672
J. R. Vestal 513-475-2980
Dept of Biological Sciences
University of Cincinnati
Cincinnati, OH 45221

M. C. Butler
Great Lakes Research Division
Univ. of Michigan
Ann Arbor, MI

Lefty Schallock 479-7679
EPA
AERS
Fairbanks, AK

George McCay 279-1563
U.S.G.S.
URD

Vera Alexander
Bob Barsdate
U. of AK
Fairbanks, AK

4. Applicable Habitats:

Lakes and Ponds of Alaska.

5. Applicable Conditions:

A. Ponds should be thawed.

B. Lakes may or may not be liquid. If covered with ice, sampling may be somewhat limited compared to thawed.

C. Finding control (unoiled) sites may or may not be a problem.

D. Weather would dictate, to some extent, the types of sampling and extent of sampling.

6. Applicable Oil Type:

Any petroleum--crude or refined.

7. Time Frame:

A. Quick initial response (i.e., 24 hours) for initial sampling and survey of conditions.

B. Weekly sampling for 4 weeks post-spill is recommended.

C. Periodic annual sampling to monitor recovery of the biota studied. This could be up to 10 or more years.

8. Cost:

Primary production--isotopes	$1,000
supplies	500
Time cost/sample 4 hrs x 2 people x $15/hr	120/sample
Phytoplankton species composition 8 hrs x 1 person x $15/hr	120/sample
Zooplankton species composition 2 hrs x 1 person x $15/hr	30/sample
Benthic invertebrates 6 hrs x 1 person x $15/hr	90/sample
Fish mortality 4 hrs x 1 person x $15/hr	60/observation

The number of samples taken an analyzed will depend on the extent of spill, physical factors, etc. Ideally, a spill on a small (200 m^2) pond, for example, would require on one day, 4 primary productions, 2-4 phytoplankton compositions, 2-4 zooplankton, and 10-15 invert. samples. This is about $3,800.00.

9. Equipment Needs/Equipment Available:

A. Needs.

All equipment is available; however, duplication of some field gear for oil spill responses only would be desirable to take to spill site. Expandable supplies should also be on hand for oil spill only:

- Van Dorn bottles, primary production bottles, Schudle, trap inflatable boat, outboard motor, etc.

B. Available.

1. Lab: microscopes, scintillation counters, fluoremeter, Coulter counter, etc.

2. Field: light meter, O_2 probes, anemometer, solarmeters, sonar, filtration apparatus, generator, AC-DC converter, etc., nets, seines, etc.

10. Facility Needs/Facilities Available:

A. Transportation to site for personnel and equipment.

B. Room and board for personnel.

C. Lab space in Fairbanks, Anchorage or Barrow (NARL).

D. Field labs will be available in summer at Toolik Lake.

11. Personnel Needs/Personnel Available:

A. See item no. 3 for primary response personnel.

B. Additional consultants with Alaskan experience:

1. John O'Brein, Dept. of Ecology and Systematics, Univ. of Kansas

2. Sam Mayley, Dept. of Zoology, N.C. State Univ., Raleigh, NC.

3. John Hobbie, Marine Biological Lab, Woods Hole, MA

12. Support Services:

A. Weather data--complete.

B. Chemical analysis of water and oil.

1. Water--N, P, S, Fe.

2. Oil--class composition.

C. Oil spill quantity and characteristics (fate) as a function of weather (season).

D. Morphometry of the lake or pond.

13. Payoff:

A. Will be able to follow recovery of biota after environmental insult.

B. Will be able to study effectiveness of clean-up operations.

C. May be able to determine the effects of long-term toxicity on the biota, especially fish in some instances.

D. Will be able to do some research on the biological response to an oil spill.

14. Limitations:

A. May not be able to get to spill site in time to monitor initial biological reactions.

B. Winter may produce sampling problems not experienced in summer.

C. May not be able to find suitable control site for comparative studies.

D. Cleanup operations may disturb the study site, thus, negating some oil spill effects.

PANEL: INLAND SPILLS
PROJECT NO: 3
PRIORITY RANK:

1. Project Title: Impact of Oil Spills on River and Stream Systems

2. Project Description:

Very little information is available about behavior of oil in streams, especially under ice cover, and the effects of these conditions on benthic invertebrates and fish. Therefore, we propose a project with following objectives:

A. Experimental Spill

1. Assessment of impact of experimental oil spill on benthic invertebrates community.

   a. Investigations of benthic invertebrates to lowest possible taxon.

   b. Measure community structure using diversity indices, equitability indices, etc.

   c. Examine duration of effects on above.

2. Assessment of impact of experimental oil spill on fish population.

   a. Determine fish behavior, e.g., behavior.

   b. Determine mortality on eggs, sub-adults, and adults.

   c. Determine population changes within and between species.

3. Assessment of the effects of oil on selected water quality parameters.

   a. Examine concentrations of various organic fraction, dissolved oxygen, heavy metals, conductivity, major ions, nutrient groups.

   b. Chemical analyses to determine persistence of components of crude oil in water and on/in substrates.

B. Spill of Opportunity.

Methodology and objectives in this segment would be similar to that of experimental oil spill. Exception: attempt to get to spill as quickly as possible.

3. Performing Organizations:

Aquatic Environments Limited. Calcary 276-8171

Univ. of Alaska--Fairbanks
Co-op Fisheries Research Unit--Will Barber
Institute of Water Resources
Jackie LaPerriere

U.S.E.P.A.
Arctic Environmental Research Lab
E.W. Schallock 479-7679

Univ. of Cincinnati
J. Robie Vestal; Michael C. Miller

U.S. Geological Survey
Geo. McCoy 279-1563

4. Applicable Habitats:

The experimental segment of this project could be applied in any of geologic provinces. However, winter segments of study should be conducted in arctic-subarctic situations.

5. Conditions Applicable:

Stream must be small enough to be workable with winter flow and over-wintering fish population. Small amount of oil will be a large percentage of total volume of liquid. Also, simplifies the clean-up procedures. Spill location should be accessible by road and very carefully chosen; with all concerned governmental agencies blessings.

6. Oil Type Applicable:

A. Crude oil should be used for experimental segment study.

B. Spill of opportunity--should be crude for comparison, however, less detailed studies at sites of products spills.

7. Time Frame:

A. Establish preperturbation baseline condition; should be at least one year to cover a full season:

- spill--heavy concentration of effort at this time.

- post-perturbation--at least one full year, a second year with a lower level of effort.

B. Spill of opportunity-every effort would be made to begin measurements as soon as possible after the spill has occurred. Amount of effect depends on the size, extent, and duration of the spill. Spill site should be sampled occasionally over a two-year period following the spill.

8. Cost:

10 man-years of effort including costs associated with clean-up at the exp. site	$600,000
Chemical analyses	50,000
Equip., supplies, and transportation	50,000
	$700,000
Spills of opportunity	
2 1/2 man-years each	$150,000
Chem. analyses	3,000
Equip., supplies, and transportation	30,000
	$183,000

9. Equipment Needs/Equipment Available:

Will include standard sampling gear for fish, invertebrates, water and substrate samples and equipment for the analysis thereof.

10. Facility Needs/Facilities Available:

A. Mobile laboratory in field camp.

B. Refer to facilities group.

11. Personnel Needs/Personnel Available:

A. Personnel needed include:

1. Invertebrate Zoologist.

2. Icthyologist.

3. One or the other of the above individuals should be capable of interpreting chemical data in relation to its biological significance.

B. Refer back to section three for possible performing organizations. It may be necessary to set up some sort of cooperative organization at the spill of opportunity to insure that sufficient manpower is available on short notice. However, there should be a single individual responsible for the project.

12. Support Services:

The study will be internally self-sufficient.

13. Payoff:

A. No comparable study has been undertaken, particularly concerning the winter aspects.

B. This study will allow us to examine the biological phenomena associated with oil spills in streams under carefully cost-controlled conditions.

C. The results of our study will improve our ability to predict the environmental impact of oil spills in natural environments.

D. The spill of opportunity studies will allow us to verify the predicative capacity of the experimental spill and will give us a greater basis for generalization about the effects of spills in various stream types.

E. It will allow us the opportunity to develop special methods and techniques under winter conditions.

14. Limitations:

A. The experimental study will only look at one habitat, but this will be partially negated by the spill of opportunity.

B. A stream north of the Brocks Range would not be appropriate for the experimental stream because those reaches of streams that have flow in the winter almost always are overwintering areas critical for fish populations, and secondly because of access problems.

PANEL: INLAND SPILLS
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: Detection of Oil Under Ice and Snow Cover

2. Project Description:

Through the use of remote sensing, gas chromatography, electronics, etc. develop methods and techniques for determining the presence of oil beneath a snow or ice cover.

The methods/techniques/equipment would be developed under laboratory conditions, tested under field conditions, and evaluated under actual conditions resulting from a spill of oportunity.

3. Performing Organization:

Geophysical Institute, U. of A.

U.S. Army, Cold Regions Research and Engineering Lab
Hanover, N.H.

Ames Research Center, NASA.

4. Applicable Habitats:

Any surface (land or water) covered with snow and/or ice.

5. Applicable Conditions:

The project should result in techniques that are applicable to all snow and freshwater ice conditions that may be encountered in Alaska and be capable of operating through the normal ranges of weather conditions. Also, method/technique/equipment must be applicable to field conditions in Alaska.

6. Applicable Oil Type:

All groups of oils.

7. Time Frame:

Unknown.

8. Cost:

Unknown.

9. Equipment Needs/Equipment Available:

At this time it is not possible to specify equipment needs as the same will depend upon the techniques developed.

10. Facility Needs/Facilities Available

Same as item 9 above.

11. Personnel Needs/Personnel Available:

Same as item 9 above.

12. Support Services:

Same as item 9 above.

13. Payoff:

The resulting method/techniques/equipment would enable the OSC to accurately determine where the oil front is so that proper cleanup techniques can be deployed. (It must be remembered that under many winter conditions in Alaska, the oil would not be visable to an observer standing on the snow and/or ice cover.)

14. Limitations:

Consideration must be given to the varied snow and ice conditions encountered in Alaska. These conditions are not the same as encountered in the Iowa '48.

PANEL: INLAND SPILLS
PROJECT NO: 5
PRIORITY RANK:

1. Project Title: Fate of Oil Under Various Conditions in the Aquatic Environment

This is a generalized title which may encompass several studies--perhaps as sub-projects under one umbrella study.)

2. Project Description:

The overall study encompasses the chemical, physical and biological considerations and water relationships impinging on the fate of oil in aquatic environments. The intent of this description is to point out general types of information required for damage assessment in both space and time. It does not necessarily address all factors or interrelationships of potential importances.

A. Objectives:

1. Conduct a literature search to establish the "State-of-the-Art" to determine additional information needs for the fate of oil in Arctic and subarctic aquatic ecosystems.

2. Determine rate, extent and interactions of chemical, physical and biological activities on the dispersion and persistence of oil in arctic and subarctic aquatic ecosystems.

B. The study should be carried out through both controlled laboratory studies and field studies when spill opportunities arise. It will be necessary to examine the chemical, physical and biological roles both separately and in combination for the following points:

1. Solubility.

2. Entrainment.

3. Evaporation.

4. Photochemical oxidation.

5. Sedimentation (organic and inorganic sediments).

6. Degradation including intermediate products.

C. There are perhaps other factors to be considered also.

1. Various temperature conditions.

2. Sunlight conditions.

3. In rivers and lakes (winter and summer) for both ice covered and ice free conditions.

3. Performing Organization:

CRREL--Fairbanks

Institute of Water Resources--Univ. of AK., Fairbanks

Institute of Marine Science-- Univ. of AK., Fairbanks

4. Applicable Habitats:

This information would be applicable to rivers, streams, lakes and ponds in the arctic and subarctic regions.

5. Applicable Conditions:

Controlled laboratory studies used to be conducted immediately to establish the necessary hypotheses for testing when an actual spill occurs. These spills can occur directly in rivers or lakes or could originate in the terrestrial environment with the aquatic system being impacted by overland movement of oil, degradation products and other material resulting from movement or cleanup efforts. Field studies should be conducted under both winter and summer conditions in enough ecosystems (arctic to subarctic) to ensure validity of hypotheses and to determine variability.

6. Applicable Oil Type:

A. Crude oil

B. Arctic diesel

C. No. 2 fuel oil

D. Gasoline.

7. Time Frame:

As an estimate, the laboratory work would require 2-4 years. Collection of field data would require an indeterminant time span.

8. Cost:

No cost estimate is possible without further delineation of sub-projects which are necessary.

9. Equipment Needs/Equipment Available:

A. Laboratory--not possible without further delineation of sub-projects.

B. Field--depends on location, time of year, etc.

10. Facility Needs/Facilities Available:

Same as for equipment.

11. Personnel Needs/Personnel Available:

A. Analytical chemists.

B. Microbiologists.

C. Hydrologist.

D. Soil chemists.

E. Aquatic biologists.

12. Support Services:

13. Payoff:

For damage assessment, it would provide a basis for determining where oil components would be found in the ecosystem and the length of time various components would persist.

14. Limitations:

There should be few problems with the laboratory studies. The field studies would be limited by the ability to find

the components in the water--particularly under ice, and would have the same constraints as any other cold climate operations.

PANEL: INLAND SPILLS
PROJECT NO: 6
PRIORITY RANK:

1. Project Title: Identification of Critical (Sensitive) Terrestrial and Aquatic Habitats

2. Project Description:

Assimilate and update, identify and define critical habitat information within the state of Alaska. Most immediate approach would be via a literature search, review of existing projects and field investigations.

Identify critical habitats by geographical area so that the information is readily available at the time of the spill possibly subject to computer withdrawal.

3. Performing Organization:

U. of Alaska
Dr. David Klein
Cooperative Wildlife Research Unit

ADF & G

BLM

USFWS

Private Consultants

4. Applicable Habitats:

A. Raptors.

B. Endangered species.

C. Waterfowl, nesting and staging areas.

D. Mammalian partuition areas.

E. Mineral licks.

F. Riparian vegetation.

G. Fisheries spawning and overwintering areas.

H. Winter range.

I. Water use areas.

J. Scenic, wild, recreational areas.

K. Wetlands.

5. Applicable Conditions:

Rapid development of oil and other natural resources within the state. Appropriate habitat studies should be done concommitantly.

6. Applicable Oil Type:

All petroleum products.

7. Time Frame:

Continuing program. To be updated routinely once the baseline study is completed.

8. Cost:

Recommend that funding be made available to employ at least one person on a full-time basis in one of the resource agencies to review, oversee and compile all critical habitat information.

Estimate $50,000/annually which includes salary and benefits.

9. Equipment Needs/Equipment Available:

Appropriate equipment as needed to complete the task. No specialized equipment needed unless field investigations are funded. Numerous field studies could be conducted.

Aerial photographing (Re: plane and cameras).

10. Facility Needs/Facilities Available:

A. Office

B. Storage area

C. Primarily an office-type job.

11. Personnel Needs/Personnel Available:

A. ADF & G--central

1. Scott Grundy Reg. III (Habitat Section)

2. Tom Trent Reg. II (Habitat Section)

3. Rick Reed Reg. I (Habitat Section)

B. BLM

1. Lou Jurs--State Office Wildlife Biologist

2. Roger Bolstead--Fishery Biologist

C. USFWS.

D. U. of Alaska.

1. Institute Marine Sciences

2. Institute Water Resources

3. Dept. Biology.

12. Support Services:

A. Clerical Support.

B. Graphic Services.

C. Some contractual services (printing, computer time).

13. Payoff:

Accurate detailed mapping of critical habitat essential for determining what has been damaged so that assessment of such damages (economic or otherwise) can be made in a logical manner.

14. Limitations:

A. Subjective approach.

B. Immense area and type of habitats under consideration.

C. Difficulties in "cataloging" or characterizing "critical habitat".

D. Integration of critical habitats with time.

PANEL: INLAND SPILLS
PROJECT NO: 7
PRIORITY RANK:

1. Project Title: Effects of an Oil Spill on Primary and Secondary Production in Lakes and Ponds Systems

2. Project Description:

Will study in the lab, the effects of the soluble toxic components of any oil on gross primary production. This will use the $^{14}CO_2$ uptake technique. Also, the toxicity of oil to specific phytoplankton grown in the lab will be studied. Zooplankton (from the spill site) mortality will also be studied in the lab. Histopathology of the zooplankton will be important. Phytoplankton and zooplankton will be placed in containers and immersed into the water column of the spilled site to study a time course for soluble toxic products. The containers would have membranes or fine mesh nets to allow the toxic products to enter. Behavior of zooplankton in response to soluble toxic oil products would be studies. Bottomed subponds containing water and/or zooplankton and then spilled with the amount of oil as spilled on the site would be incubated in situ to allow oil effects in a more quantitative way.

3. Performing Organization:

Department of Biological Sciences
Univ. of Cincinnati
Cincinnati, OH 45221
M.C. Miller 513-475-6672
J.R. Vestal 513-475-2980

Univ. of AK
Fairbanks, AK
Vera Alexander - possible
Bob Barsdate - possible

Marine Biological Laboratory
Woods Hole, MA

John Hobbie - possible
Bruce Peterson - possible

4. Applicable Habitats:

Any lake or pond in Alaska.

5. Applicable Conditions:

A. Early sample collection.

B. Adequate lab facilities.

C. Finding control sites nearby for comparative studies.

D. Weather would dictate, somewhat, the type of sampling and extent of sampling.

6. Applicable Oil Type:

Any petroleum--crude or refined.

7. Time Frame:

The lab studies could take a few months per sample or experiment--the subpond experiments could be followed for a few months to a few years. Hard to commit a specific time frame for research.

8. Cost:

A ballpark guess would be $30-40K/year which would include salaries, supplies, equipment, travel and overhead to an academic institution. Hard to estimate for basic research.

9. Equipment Needs/Equipment Available:

Most lab equipment is available to complete this study. Some additional equipment mainly for field sampling or for field-lab set-up would be necessary. Isotopes, supplies, etc. would be needed.

Microscopes, scintillation counters, and general field equipment are available.

10. Facility Needs/Facilities Available:

A. Needs.

1. Transportation to site for personnel and equipment.

2. Room and board for personnel.

3. Near spill lab in AK-NARL, FAI, or ANC.

B. Facilities.

1. Lab facilities as the Universities is adequate.

2. Field lab will be available in summer at Toolik Lake on the TAPS.

11. Personnel Needs/Personnel Available:

A. See item 3 for primary personnel.

B. Consultant:

Claire Buchannan
Dept. of Zoology
Univ. of New Hampshire.

12. Support Services:

A. Complete chemical analyses of the water and oil.

B. Oil quality spilled/m^2 water surface.

C. Morphometry of the lake or pond.

D. Histological examination of zooplankters.

13. Payoff:

These studies would contribute to the fundamental knowledge of primary and secondary production in arctic or subarctic lakes and/or ponds. The effects of oil on the biota and recovery of the biota after the spill would increase our knowledge of the abilities of algae and zooplankton to recover from these insults. If primary and/or secondary production is seriously affected, this could seriously affect the organisms higher on the food chain (Birds, fish, etc.). Any additional fundamental knowledge of the limnology of Alaskan lakes and ponds would be of scientific benefit concerning this unique environment.

14. Limitations

A. Funding.

B. Weather (summer/winter).

C. Hard to determine limitations for a basic research project(s).

PANEL: INLAND SPILLS
PROJECT NO: 8
PRIORITY RANK:

1. Project Title: Effects of Oil on the Behavior of Various Selected Alaskan Fishes

2. Project Description:

   A. Five Species:

      1. Arctic grayling, *Thymallus arctieus*

      2. Slimy Sculpin, *Cottus coznatus*

      3. Round whitefish, *Prosopuim cylindraceum*

      4. Chum salmon, *Incorhynchus keta*

      5. 9-spine stickleback, *Gasterosteus aculeateus*

   Establish cultures of the above fishes for use of response team as bioassay organisms

   B. Acute toxicity studies on eggs, fry, juveniles and adults with proper documentation of behavioral effects.

   C. Chronic bioassays--possibly for future project which is separate (if chronic dosing is noticed in any specific spills).

3. Performing Organization:

   Proposed Alaska Cooperative Fisheries
   Research Unit USFWS/ADF & G--Laboratory studies

   Various University Research Institutes--response team

4. Habitats Applicable:

   A. All freshwater habitats

   B. Streams and Lakes

   C. Arctic and subarctic Alaska.

5. Conditions Applicable:

In the Laboratory:

A. Various water temperatures 0°-20°C.

B. Low oxygen simulating ice cover.

C. Sediment added to some tests.

D. Varying water velocities.

E. Varying pH, alkalinity and hardness.

6. Applicable Oil Type:

A. Crudes--from Alaskan fields.

B. Refined products--stored or shipped in bulk.

7. Time Frame:

A. Phase I: (3-5 years)

Initial establishment of cultures acute bioassays--behavioral studies establishing response capability for spills of opportunity.

B. Phase II: (3-5 additional years)

Chronic effects on behavior and histopathology. Maintenance of cultures and response capability.

C. Phase III:

More detailed variation of selected parameters (environmental) in chronic bioassays. Maintenance of response capabilities and cultures.

8. Cost:

9. Equipment Needsl/Equipment Available:

A. Available:

1. Pools

2. Streams

3. Mount degassers (EPA)

4. Video equipment

5. Aquaria

B. Needed:

1. Water hauling equipment

2. Cages

3. Avoidance apparatus

4. Transportable live tanks.

10. Facility Needs/Facilities Available:

Needs: Fish culture facility with proper water supply for flow-through or recycling experiments.

11. Personnel Needs/Personnel Available:

A. Project leader.

B. Students.

C. Technicians.

12. Support Services:

A. Here, the laboratory assays and behavioral studies support the field spill response team.

B. Portable laboratory for sampling at spills of opportunity (water chemistry and oil concentration).

C. Detection of water and oil under ice.

D. Hydrological information capabilities.

13. Payoff:

A. This project would have great scientific importance.

B. This project would allow measurement of damages especially as it allowed proper assessment of behavior associated

with mortality that may be impossible to document in cold and especially running water.

14. Limitations:

Limited number of species of organisms being tested.

PANEL: INLAND SPILLS
PROJECT NO: 9
PRIORITY RANK:

1. Project Title: Extent and Pesistence of Oil Contamination of Watercourse

2. Project Description:

   A. Survey banks for contamination through a time frame with periodic sampling to encompass:

      1. Seasonal water level variation.

      2. Seasonal water temperature variation.

      3. Water changes.

      4. Rate of oil loss and/or collection.

      5. Water quality.

      6. Hydrological and meteorological records during project.

      7. Water flow data (volume).

   B. Select sites to sample persistence

      1. Oil loss.

         a. Mechanical.

         b. Chemical.

      2. Collection rates of:

         a. Mineral substrates.

         b. Organic substrates.

         c. Submerged objects.

         d. Surface objects.

         e. Benthos fauna and flow.

C. Transportation.

1. Location.

2. Personnel.

3. Frequency.

4. Equipment.

D. Equipment

1. Field.

2. Laboratory.

3. Performing Organization:

University of Alaska--Institute of Water Resources.

Cold Regions Research and Engineering Laboratory

University of Cincinnati--J. Robie Vestal

4. Applicable Habitats

A. All new--Inland/Freshwater.

B. Glacial streams.

C. Clearwater streams.

D. Tannic streams.

E. Tundra lakes.

F. Deep lakes.

6. Applicable Conditions

All conditions where personnel can be placed in the area are to be considered since virtually no information is available which is applicable to Arctic, subarctic and inland oil spill damage assessment.

Oil spills in Alaska are most assuredly going to occur in remote areas where detection will not be instantaneous and where

freshwater courses will be contaminated. The extend of contamination is essential information for damage assessment.

6. Applicable Oil Type:

Petrochemical products.

7. Time Frame:

The study would require a minimum of one (1) year for field investigation to cover all seasons. Additional field work would be judged dependent on persistence which is currently unknown.

Sample working would have to be conducted continuously throughout the sampling period in order to determine persistence. A short turnaround on lab analyses of samples would be essential.

8. Cost:

Cost would be very dependent on the geographical distribution of the oil spill.

A. 500 acre lake along a road system within 200 miles of reseach facilities.

$1.00/mile/vehicle x 2 vehicles x 12 round trips/yr/vehicles--

$10,000

$20/hr for boat x 24 trips x 5 hrs/trip for samples

2,500

6 persons/$15 hr x 1000 hrs

13,000

Lab contracts, equipment, etc.

15,000

TOTAL $40,500

River spill costs would be higher since transportation by helicopter at $350/hr would be necessary to keep in contact with oil and to prevent boat wakes from affecting oil distribution.

9. Equipment Needs/Equipment Available:

A. Cameras--3 (35mm with macro lenses)

B. Sterile glass bottles for sampling--1,000 + 1 liter size.

C. Carrying cases for sample bottles--40-50.

D. Film--500 rolls color slide 35 mm.

E. Portable radio with air to ground capability--8-10.

F. Plastic bags--all sizes--200 each.

G. More as requested by a qualified project leader.

10. Facility Needs/Facilities Available.

A. Analytical laboratory.

B. Office space for 3-6 persons.

C. Lake boat, river boat, helicopter(s), 2-six passenger vehicles, garage for vehicle and boat storage.

D. (2)-4 man tents, camping gear.

E. Commercial or other lodging for 4-6 people for 2-6 weeks a year.

11. Personnel Needs/Personnel Available:

A. Project leaders should be at the organizations listed under item 30.

B. Local people, university students, military, etc. could be utilized for field assistance to the scientists.

12. Support Services:

Computer services for data analysis, mapping, etc.

13. Payoff:

Project would assist in damage assessment by identifying extent and persistence of oil contamination.

14. Limitations:

A. Harsh winter climate.

B. Possibility of Geographical remoteness.

C. Response time.

D. Equipment availability for timely response.

PANEL: INLAND SPILLS
PROJECT NO: 10
PRIORITY RANK:

1. Project Title: Behavior and Movement of Oil Through Snow, Ice and Permafrost

2. Project Description:

For under oil, determine the flow characteristics: A) through various snow/ice profiles B) into and along various water sources (with varying ice cover); C) and through/over permafrost soils.

The flow characteristics would be correlated with snow/ice parameters, geographic consideration, and oil properties into a prediction model and in forecasting the movement of the oil for a given set of conditions.

3. Performing Organziations:

U.S. Army Cold Regions Research and Engineering Lab

Geophysical Institute, U. of Alaska.

4. Applicable Habitats:

Various snow and ice conditions to Alaska.

5. Applicable Conditions:

Preliminary laboratory studies in each of the various climate zones of Alaska. From these studies various models would be developed which would be field tested whenever a spill occurs on a snow/ice covered environment.

6. Applicable Oil Type:

Crude oil.

7. Time Frame:

The preliminary work could be performed during two winter seasons. The verification under actual conditions could be performed concurrently or following the preliminary studies at the time of a spill of opportunity.

8. Cost:

Development Work--minimum

2 man-years, principal inv.

2 man-years, tech.

Field verification.

9. Equipment Needs/Equipment Available:

A. Routine snow sampling equipment.

B. Application devices (for oil).

C. Equipment for monitoring movement of oil front.

D. Meteorological sensors.

E. Above for both laboratory and field investigations.

10. Facility Needs/Facilities Available:

Research team would be capable of providing all required facilities except possible logistical support to the spill site.

11. Personnel Needs/Personnel Available:

Staff at CRREL, Fairbanks, Geophysical Institute, U. of AK, Fairbanks and NWS/Hydro, Anchorage.

Personnel are available and could respond within 6 hrs.

Terry McFadden CRREL 353-8114.

Carl Benson 61, U. of AK.

Henry Santeford, NWS/NOAA 265-4717.

12. Support Services:

Data on the rate of movement of the oil front, physical properties of the oil, i.e., viscousity, temperature, specific weight, etc.

13. Payoff:

The study would develop various models for predicting the movement of crude oils in and through varying snow and ice conditions. The models would then be used by the OSC in determining the extent of the oil at various and future times. Knowing where the oil is moving--and how fast--the OSC could then make better deployment of any cleanup operations.

14. Limitations:

Much of the work could be performed in advance and then verified on winter spills.

PANEL: INLAND SPILLS
PROJECT NO: 11
PRIORITY RANK:

1. Project Title: Techniques for Assessing Damage and Toxicity Mechanisms of Terrestrial Oil Spills

2. Project Description:

A. Evaluate quick-test methods for determining degree and extent of damage by spilled oil.

B. Correlate quick-test methods with long-term biological impacts.

C. Investigate possible phytotropic mechanisms limiting vegetations growth and development following an oil spill.

D. Suggest possible avenues for restoration of oil damage to correct specific toxicity limitations.

This project will allow short-term on site assessment of spills which, correlated with long-term impacts, will suggest proper corrective actions as well as aid in economic assessments of damages. Inappropriate actions on spills may be more detrimental than the presence of oil in the ecosystem. Restoration, when useful, ought to be undertaken. Identifying toxicity factors of crude oil in soil will presumably clarify when and what kinds of techniques would be appropriate, i.e., aeration, fertilization, seeding, etc.

A biological assay of oil damaged soil diluted with uncontaminated soil will be used to grow standard seedling or vegetation clones. These results coupled with quantitative analyses of oil in soil will be correlated with field responses of vegetation on oil damaged sites. The advantage of the bioassay is in detecting toxicities that would otherwise be obscured in a purely physical measurement of oil content in soil.

3. Performing Organization:

4. Applicable Habitats:

A minimum of six field research sites should be available, two arctic tundra, two interior forest and two non-forested coastal "forest-zone" types including a possible shoreline graminolid community. Variablity and economic importance may suggest alterations of that scheme. Additionally, careful examination

of existing natural and accidental oil contaminated sites with respect to vegetation recovery and quick-test parameters will provide basic data for correlation and evaluation.

5. Applicable Conditions:

Oil spilled on terrestrial locations representing typical ecosystems is needed, even if artifical spills must be considered.

6. Applicable Oil Type:

Crude oil has first priority.

7. Time Frame:

The study would require at least 4 years to complete with additional 6 years of low-level monitoring. A soil scientist, a plant physiologist and a competent laboratory for oil extraction and soil analysis. At least 1/2 SMY per scientist will be required for 4-year period, with minimal SMY's for additional 6 years.

8. Cost:

5 1/2 SMY's	$195,000	(10-year project)
Supplies	10,000	
Travel	20,000	
Services	10,000	
Equipment	10,000	
Overhead	25,000	
	$270,000	

9. Equipment Needs/Equipment Available:

Some of the equipment required will be dictated by the suggested mechanisms of damage and by the quick-test procedures developed. A partial list of equipment follows, including its availability to Alaskan Agricultural Experiment Station personnel:

A. Growth chamber, available.

B. Randall oil extractor, available.

C. Column chromatography, available.

D. Gas chromatography, available.

E. Soil and/or plant water tension.

F. pH electrodes or O_2 probe.

10. Facility Needs/Facilites Available.

Access to laboratory space will be needed for oil extraction. Growth chamber facilities will be needed for uniform growing conditions in bioassay phase.

11. Personnel Needs/Personnel Available:

W.W. Mitchell	Alaska Ag. Exp. Station, AK (907) 745-3257
Bill McGill	University of Alberta Edmonton, Alberta, Canada
Tom Hutchinson	Dept. Botany, University of Toronto (416) 978-3537
Larry Johnson	Graduate student, U. of Alaska Fairbanks

12. Support Services:

This project would need support from the literature and persons field experience in restoration and natural recovery data. Concurrent studies on oil spill rehabilitation would be desirable support for this study.

13. Payoff:

Very little is presently known concerning long-term impact of oil spills in cold regions. Industry support has provided minimal initial data, which is inadequate in assessing and predicting damage at the time of a spill, or for a reasonable period (months) following spills. This research would fill a very significant knowledged gap and provide very practical assistance to all those facing damage assessment on terrestrial sites. A systematic and objective approach is needed to direct

cleanup and restoration techniques toward positive ends. Usually major decisions by company and regulation agency personnel are currently bored in a short-time frame and with inadequate information. Visual assessment and hunches are poor substitutes for quantitative measurements and they give little hope where inexperience prevails.

14. Limitations:

Following assessment of data, specific on-site parameters will be correlated by multiple regression analysis with the quick-test values and determined plant growth responses. Since only six sites are to be evaluated, interpolation to other sites having dissimilar conditions will be required. Thus, existing data will need to be applied to conditions other than those under which the data were collected. Soil and plant conditions exist on a continuum and a certain amount of interpolation is always required. The seriousness of this problem will depend to a degree upon the extensiveness of the onsite gathering of soil and floral parameters. Nevertheless, even if the guide is not 100 percent accurate, it will provide a means of objective evaluation, and recommendation for site restoration.

LEGAL ASPECTS PANEL

Participants

R. A. DuBey, Chairperson

J. Tillinghast	J. Ellis
T. Pursley	W. Moses
E. Fidell	M. Garcia

LEGAL ASPECTS PANEL

General Information and Guidance

- General Considerations
- Objective 2: Damage Assessment - Legal Aspects
- Legal Panel Presentation to Plenary Session
- Summary of Pertinent Laws
- Listing of Legal Expertise

GENERAL CONSIDERATIONS

During the three days of the Program, the Panel on Legal Considerations conducted extensive discussions regarding the assessment of damages associated with oil spills. Topics discussed included the present and anticipated Federal and State laws and legal doctrines relevant to oil spill damage assessment, and the legal framework for scientific data development for use in legal proceedings. In general, the discussion focused on the model of the civil action for damages in Federal District Court. Administrative and other judicial and non-judicial forums were noted. Attention was also given to the pressing need for scientific evidence to be gathered with a view to prospective introduction into evidence, the need for formal assignment of legal counsel to the staff of the Scientific Research Coordinator, and the need for continuing legal assistance in all phases of the development and execution of scientific research programs.

OBJECTIVE 2: DAMAGE ASSESSMENT - LEGAL ASPECTS

The Panel's deliberations included a review of alternative approaches to the question of assigning a dollar figure to environmental damage due to oil spills. The following approaches were noted:

(1) The present system of judicial assessment of damages under the traditional civil burden of proof--i.e., preponderance of the evidence--has yet to be adequately tested, owing to the rarity of oil spill cases which have resulted in a judgment after trial on the merits. On this view, the present system ought to be given an opportunity to function.

(2) The "superfund" legislation should not be regarded as a panacea or ultimate solution.* Pending bills still leave a considerable burden on the damage claimant to prove and quantify damages. Concern was expressed over the bills' provisions regarding attorneys' fees and expert witness costs.

(3) The concept of a "Development Document" designed to provide guidance to the damage assessment function was also discussed. As envisioned, such a document would attempt to affix a dollar value to various living and nonliving natural resources. Priority in the preparation of such a document on a resource-specific basis should be given to those resources that presently have a recognized commercial value. Information could be made available in steps, as it is developed.

(4) Attention could be given to the conduct of a Federal rulemaking for the purpose of developing damage values for specific types of environmental injury.** Such a rulemaking could reduce the research burdens on individual claimants, and could be effective in reducing the potential for relitigation of the value of a particular economic loss. Such rules might have to be made only presumptively valid, and even with that limitation, problems of consitutional dimension (including jury trial rights) could be raised.

(5) Due to the difficulty in accurately assessing environmental damages, and translating those damages into a specific dollar figure, governments may choose to invoke substantial civil penalties based on the size of the spill and the character of the receiving environment. Recoveries by governmental plaintiffs would be utilized for restoration and rehabilitation purposes.

(6) The Coastal Zone Management Act*** could provide a model for the development of a joing Federal-State damage assessment scheme. Such a scheme would consist of a State-developed Natural Resources Damage Assessment Plan (NARDAP), prepared in conformity with Federal criteria. Use of

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*S. 687, 95th Cong., 1st Sess. (1977).

**Analogues for this approach include Senate Document 97 (Water Resources Council), Florida regulations, and the list of values prepared by the American Fisheries Society.

***16 U.S.C. § 1451 et seq. (Supp. V 1975), as amended by Pub. L. No. 94-370 (1976).

Federal criteria would foster the development of uniform State approaches to damage assessment. Damages assessed in accordance with a Federally-approved NARDAP could be given priority in "superfund" disbursements.

LEGAL PANEL PRESENTATION TO PLENARY SESSION

The purpose of this panel is to establish a legal framework for scientific data development so that such information would be useful in subsequent proceedings. There is no clear legal answer to exactly what information will result in a win in litigation. There are many variables, and lawyers will use whatever they have to try to get it introduced. Study development and associated legal guidance will occur on case by case basis.

Legal Framework for Scientific Data Development

I. Burden of Proof.

A. Dealing with civil cases.

B. Preponderance of the evidence is the standard of the burden of proof in civil cases--that is, 51 percent or "more likely than no" that the event occurred.

C. Scientific certainty is not required (beyond reasonable doubt is a criminal standard).

D. Experts can and should give opinions - even though the opinions may be qualified.

II. Need for Documentation.

A. Information (evidence) in cases should be fully developed - do not make assumptions about what evidence is already available.

B. Expect that the matter will be litigated some time in the future and that the time period may be as long as three (3) of four (4) years. Memory alone will not suffice.

C. The record must stand by itself so it can be used by someone else.

D. All steps of study or analysis should be taken and recorded, avoiding gaps in the decision making process.

III. Elements of an Oil Spill Case.

A. There are five basic legal elements that will be present and must be provable before a fact finder before liability will run to the spiller:

1. The spill occurred;

2. X-Co. caused the discharge;

3. Environmental impacts resulted;

4. The oil spill caused the impact; and

5. There is a dollar value to the impact.

B. Identification of the legal concerns associated with these 5 elements.

1. The spill occurred.

a. Gather data with the most emotional impact. The fact finder, whether judge, jury or mediator, is a human being. Gather the most impressive, representative evidence.

b. Conduct an oil spill analysis.

c. Take water quality samples both inside and outside the spill area, using standard methods. Take control sample of background water quality.

d. Picture should be marked with date, time, place, photographer. Initial the picture.

e. Gather physical evidence, such as oiled birds. This helps make the event real to a judge several years from now.

2. X-Co. caused the discharge.

a. Get oil from the vessel in sufficient quantity to conduct all tests.

b. There are also chain-of-evidence concerns. Each person who has custody of the evidence should sign-in and sign-out the evidence, so that control of the information or sample can be shown.

3. Impact of the spill.

   a. Take represenative samples that are statistically valid (using standard methods).

   b. Accumulate baseline and historical data.

   c. Accumulate previously developed information that is linked to this incident.

   d. In prioritizing data gathering, consider the order of commercially valuable resources; e.g., salmon vs. starfish.

   e. More esoteric data gathering should come later.

4. Oil spill caused the impact.

   a. Utilize the best information available.

   b. Experts have a license to render judgments that something is more likely to happen than not (preponderance of the evidence).

5. Establish dollar value of the impact.

   a. This is primarily a function of the economists and <u>not</u> the scientists.

   b. This does <u>not</u> refer to cleanup costs; i.e., the amount of money expended to clean up the oil. Proof is less of a problem with regard to cleanup costs.

   c. Legal "damage" or "damages" means any economic loss, arising out of or directly resulting from an incident, including but not limited to:

      1. Injury to, or destruction of, real or personal property.

      2. Loss of use of real or personal property.

      3. Injury to, or destruction of, natural resources.

      4. Loss of use of natural resources.

5. Loss of profits or impairment of earning capacity due to injury or destruction of real or personal property or natural resources, including loss of subsistence hunting, fishing and gathering opportunities.

6. Loss of tax revenue for a period of one year due to injury to real or personal property (42 Fed. Reg. 31789-92 (June 23, 1977)).

IV. Law of Tort: Damages.

1. Tort law is designed to make people whole, and there are centuries of precedent.

2. However, development of environmental protection laws is a recent event.

3. Courts and legislatures first began to address oil spill damages in the 1970's with the birth of Federal environmental law.

V. Non-legal concerns that have an impact on the development of legal damages include:

A. Political.

B. Public Image.

C. Uncertainty on a both sides, which has usually resulted in settlement without court decision in major oil spills to date.

VI. Assistance offered by lawyers includes:

A. Can apprise scientists of the standards by which expert testimony is judged.

B. Can act as sounding boards in study design and redesign.

C. Can help narrow the issues in controversy among the parties.

VII. Continuing scientist/lawyer relationship is important - it can't work any other way.

Alaska Oil Spill Response Workshop
November 29-30, 1977
Panel 5B: Legal Considerations
Prepared by Richard A. De Day, Chairman
Of Counsel: Steven Helgesen, Legal Intern

Existing and Proposed Federal Laws
Relevant to Oil Spill Damage Assessment
Within Alaska's Coastal Zone

Applicable Federal Law	Prohibited Acts	Geographical Jurisdiction	Extent of Liability *	Legal Defenses to Liability	Legal Damages (Costs) Recovered	Fines and Penalties Available	Availability of Fund: Size and How Financed	Recovery Upon the Fund	Preemption of F eral or State L
Rivers and Harbors Act of 1899 (Refuse Act) 33 USC §§407, 411)	Discharge from vessel or shore of any refuse matter including commercially valuable oil §407	Tributaries of navigable waters and banks of navigable waters §407	See Fines and Penalties Vessels are liable in rem	Compliance with permit §411	None	$500-$2,500 or imprisonment for not more than one (1) year or both §411	None	None	None
Federal Water Pollution Control Act Amendments of 1972 (FWPCA) (33 USC §1321)	Discharge of oil or hazardous substances in harmful quantities (visible sheen) §1321(b)(3)	Waters of the U.S. including the territorial sea, adjoining shoreline and contiguous zone §1321(b)(1)	§1321(f) Vessel-up to $100 per gross ton or $14,000,000 whichever is less. Facility-up to $8,000,000 where there is willful negligence or misconduct the spiller is liable for total cleanup costs	1) Act of God 2) Act of war 3) Negligence of U.S. 4) Act or omission of third party §1321(f)	Actual cost of removal incurred by the U.S. §1321(f)	Failure to notify up to $10,000 or one (1) year imprisonment or both §1321(b)(5) Failure to comply with regulations up to $5,000 for each violation §1321(b)(2)	Not to exceed $35,000,000 financed by recovery from spiller for costs of removal §1321(k)	Available to Federal agencies for cleanup operations §1321(i)	None §1321(o)
Senate Bill 1952, 95th Cong., 1st Sess., Amendments to §1321 of the FWPCA	Unchanged	Extended to waters above the outer continental shelf or 200 miles §40(b)(1)	Vessel-up to $150 per gross ton or $ 500,000 whichever is greater Facility-up to $50,000,000 §40(d)	Unchanged	Actual cost of removal incurred by U.S. including the cost of restoration or replacement of natural resources. Spiller entitled by subrogation to all rights of U.S. to recover from third party §40(f), (g)(4)	Unchanged	Unchanged	Unchanged	Unchanged
FWPCA (33 USC §§1311, 1362)	Discharge of any pollutant by any person §1311	Waters of the U.S., including the territorial sea §1362	See Fines and Penalties	Compliance with permit §§1311, 1319	None	Criminal-$2,500-$25,000 per day of violation or imprisonment for not more than one (1) year, or both. Additional fines for subsequent offenses up to $50,000 per day or two (2) years or both. Civil Penalty-up to $10,000 per day of violation. False Statement-fine of $10,000 or six (6) months, or both. §1319	None	None	None as long as state actions are as stringent as Federal requirements §§1370, 1371

*This column represents the dollar amount to which the spiller may be held liable without regard to fault(strict limited liability).

Alaska Oil Spill Response Workshop
October 30-31, 1977
Oil Spill Legal Considerations
Prepared by Richard A. De Bay, Chairman
of Counsel: Steven Helgeson, Legal Intern

Existing and Proposed Federal Laws
Relevant to Oil Spill Damage Assessment
Within Alaska's Coastal Zone

Applicable Federal Law	Prohibited Acts	Geographical Jurisdiction	Extent of Liability	Legal Defenses to Liability	Legal Damages (Costs) Recovered	Fines and Penalties Available	Availability of Fund: Size and How Financed	Recovery Upon the Fund	Preemption of Federal or State La
Senate Bill 1952, 95th Cong., 1st Sess., Amendments to §§1301, 1342 of the FWPCA	Unchanged except for extention of time for compliance §26	Unchanged	Unchanged	Unchanged	Unchanged	Additional non-compliance fee equal to the economic value of a delay in compliance §319	Unchanged	Unchanged	Unchanged
Trans-Alaska Pipeline Authorization Act (43 USC §1651 et seq.) §1653	Pollution along or in vicinity of pipeline right-of-way; discharges from vessels loaded at Valdez	Covers the movement of Alaskan crude oil from the TAP to any U.S. port	Holders of right-of-way: limited to $50,000,000 for any one incident. Vessels: limited to first $14,000,000 per incident	1) Act of war 2) Negligence of U.S.	All damages (including cleanup costs) public or private, sustained by any person or entity, including resident of Canada	None. (Stipulation §25 provides for temporary suspension of operations to protect either public health or the environment Stipulation §25-Civil	Size limited to $100,000,000. Financed by 5¢ per barrel of oil loaded on a vessel at Valdez §1653(c)	Applies only to damage caused by vessel discharges Available for claims exceeding $14,000,000 up to $100,000,000 §1653(c)	None, (however, no multiple recovery for same injury) §1653(c)
Deepwater Port Act of 1974 (33 USC §1501 et seq.) §1517	Discharge of oil in marine environment from a vessel which has received oil and discharges of oil from the port itself	The marine environment within any safety zone established around a deep-water port. §§1506, 1512	Vessel: up to $150 per gross ton or $120,000,000 which-ever is less (vessel is liable in rem) §1514(e) Deepwater Port: up to $50,000,000 Gross negligence or willful misconduct will make spillers liable for full amount of all cleanup costs §1517(e)	1) Act of war 2) Negligence on part of U.S. 3) Caused by actions of 3rd parties §1517(g)	All damages to real or personal property sustained by any person including cleanup costs. Damages includes injury to natural resources of marine or coastal environment. §1517	Willful violation up to $25,000 per day or one (1) year or both. Failure to notify up to $10,000 or one (1) year or both. §1517(b)	Size limited to $100,000,000 financed by 2¢ per barrel on oil either loaded or unloaded at deepwater port. Exception - Alaskan oil §1517(f)	Applies to all damages and cleanup costs in excess of those compensated by spiller §1517(f)	None (however, no multiple recover for same injury. §1517(k)

Alaska Oil Spill Response Workshop
November 28-30, 1977
Panel 10: Legal Considerations
Prepared by Richard A. Du Bay, Chairman
Of Counsel: Steven Helgesen, Legal Intern

Existing and Proposed Federal Laws
Relevant to Oil Spill Damage Assessment
Within Alaska's Coastal Zone

Applicable Federal Law	Prohibited Acts	Geographical Jurisdiction	Extent of Liability	Legal Defenses to Liability	Legal Damages (Costs) Recovered	Fines and Penalties Available	Availability of Funds: Size and How Financed	Recovery Upon the Fund	Preemption of Federal or State Law
National Oil Pollution Liability and Compensation Act of 1977, S.687, 95th Cong., 1st Sess.	Discharge of oil §3(a)	Waters of the U.S., including the territorial sea and the OCS and including the fishery resources of the fishery conservation zone §2(a)(1),3(12), 3(13) & 3(14).	Vessels carrying oil in bulk- $200 per gross ton or $20,000,000 whichever is less. Facility-up to $100,000,000 spiller is liable for full amount of damages and cleanup costs where such discharge was the result of gross negligence, willful misconduct or a violation of applicable safety standards §5	1) Act of war 2) Negligence or willful act of claimant 3) Act or omission of third party 4) Act of God §5(d)	Cleanup costs and damage to or cost of restoring, repairing, or replacing any real or personal property, lost income due to damage to property including natural resources. Up to one (1) year loss of federal, state or local government tax, royalty, rented or net profit share revenue. §16,10	Civil-up to $10,000 for facilities to pay oil facility fee into fund §4(b)(2),(c)	Size limited to $200,000,000. Financed by a fee up to 3 cents per barrel collected from facility owners when oil is loaded or unloaded §§4(b),4(b)(3)	All damages and cleanup costs not compensated by spiller. Except where damage was caused solely by claimant's own negligence or willful act. §5(a)(b)(c)	State Law- §9(c) Vessel and facility financial responsibility provisions are preempted. No other state preemption. Federal Law- Where conflict or inconsistency this act preempts other federal law. (No multiple recovery for same injury.) §17(a)&(b)

LISTING OF LEGAL EXPERTISE

Michael Garcia
Legal Support Branch
Environmental Protection Agency, Region X
(206) 442-1275
FTS: 8-399-1275

a. Rivers and Harbors Act of 1899
b. FWPCA §301 and 402
c. Proposed Amendments to §301
d. FWPCA §311
e. Proposed Amendments to §311
f. Containment and Control under §311 and 40 CFR Pt. 112

Jim Ellis
District Legal Officer
17th Coast Guard District
(907) 586-7298

a. FWPCA 311 Enforcement
b. Intervention on the High Seas Act
c. U.S.C.G. Responsibilities under S. 687

William Moses
Division of Energy and Resources
Office of the Solicitor, DOI
FTS: 8-343-5581

a. TAPPA; pollution control and liability

- Stipulations
- Contingency plan for the TAP
- Role of the Authorized Officer
- EPA/DOI coordination and OSC delegation

Jon Tillinghast
Assistant Attorney General
State of Alaska
(907) 465-3600

a. Alaska oil spill liability legislation
b. State common law oil spill damage remedies

Tom Pursley
Pollution Control Section
Division of Land and Natural Resources, DOI
FTS: 8-739-3607

a. Procedural and evidentiary concerns associated with oil spill litigation

b. Burdens of proof and standards of liability

Eugene Fidell
LeBoeuf, Lamb, Leiby & MacRae
Washington, D.C.
(202) 457-7500

a. Private industry insurance schemes

- TOVALOP
- CRISTAL

b. Other common law oil spill remedies
c. Interface of "damage assessment" and private insurance

EPA's Responsibility for furnishing expertise in damage assessment (40 CFR §1510.22(1)):

Framing Legal Damages
Proposed National Oil Pollution Liability and Compensation Act of 1977 (S. 687, 95th Cong., 1st Sess.). [to be expanded upon below]

Legal Framework for Damage Assessment:

FWPCA §311
Executive Order 11735
MOU: EPA/DOT
National Oil & Hazardous Substance Pollution Contingency Plan (40 CFR §1510).
Regional Contingency Plans

HISTOPATHOLOGY PANEL

Participants

J. Hawkes, Chairperson

R. Grischkowsky
J. Karinen
M. Landolt
B. McCain
A. K. Sparks
W. T. Yasutake

HISTOPATHOLOGY PANEL

General Information and Guidance

The Panel decided to address one major project which encompasses several aspects of a structural study of potential changes in marine organisms resulting from exposure to petroleum in a spill situation. Although baseline data is being developed on the histology of marine organisms, there is such a paucity of information in this field that we lack essential data which is needed to compare suspected toxic reactions with non-petroleum related phenomena such as species differences and seasonal variations. Points that should be considered to obtain maximum information from a spill are as follows:

- Since the effects of chemical contaminants on tissues are seldom specific, histopathology alone cannot be definitive in identifying etiology. Our research effort should be interfaced with other groups such as analytical chemistry.

- Many fixatives are under the Hazardous Materials Act and cannot be transported by air. These solutions should be moved by either truck or boat and stockpiled in Alaska so that a response team could obtain fixatives legally.

- One species from each of at least three major groups of marine organisms should be sampled (a mollusc, crustacean and teleost) from the spill site and a comparable uncontaminated site.

- Whenever possible, chemical analyses for contaminants other than petroleum hydrocarbons could be performed and possible antagonism or synergism considered.

- Follow-up studies should be incorporated to obtain information about the long-term effects of the spill.

HISTOPATHOLOGY PANEL

Recommended Projects

1. The histopathologic effect of an oil spill on marine organisms.

PANEL: HISTOPATHOLOGY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: The Histopathologic Effect of an Oil Spill on Marine Organisms

2. Project Description:

A. Objectives:

1. To sample representative species distributed throughout the water column which may be affected by petroleum contamination and to examine them histologically.

2. To correlate histopathological data with information on other biological parameters, such as species distribution, behavior, disease frequency, and additionally, with analytical chemistry to correlate the presence of petroleum or the metabolic products of petroleum in affected fish.

3. To do follow-up sampling to measure potential chronic effects from the spill.

B. Methods:

1. General Comments.

a. Rapid communication with the predictive team is essential so that plans can be formulated to optimize sampling areas and times with respect to the movement of the oil.

b. It is essential that trained histopathologists be involved in collecting sampling and sharing samples with scientists from other panels (Chemical Analyses, Water Column Biology, Benthic Biology, Marine Birds/ Mammals).

c. Samples should be collected with careful attention to minimal extraneous contamination of petroleum. Therefore, if conditions warrant, divers would be both useful and preferred for sampling bottom and mid-water fish.

2. Specific Recommendations for Sampling.

a. An optimum of 60 fish or shellfish (or as available) should be included in the initial collection. Sections and slide preparations should be carried out on enough individuals from this sample until adequate repeatability of effect is obtained.

b. At the time of sampling only healthy-appearing or moribund animals should be taken. DEAD ANIMALS ARE NOT SUITABLE! Healthy animals from similar but unexposed sites should also be sampled.

c. Accession numbers should be ascribed to each animal to facilitate correlating the analytical chemistry data with histopathology from each individual.

d. We suggest the following tissues be sampled and have ranked their order with the highest priority tissues listed first:

- MOLLUSCS (bivalves). Either the whole animal or a slice from behind the palps. If individual organs are taken the following should be included: gill, hepatopancreas, stomach, intestine, gonad, mantle.

- CRUSTACEA. Gill, hepatopancreas, heart, antennal gland, sensory antennule, eye stalks, nervous tissue, carapace muscle.

- FISH. Skin, gill, liver, eye, olfactory, intestine, anterior kidney, posterior kidney, spleen, brain, heart, gonads, blood.

3. Specific fixation and sample preparation procedures will vary depending on the type of specimen and preference of the investigator. Included is a routine procedure for histopathology of fish which has been modified from Mr. Yasutake's procedure, National Fisheries Research Center.

a. Selection of Specimen:

Select living animals only. Those near death are desirable. In addition, select specimens which are showing the first apparent symptoms of toxicity. Each of these groups should be labeled separately.

Always send healthy specimens from identical non-affected groups, if possible. If not, select fish from the oiled group which do not show disease symptoms.

Every jar should be individually labeled identifying the fish and with the date they were put into the fixing solution.

b. Fixation:

Fixative: Bouin's Fluid - total volume 2 liters.

Picric acid----------	17.2	gm
Distilled water----------	1430	cc
Formalin----------	475	cc
Glacial acetic acid----------	95	cc

Weigh picric acid and place in a pyrex container large enough to hold 2 liters and add distilled water. Stir until all crystals are disolved. DO NOT BOIL. WARNING: Picric acid is explosive at 300°C. Add formalin and glacial acetic acid to the cooled solution. Stir briefly and pour into a jar. This solution will keep well, but should be protected from freezing.

To facilitate fixation, the fish, regardless of size, should be slit down the abdomen from the anus to the gills. The intestines and other organs should also be slit if the fish are larger than fingerlings. The importance of these incisions cannot be overemphasized. If the fish are too large to ship whole, cut pieces from individual tissues, e.g., gill, heart, liver, and especially any lesions observed. These pieces should not be larger than one-half inch square and one-quarter inch wide.

Volume of the fixative should be at least 10 times that of the fish or tissue. (Thus, put only one 6" fish in a pint of fixative). Fish and tissues should be left in the fixative for at least 24 hours and then replace the fixing solution with 65 percent ethyl alcohol. However, if alcohol is not available, send specimens in Bouin's fluid.

We suggest Davidson's fixative as an alternative and, for electron microscopy, see Hawkes (1974).

C. Anticipated Results:

1. The results will address possible morphological changes of tissues and cells from both light and electron microscopical examination. A generalized inflammatory response and non-specific necrosis can be expected. Therefore. . .

2. . . .the relationship of our results on specific tissues with chemical analyses of petroleum hydrocarbons or their metabolic products is crucial to any statement of causality.

3. Performing Organization:

MS. MALIN BONNETT
NMFS, NWAFC
Juneau, Alaska
(fish and shellfish)

MR. ALDIDIER
Alaska Department of
Fish and Game
Anchorage, Alaska
(fish and shellfish)

DR. ROGER GRISCHKOWSKY
Alaska Department of
Fish and Game
Anchorage, Alaska
(fish and shellfish)

DR. MURRAY HAYES
NMFS, NWAFC
Seattle, Washington
(resource assessment,
fishing operation)

DR. JOYCE HAWKES
NMFS, NWAFC
Seattle, Washington
(ultrastructure)

MR. JOHN KARINEN
NMFS, NWAFC
Juneau, Alaska
(fish and crustaceans)

DR. MARSHA LANDOLT
University of Washington
Seattle, Washington
(fish, birds, mammals)

DR. BRUCE McCAIN
NMFS, NWAFC
Seattle, Washington
(fish, and fish diseases)

DR. R. SCHWARTZ
U.S. EPA, Corvallis ERL
Newport Field Station, Oregon
(benthic biology)

MR. KARL SCHNEIDER
Alaska Department of
Fish and Game
Anchorage, Alaska
(marine birds and
mammals)

DR. A. K. SPARKS
Alaska Department of
Fish and Game
(invertebrate pathology)

DR. W. T. YASUTAKE
National Fisheries
Research Center
Seattle, Washington
(fish)

4. Applicable Habitats:

The following species are suggested for each of the Alaskan habitats.

a. Pelagic
   Salmonid spp. (fry, subyearling, yearling)
   Flatfish spp. (eggs, larvae)
   Herring - (*Clupea harengus*), (adults).

b. Offshore bottom
   Shrimp (*Pandalas* spp.)
   King crab (Parathodes spp.)
   Flatfish; for example, Yellowfin sole (*Limanda aspera*)
   Arrowtooth flounder (*Atheresthes stomias*)
   and Rock sole (*Lepidopsetta bilineata*)

c. Rocky shore
   Shore crab (*Hemograpsis nudis*)
   Mussel (*Mytilus edulis*)
   Abalone (*Haliotus* spp.).

d. Sandy beach
   Razor clams (*Siliqua* spp.)
   Butter clams (*Saxidomus* spp.)
   Cockles (*Clinocardium* spp.)
   Other clams (*Macoma* spp.).

e. Mud flats
   Hermit crabs (*Pagurus* spp.)
   Clams (*Macoma* spp.)

f. Kelp and eel grass
   Dungeness crab (*Cancer magister*)
   Abalone (Haliotus spp.).

g. Estuary
   Salmon from rearing pens such as in K.

5. Applicable Conditions:

a. The first consideration is the safety of personnel. Our initial sampling should be done as soon after the spill as possible and safe.

b. Biota from all habitats may be sampled.

c. Dead organisms or frozen organisms are totally useless for histopathology. We require live or moribund animals.

6. Applicable Oil Type:

All types apply.

7. Time Frame:

The study requires an initial sampling period of approximately 2 days to one week depending on the size of the spill and the variety of different habitats affected. Based on the data obtained in the first sampling, followup studies may require sampling at 6 and 12 months. Completion of specimen processing and analysis would take 3-12 months.

8. Cost:

The cost for histopathological studies after a spill depend on the severity of damage to biota and number of habitats affected rather than on the direct size of the spill. For an incident requiring two people sampling for 2 days, the cost would be about $24,000 including 10 days laboratory time upon return. If biased in any direction, this is a low projection and reflects a minimum reasonable cost.

TRANSPORTATION:	
Flights: commercial	$300/person
charter*	500/person
Shipboard time*	1000/day/person
SALARY:	
On site	$200-400/day/person
Laboratory time (histotechnique and report writing)	100-300/day/person
ADMINISTRATIVE OVERHEAD:	60%
SUPPLIES:	up to $6000
SHIPPING CHARGES: (for solvents, other supplies, samples)	$1000-4000/incident groups.

*probability of piggybacking with other groups could reduce this estimate

EQUIPMENT:	
nonrenewable nets	Estimate to be coor-
repair	dinated with other

9. Equipment Needs/Equipment Available:

   a. Major Equipment:

      Collecting equipment for obtaining fish such as:
      Nets (in conjunction with fisheries resource groups)
      Inflatable boat

   b. Supplies:

      Histopathological supplies commonly used by any trained histologist such as collecting vials, forceps, blades, scalpels, fixatives.

10. Facility Needs/Facilities Available:

   a. Pelagic or Benthic Habitats:

      - Shipboard sampling with counter space for dissecting and processing samples.

      - Living accommodations either on board or within access to harbor.

   b. Shore Access Habitats:

      - Inflatable boat.

      - Living accommodations for lodging and makeshift laboratory space for dissecting and processing samples.

11. Personnel Needs/Personnel Available:

   See Section 3.

12. Support Services:

   It is essential for histopathologists to obtain data from other disciplines on the same animals in order to correlate possible inflammatory or necrotic tissue alterations with the presence and types of petroleum hydrocarbons. The other groups with which we expect

to share samples and data include chemical analysis, water column biology, benthic biology, marine birds/mammals.

13. Payoff:

Histopathology is a direct and visual method of identifying changes in tissues and cells of animals exposed to toxic materials. When histopathology is used in conjunction with information from other disciplines such as analytical chemistry, it can provide data on the severity of tissue damage and response of marine organisms to toxic contaminants. As information on the extent of damage is obtained for commercial species, the study becomes useful in determining a portion of the economic cost of the spill.

14. Limitations:

a. The restrictions of weather and logistics during sampling are the primary limiting factors.

b. The time drain and availability of personnel with so few experts in this particular field is another serious consideration.

c. Histopathologic studies can indicate trends and the degree of deleterious conditions but without supporting experimental work cannot be definitive on cause and effect.

d. It is essential that adequate cooperation with other groups be implemental in otaining samples and backing up our findings (i.e., with chemical analysis of petroleum in the tissues examined for histopathology).

BENTHIC BIOLOGY PANEL

Participants

R. C. Swartz, Chairperson

H. M. Feder	D. Maiero
E. R. Fidell	M. S. May
L. B. Flagg	T. Merrell
J. J. Gonor	J. W. Nauman
J. Gottlieb	G. Perkins
R. S. Grischkowsky	J. Sainsbury
S. Hum	F. Wendling

BENTHIC BIOLOGY PANEL

General Information and Guidance

- Objective 1: Support to the OSC
- Objective 2: Damage Assessment
- Objective 3: Recommended Research

OBJECTIVE 1: SUPPORT TO THE OSC

A. Vulnerability of Intertidal Habitats to Oil Spills*

Intertidal habitats may be classified as follows with respect to their vulnerability to oil spills:

- Solid Rock Headlands

These represent one of the most common open coast habitats in the Gulf of Alaska. They are characterized by high wave energy and greatly dissected solid rock topography. They are likely to be the first intertidal habitat impacted by an offshore oil spill and oil may accumulate there because of the combined effects of wind and longshore currents. Acute mortalities can be expected. Species found in this habitat are widely distributed along the coast and larval recruitment from adjacent areas can be expected to recolonize decimated areas.

- Open Coast Sand Beach

This is another high energy habitat likely to be oiled by an offshore spill. Oil will probably be incorporated into the sand where it may become a source of recontamination. Remobilization of oil during storms might result in chronic tainting of otherwise harvestable stocks on the beach and in nearshore subtidal habitats.

- Protected Rocky and Sand Beaches

The effects of oil should be similar to that on rocky and sand beaches on the open coast. However, because of the protection from

*Miles Hayes has reviewed the vulnerability of Alaskan benthic habitats to oil spills in his article on Coastal Morphology and Sedimentation in Vol. 4 (p. 89 - 103) of the Environmental Assessment of the Alaskan Continental Shelf, NOAA Environmental Research Labs, Boulder, Colorado, February 1977.

high energy wave action, the time required for natural forces to remove the oil will probably be much longer. Clam beds often occur on protected sand beaches, especially when the sand is covered by a thin layer of fine gravel.

- Unconsolidated Rocky Shore

This is usually a protected, low-energy habitat. It typically supports a relatively depauperate flora and fauna.

- Mud Flats and Salt Marshes

These are among the most highly productive marine ecosystems. Every attempt should be made to use booms and skimmers to prevent an oil slick from entering a marsh or mud flat. Oil is not likely to rapidly penetrate the fine sediments of these habitats. Thus, a significant proportion of oil brought in on a flood tide may leave on the ebb. However, if storm activities force oil into the upper reaches of these habitats, decades may pass before recovery is effected by natural processes.

Another type of protected Alaskan beach consists of fine glacial sediments. These muddy beaches are not highly productive since detrital material (and probably oil) is not easily incorporated into the fine sediments.

B. Alternative Cleanup Strategies and the Use of Dispersants

Logistical problems may limit the feasibility of cleanup attempts on many remote Alaskan beaches. Access to some habitats may be difficult and unsafe. Natural physical forces will probably remove oil from open coast rock and sand beaches in relatively short time periods. A greater emphasis should be placed on cleaning more protected shores. If oil persists on protected rocky shores, attempts should be made to clean patches by burning or steam to create areas for initial recolonization through larval recruitment from unaffected, nearby areas. Protected sandy beaches may support large clam populations. Removal of the top few inches of the oil-sediment mixture could be achieved by careful grading. This may protect the surviving adult population and minimize the impact on future year classes. If oil on unconsolidated rocky shores has the potential for chronic contamination of more productive nearby habitats, burning might be considered. Salt marshes and mudflats might be significantly altered by grading and this procedure should not be attempted. If large quantities of oil are deposited in marshes or mud flats, local flushing in conjunction with a boom and skimmer operation might be attempted. Burning of salt marshes might also be considered since it would probably cause less long term impact than most other cleanup strategies. Cutting of

marsh grasses should be considered if burning is not possible and if the quantity of oil in the marsh is likely to result in chronic contamination.

The method and scheduling of cleanup operations should be determined in consideration of the seasonal sensitivity of the affected biota. Burning of salt marshes should be restricted to the dormant plant season. Wildlife scare devices could be used to keep animals away from the spill site.

Decisions on the use of dispersants must be situation-specific. Only those dispersants approved by EPA should be considered. They should not be used unless an oil slick is likely to impact a critical habitat, commercial or recreational resource, or large aggregations of marine birds or mammals. Consideration must also be given to the effects that the oil-dispersant mixture might have on the subtidal biota.

A high research priority should be assigned to determine the long term effects of all cleanup procedures on benthic ecosystems. This is especially true for operations conducted under the icing conditions frequently encountered in Alaska because normal cleanup techniques might not be effective in the presence of ice.

C. Critical Benthic Habitats

A number of reviews of critical benthic habitats in Alaska are in existence and should be available to the scientific response element at all times. The highest priority should be assigned to the protection of habitats which support rare and endangered species. Other critical habitats include marine bird and mammal rookeries; waterfowl nesting, staging and feeding areas; major fish and shellfish breeding, rearing, and harvest areas; and designated marine sanctuaries. References to these and other critical habitats are provided by the following sources:

Critical Habitat Atlases

1. NMFS, ADF&G, USF&WS and BLM nomination for marine sanctuaries.

2. Inventory of Coastal Fishes and Wildlife Resources for Alaska, ADF&G (only 1 copy now).

3. Inventory of Wildlife Resources of Alaska, ADF&G.

4. Inventory of Potential Critical Habitats, Refuges and Marine Sanctuaries in Alaska's Coastal Zone and Marine Waters, ADF&G.

5. Resource Inventory of Lower Cook Inlet, in press by ADF&G Habitat Protection Division, Anchorage.

6. Alaska Intertidal Atlas, NMFS-Auke Bay - includes maps of intertidal habitats from Bering Strait to Yakutat.

7. Catalog of Seabird Colony's, in press by USF&WS - January completion date.

8. BLM EIS's for Alaskan Continental Shelf:

   Draft and Final EIS for NE Gulf of Alaska
   Draft and Final EIS for Lower Cook Inlet
   Draft EIS for Western Gulf of Alaska (Kodiak)

9. Joint Federal-State Land Use Planning Commission Regional Profiles.

10. State of Alaska Anadromous Stream Catalog, ADF&G.

11. Arctic Environmental Information Data Center has been contracted by USF&WS to prepare a compendium of existing inventories of critical habitats.

12. NOAA/OCSEAP Synthesis Reports, Lower Cook Inlet, NE Gulf of Alaska, Kodiak, and Beaufort Sea.

13. Rare and Endangered Species Lists as designated by Federal and State authorities.

D. Facilities and Logistics

Mechanisms should be established in advance for interaction between benthic biologists and the On-Scene Coordinator. Advice given by biologists will depend heavily on predictions of the oil slick trajectory made by either models or *in situ* observations. Biologists on the scene must have easy access to communication facilities so that they can contact appropriate experts. These should be provided on a centralized basis in accordance with pre-established arrangements. Agreements must be made in advance to allow biologists to participate in interagency reconnaissance of the slick and potentially impacted habitats. The most appropriate benthic specialist(s) should be selected by the scientific response team to make site visits during the spill emergency. Necessary legal arrangements concerning matters such as liability for personal injury should be made in advance to ensure the participation of the most qualified scientists without regard to their institutional affiliation.

It is highly recommended that serious thought be given to the development of a permanent, small strike force of six to ten individuals. These (or one half of the group) would travel on a year-round basis to critical areas likely to be impacted by spills. This group would continuously monitor a variety of areas while simultaneously working out supply, equipment and logistic needs. Such a group would form the core of a larger strike force to be selected from a list of available benthic biologists.

E. Costs

Costs to provide advice on the potential benthic impact during emergency spill situations will be restricted to salaries and per diem for the participants and travel costs to bring them to the spill scene or other coordinating site. Salaries and per diem (if necessary) will range from $1-300/scientist/day. In the absence of advance contingency arrangements, the scientific support team leaders must have pre-designated authority to commit salary, per diem, and travel costs to ensure the participation of the most qualified benthic biologists.

F. Potential Sources of Expertise

Table 1 identifies benthic biologists capable of responding to an oil spill emergency. Seven individuals who can probably mobilize appropriate scientists in their respective organizations are designated as principal contacts. Participation beyond the emergency advisory phase is clearly dependent on establishment of funding agreemnts with appropriate agencies. The SSC may contact these scientists and obtain an agreement to respond. Other individuals should be added to this list during the review of the draft plan. Home and business telephone numbers must be obtained to facilitate communication in an emergency situation.

Expertise on local environmental conditions can also be obtained from the Alaskan Department of Fish and Game Regional Response Team for EPA. A list of the location and telephone numbers for team 2 members is included in Table 2. These lists of advisors and researchers must be periodically updated to ensure the availability of appropriate scientific expertise in an emergency situation.

OBJECTIVE 2: DAMAGE ASSESSMENT

The Panel outlined two projects for assessing spill related damage. The projects are presented using the 14-point format and are specifically intended to assess damage to benthic communities in intertidal and shallow subtidal areas (see Recommended Projects).

Table 1.

Name	Institution	Specialty	Area**
George Mueller*	UA, Fairbanks	Intertidal/Subtidal Benthos	7
Howard Feder*	UA, Fairbanks, IMS	Clam Biology	7
A.J. Paul	UA, Seward, IMS	Clam Biology	1, 2, 3
Richard Neve	UA, Seward, IMS	Clam Toxicity	1, 2
Peter McC	UA, Fairbanks, IMS	Macroalgae, Sea Grasses	1, 2, 4, 5
Robert Moore*	UA, Fairbanks, IMS	Director	7
Rick Rosenthal	Alaskan Coastal Services	Subtidal Algae, Invertebrates, Fishes, Sea Otters	1, 2, 3
Dennis Lees	Dames and Moore	Subtidal Algae, Invertebrates, Fishes	1, 2, 3
Ted Merrell*	NMFS, Auke Bay	Benthic Assessment	7
Dick Myren	NMFS, Auke Bay	Intertidal Ecology	1, 2, 5
Charles O'Clear	NMFS, Auke Bay	Intertidal Ecology	1, 2, 4
Lou Barr	NMFS, Auke Bay	Subtidal Ecology, Shellfish	7
Bob Ellis	NMFS, Auke Bay	Subtidal Ecology, Shellfish	1, 4, 5
Natasha Calvin	NMFS, Auke Bay	Subtidal and Intertidal Macrophytes and Invertebrates	1, 2, 4, 5
John MacKinnen	NMFS, Auke Bay	Subtidal and Intertidal Macrophytes and Invertebrates	1, 2, 4, 5
Joyce Gnagy	NMFS, Auke Bay	Intertidal Biology	1, 2, 4, 5

Table 1. (continued)

Name	Institution	Specialty	Area**
Bud Burgner*	UW, Fisheries Research Institute	Benthic Ecology	7
Phil Lebednick	UW, Fisheries Research Institute	Intertidal and Subtidal Algae	1, 4
Charles Sunonstead	UW, Fisheries Research Institute	Nearshore Fishes	1, 4
John Palmisano	UW, Fisheries Research Institute	Intertidal Ecology, Benthic Invertebrates, Sea Otters	1, 2, 4
M. Lawrence	Canadian Dept. Fish and Env.	Intertidal Benthos	6
J. Stein	Canadian Dept. Fish and Env.	Intertidal Benthos	6
J.W. Wacasey	Canadian Dept. Fish and Env.	Subtidal Benthos	6
A.R. Milne*	Canadian Dept. Fish and Env.	Benthic Ecology	6
W. Griffiths	LGL Limited	Subtidal Benthos, Fishes	6
Bruce Wing	NMFS, Auke Bay	Intertidal and Subtidal Benthos	1, 4, 5, 6
Sam Stoker	UA, Fairbanks	Subtidal Benthos, Macroalgae	1, 5
Grant Matheke	UA, Fairbanks	Subtidal Benthos, Macroalgae	2
Steve Jewett	UA, Fairbanks	Subtidal Epibenthos	3, 4

Table 1. (continued)

Name	Institution	Specialty	Area**
Gretchen Keiser	UA, Fairbanks	Intertidal Benthos	2
Andrew Carey	Oregon SU	Subtidal Benthos	6
Jeff Gonor	Oregon SU	Intertidal Benthos	1
Murray Hayes*	NMFS, Seattle	Fishes	7
Lael Ronholt	NMFS, Seattle	Demersal Fishes	1, 2, 3, 4, 5
Richard Strety	NMFS, Auke Bay	Salmon and Demersal Fish	1, 2, 3, 4, 5
Max Huberg	UA, Fairbanks, IMS	Demersal Fish, Food Webs	2, 3, 4, 5, 7
Steve Jewett	UA, Fairbanks, IMS	Demersal Fish, Food Webs	2, 3, 4, 5, 7
Ron Smith	UA, Fairbanks, IMS	Demersal Fish, Food Webs	2
John Rose	UA, Fairbanks, IMS	Demersal Fish, Food Webs	2
Peter Craig	LGL Consultants, Nanaimo BC	Coastal Fishes	6

*Prime Contact.

**Area Code: 1. SE Coast. 2. PW Sound - NE Gulf of Alaska. 3. Cook Inlet. 4. Kodiak-Aleutians. 5. Bering Sea. 6. Arctic Coast. 7. All Alaskan Waters.

TABLE 2

OIL AND HAZARDOUS MATERIALS SPILL NOTIFICATION LIST

I. Assessment Team

South Eastern Region (Juneau)

Richard Read	Office	586-6630	
	Home	789-0212	

South Central Region (Anchorage)

Thomas W. Trent (Habitat)	Office	344-0541	x133
	Home	344-6187	

Arctic Yukon - Kuskokwim (Fairbanks)

Scott Grundy (Habitat)	Office	452-1531	
	Home	452-3526	

II. Technical Team

Anchorage

John Vania (Game)	Office	344-0541	x215
	Home	277-6261	
Russ Redick (Sport Fish)	Office	344-0541	x230
	Home	344-8674	
Ken Middleton (Comm. Fish)	Office	344-0541	x144
	Home	277-3403	

Barrow

Vacant (Game)	Office	852-5791	

Bethel

Dee Stout (Game)	Office	543-2433	
	Home	same	
Mike Jonrowe (Comm. Fish)	Office	543-2433	
	Home	same	

Ray Baxter (Comm. Fish)	Office	543-2433
	Home	543-3136

Cold Bay

Glenn Davenport (Comm. Fish)	Office	532-2419
	Home	same

Cordova

Julius Reynolds (Game)	Office	424-3215
	Home	424-3608
Ralph Pirtle (Comm. Fish)	Office	424-3213
	Home	424-3366

Delta Junction

Robert Larson (Game)	Office	895-4681
	Home	895-4546
Richard Peckham (Sport Fish)	Office	895-4632
	Home	895-4853

Dillingham

Mike Nelson (Comm. Fish)	Office	842-5227
	Home	none
Jeff Skrade (Comm. Fish)	Office	842-5227
	Home	842-5504

Fairbanks

Dick Bishop (Game)	Office	452-1531
	Home	none
John Burns (Game)	Office	452-1531
	Home	479-2671
George Van Wyhe (Sport Fish)	Office	452-1531
	Home	452-1083

Glennallen

Sterling Eide (Game)	Office	822-3461
	Home	none

Fred Williams (Sport Fish)	Office	822-3461
	Home	822-3922
Ken Roberson (Habitat)	Office	822-3461
	Home	822-3363

Homer

Dave Hardy (Game)	Office	235-8191
	Home	235-7147
Tom Schroeder (Comm. Fish)	Office	235-8191
	Home	235-8955
Joe Wallace (Sport Fish)	Office	235-8191
	Home	235-8037
Loren Flagg (Habitat)	Office	235-8191
	Home	235-8356

Juneau Region

Bob Pegau (Game)	Office	586-6700
	Home	789-0702
Don Stewart (Sport Fish)	Office	586-6700
	Home	789-2745
David Cantillon (Comm. Fish)	Office	586-6616
	Home	789-9682

Ketchikan

Robert Wood (Game)	Office	225-5195
	Home	225-2009
Don Siedelman (Sport Fish)	Office	225-5195
	Home	225-6490
John Valentine (Comm. Fish)	Office	225-5195
	Home	225-4982
Steve Haavig (Habitat)	Office	225-5195
	Home	225-5641

King Salmon

Jim Faro (Game)	Office	246-3340
	Home	246-3376
Louis Swartney (Sport Fish)	Office	246-3340
	Home	246-3323
Don Bill (Comm. Fish)	Office	246-3341 & 2
	Home	246-3462

Kodiak

Roger Smith (Game)	Office	486-5754
	Home	486-3194
Frank Van Hulle (Sport Fish)	Office	486-5753
	Home	486-3418
Paul Pedersen (Comm. Fish)	Office	486-4168
	Home	486-5664

McGrath

Pete Shepherd (Game)	Office	524-3323
	Home	same

Nome

Carl Grauvogel (Game)	Office	443-2825
	Home	443-2162
Fritz Kuhlmann (Comm. Fish)	Office	443-5167
	Home	443-2893

Palmer

Jack Didrickson (Game)	Office	745-3178
	Home	745-3490
Larry Engel (Sport Fish)	Office	745-3178
	Home	745-4132

Petersburg

Harry Merriam (Game)	Office	772-3801
	Home	none

Ed Jones (Sport Fish)	Office	772-3801
	Home	772-4868
William Bergman (Comm. Fish)	Office	772-3801
	Home	772-3571

Sand Point

Ken Griffith (Comm. Fish)	Office	383-2066
	Home	same

Seward

Ted McHenry (Sport Fish)	Office	224-3017
	Home	224-3036

Sitka

Loyal Johnson (Game)	Office	747-8488
	Home	747-8083
Art Schmidt (Sport Fish)	Office	747-3278
	Home	747-6414
Jim Parker (Comm. Fish)	Office	747-3278
	Home	747-3494

Soldotna

Paul LeRoux (Game)	Office	262-4525
	Home	262-4761
Sid Logan (Sport Fish)	Office	262-4525
	Home	262-4048
Dave Daisy (Comm. Fish)	Office	262-4278
	Home	none

Tok

Larry Jennings (Game)	Office	883-2972
	Home	883-2193

Unalaska

Paul Tate (Comm. Fish)	Office	581-1239
	Home	same

Valdez

Call Cordova Biologists	Office	835-4307

Wrangell

David Zimmerman (Game)	Office	874-3614
	Home	874-3269
Vacant (Comm. Fish)	Office	874-3614

Yakutat

Ronald Quimby (Game)	Office	784-3255
	Home	none

OBJECTIVE 3: RECOMMENDED RESEARCH

The Benthic Biology Panel recognizes the following specific research needs:

A. Assessment of the ecological effects of an oil spill on benthic ecosystems would be greatly enhanced by a more complete understanding of the natural spatial-temporal dynamics of benthic communities. The panel recommends funding of research to identify seasonal and annual patterns of reproduction, growth, productivity, diversity, density and species composition in representative Alaskan benthic habitats.

B. The present state-of-the-art does not permit accurate predictions of the efficacy of various cleanup strategies. Post-spill research should be directed at the effectiveness of all attempts made to mitigate the impacts of oil on benthic communities. In addition the panel recommends funding of field experiments to determine the effects of the following activities:

- Grading of sand beaches in the absence of an oil spill.
- Oiling of small areas of a rocky intertidal habitat followed by: a) oil burning, b) steam cleaning, and c) no attempt at cleanup.
- Low pressure manual flushing of oil from mud flats and salt marshes into oil containment devices.

C. The ultimate ecological impact of an oil spill can only be determined in relation to the time required for the complete recovery of the biota. This may not occur until years or even decades after the spill. Damage assessment surveys are designed only to identify the probable extent of impact. Long term research projects can not always be justified, but for unique spills (i.e., in terms of affected habitats, or the type and quantity of oil) the damage assessment should continue until the benthos returns to natural conditions.

D. The panel recommends that the success of the scientific response to oil spills be evaluated after each incident. Damage assessment and research objectives should be reconsidered to identify the most significant ecological parameters to be investigated and the most cost-effective mechanisms for conducting oil impact analysis.

BENTHIC BIOLOGY PANEL

Recommended Projects

1. Oil spill damage assessment for intertidal environments.

2. Oil spill damage assessment for the benthic community in shallow subtidal environments.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 1
PRIORITY RANK:

1. Project Title: Oil Spill Damage Assessment for Intertidal Environments

2. Project Description:

A. Objectives:

(1) Using grid and transect analyses, determine the short-term effect of the oil on the benthic community by comparing the spill area to an unimpacted area and/or baseline data. Any design must consider the statistical reliability of the data as well as the amount of change which can be detected between the control and test areas. In addition, data analyses should include reliable procedures which have been used for OCS benchmark programs.

Determine (a) Biomass and density of individuals at the species level.

(b) Species composition.

(c) Diversity, including richness and dominance components.

(d) Hydrocarbon concentrations in tissues of selected species.

(e) Reproductive condition of dominant populations.

(2) Determine long-term effects by looking at repopulation of the impacted area.

Look at (a) Species succession.

(b) Settlement and development of larval forms.

(3) Detailed visual observations are recorded.

B. A good reference list on the effects of oil on the shore benthos (both plant and animal) should be compiled and made available.

(1) See Dale Straughan *et al.* for many references on Santa Barbara spill.

(2) J. J. Gonor, Techniques for sampling intertidal communities, EPA Ecol. Res. Ser. In preparation.

(3) EPA Field Assessment Manual.

(4) OCEAP Annual Reports.

3. Performing Organization:

It is essential that principal investigators have prior experience with the Alaskan benthos. The following organizations are recommended:

I. Demonstrated Capability

A. NMFS Northwest and Alaska Fishery Center

B. ADF&G

C. Fish & Wildlife Service

D. Univ. of Alaska:

(1) Inst. of Marine Science

(2) Marine Sorting Center

E. Univ. of Washington:

(1) Fisheries Res. Inst.

(2) College of Fisheries

F. Alaskan Coastal Services

G. Dames and Moore

II. Potential Capability

A. Texas Instruments

B. Tetra Tech. Inc.

C. Beak, Ltd.

D. LGL, Ltd.

4. Applicable Habitats:

All intertidal environments.

5. Applicable Conditions:

A. Sufficient oil is expected to reach the shoreline to produce petroleum hydrocarbon damage to a viable benthic community.

B. Good base line data is desirable, but not essential.

C. Uncontaminated control site is essential.

D. Season/weather must be considered to evaluate effects of winter icing, storm damage, etc., in addition to oil effects.

E. Site should be accessible.

F. Relative position of impacted area to other pollution sources such as power plant discharge, harbor, sewage effluent, etc., should be considered.

G. Presence of harvestable crop would add import to study.

H. Adequate funding for project completion must be committed to specific research organization prior to project implementation.

6. Applicable Oil Type:

All types.

7. Time Frame:

Intensive study initially with the continued duration and frequency of sampling dependent upon season, weathering of oil, and responses of community structure.

Within 1 year a presentation of the acute impact of the spill will be available. However, sampling should continue through a complete annual cycle.

8. Costs:

Dependent on duration and frequency of sampling and location of spill. Possible scenario:

Preparation, Travel and Sampling - Post-spill Survey = 18 days
Additional sampling as needed = 18 days/survey

Labor Costs per Sampling Event -

5-man team = 5 x 18 = 90 man-days in field
lab days = 5 lab day/field days = 5 x 90 = 450 man-days in lab/sampling event

Total man-days = 90 + 450 = 540
Cost - $125/day/scientist = $125 x 540 = $67,500/sampling event

This cost estimate does not include per diem, travel, transportation, materials, and overhead costs. A minimum of three sampling events would be needed to make the damage assessment. Sampling and laboratory efforts will increase if more than one intertidal habitat type is impacted.

9. Equipment Needs/Equipment Available:

The Hartford benthos panel provided a list of the kinds of equipment needed to sample intertidal habits. Our panel suggests that this equipment be purchased and stored at likely staging site(s) along the Alaskan coast. The Hartford list does not specify all of the equipment that will be needed. Howard Feder, Ted Merrell, and Loren Flagg should be asked to prepare more exact specifications for biological sampling. Also, Dave Shaw and William MacLeod should be asked to identify equipment necessary for collecting and preserving samples for hydrocarbon analysis.

10. Facility Needs/Facilities Available:

Access to the spill site and accommodations for the sampling team will have to be provided. These requirements will vary greatly in Alaska depending on the spill location and season.

11. Personnel Needs/Personnel Available:

A. Field Sampling Team:

Team Leader and four assistants.

B. Laboratory Personnel:

A critical element will be the availability of taxonomists for invertebrate and plant assemblages.

12. Support Services:

A. Hydrocarbon analysis

- tissue, water and sediment concentration analysis.

B. Resource analysis - how important is area?

(1) Significance for commercial and subsistence fishery.
(2) Macrophyte beds.
(3) Recreation.
(4) Future development potential.
(5) Unique species present.

13. Payoff:

A. Initial mortality and long-term loss in productivity will be determined.

B. Impact on commercial, subsistence and recreational resources.

C. Scientific interest - there is scant documentation of effects of oil spill on intertidal shores.

D. Success of clean-up techniques could be determined.

14. Limitations:

A. Manpower - get most out of limited funds and manpower available.

B. Weather.

C. Season.

D. Taxonomic expert availability.

PANEL: BENTHIC BIOLOGY
PROJECT NO: 2
PRIORITY RANK:

1. Project Title: Oil Spill Damage Assessment for the Benthic Community in Shallow Subtidal Environments

2. Project Description:

The benthos is often considered a prime area of concern when considering the potential impact of petroleum hydrocarbons on aquatic communities. This is based upon 1) documented proof that marine and estuarine bottom sediments provide natural sinks for the accumulation of toxic petroleum hydrocarbons; 2) the potential vulnerability of many benthic communities to oil impacts as a result of the broad taxonomic representation of constituent species and in many cases their seemingly apparent longevity, immobility, sensitivity, and ability to concentrate toxic substances; and 3) realization of the significant functional roles that benthic communities play, including recirculation of vital nutrients to pelagic phases and the production of both primary and secondary sources of food that are commercially important to man.

Consequently, it is imperative that we study the effect of oil spills on benthic communities in order to assess the overall impact on the health of coastal marine ecosystems.

In response to a spill, samples will be collected at designated control and impacted sites employing appropriate quantitative sampling methodology and will be processed by standard analytical and data reduction techniques which are generally available. Temporal and spatial changes in species abundance and distribution will provide the data base necessary to properly assess the impact of the spill on benthic community structure.

Guidance for sampling the macrofaunal benthos can be found in the IBP Handbook on Benthic Sampling by Holme and McIntyre and in Swartz, Guidelines for Sampling and Analyzing the Marine Macrobenthos, EPA Ecol. Res. Ser. In Prep. Guidance on methodology for macrophyte sampling is included in Rosenthal's Marine Plant Communities of Kaichemak Bay, ADF&G Rept. prepared by Dames and Moore and Rosenthal's report on the macrophytes of PWS. Diving surveys should be limited to those cases in which bottom grabs cannot be taken or a behavioral study is deemed necessary.

3. Performing Organization:

Same as Project 1, item 3.

4. Applicable Habitats:

Inshore and nearshore subtidal environments and offshore banks.

5. Applicable Conditions

Conditions which must be satisfied in order to successfully complete this project include the following:

A. Baseline data or appropriate control sites must be available.

B. Oil may be incorporated into the sediments.

C. Weather and ice conditions permit sampling.

D. The presence of a viable benthic community in the potential impact area(s).

E. Funding adequate to ensure successful completion of the project must be committed prior to its inception.

6. Applicable Oil Type:

All oils and related petrochemicals.

7. Time Frame:

Same as Project 1, item 7.

8. Cost:

A. Subtidal, Grab Sampling Event.

Minimum of 5 grabs/station and 10 stations

50 man-days per cruise
200 man-days to complete sorting, identification to the species level, and statistical analysis.

Cost - approximately $50,000/cruise

A minimum of four cruises would be required to complete the damage assessment. Univ. of Alaska Marine Sorting Center is probably the best qualified institution for subtidal grab sampling.

B. Subtidal Epibiota Collected by Divers.

Minimum of 5 diver transects would constitute a sampling unit

30 man-days/sampling event
100 man-days to complete analysis

Cost - approximately $20,000/sampling event

A minimum of four SCUBA surveys would be required to complete the damage assessment.

9. <u>Equipment Needs/Equipment Available</u>:

Field equipment for grab sampling:

A. Sampling device (0.1m^2 Smith-McIntyre, or equivalent) and supporting stand.

B. One dozen buckets.

C. 360 16 oz. jars and compartmental shipping boxes.
120 8 oz. jars and compartmental shipping boxes.

D. 2 0.5 mm 12" Tyler stainless steel screens.
2 1.0 mm 12" Tyler stainless steel screens.

E. 5 gal. buffered formalin, plastic funnel, plastic quart bottle, plastic 5 gal. bottle (empty), 5 gal. 70 percent ETOH.

F. Wash tub or other device for elutriation.

G. Forceps, 15 cm rule, coring tube, and miscellaneous items.

H. RS-5 salinometer or equivalent. DO meter, cable and probe.

I. Appropriate photographic equipment.

10. Facility Needs/Facilities Available:

Facilities required for benthic work are not extensive but include the following:

A. Vessel appropriate to sea state and depth conditions. Must have a winch capable of handling the grab, a seawater supply for sieving sediments and a freezer for sediment and tissue samples.

B. Laboratory with large amount of counter space and storage space which may also be used for staging.

C. Adequate dissection and compound microscopes.

D. For cruises involving SCUBA dives, a compressor capable of recharging SCUBA gear must be on board.

11. Personnel Needs/Personnel Available:

A. Field Sampling Team:

(1) Grab sampling: team leader and four assistants.

(2) SCUBA survey: three certified divers.

B. Laboratory Personnel:

Competent taxonomists for invertebrate and plant species. Assistants for sorting and enumerating specimens.

12. Support Services:

Additional data inputs which may be critical in the interpretation of the faunal data include:

A. Hydrocarbon content of sediment, tissues and water.

B. Sediment grain size.

C. Histopathological analysis of selected species.

13. Payoff:

Important knowledge gained through this type of study includes:

A. Assessment of the ecological damage and economic loss due to impact of spilled oil on a major ecosystem component.

B. Long-term data at control or unimpacted sites will provide presently unavailable information about long-term benthic community variability.

C. The program will provide speciments for potential use by other groups.

D. Accurate information on the status of commercial benthic species will be made available to local agencies.

E. Immediate guidance will be provided to assist in the direction of clean-up efforts.

14. Limitations:

A. Sufficient taxonomic expertise may be unavailable and considerable delay may result.

B. Costs for developing a good statistical study are often prohibitive and the compromise study which results is of limited value.

C. Even with sufficient personnel and funds there is always a lag between collection of samples and availability of data. This is typically longer for benthos then for most other areas.

WATER COLUMN BIOLOGY PANEL

Participants

V. Alexander, Chairperson

C. Carty
B. Morris
P. C. Pedersen

WATER COLUMN BIOLOGY PANEL

General Information and Guidance

- General Considerations
- Objective 1: Support to the OSC
- Objective 2: Damage Assessment
- Objective 3: Recommended Research

GENERAL CONSIDERATIONS

The Panel addressed the Workshop objectives in the following manner:

A. Objective 1: Support to the OSC

1. Identification and description of appropriate experts.

2. Guidelines on implementation of mitigation activities to minimize impact.

B. Objective 2: Damage Assessment

1. Three projects were proposed to assess the impact of spilled oil on water column communities.

C. Objective 3: Recommended Research

1. The Panel composed a list of projects to take advantage of the research opportunity provided by emergency oil spills.

Projects from this panel should be combined with those from other areas to produce comprehensive, well coordinated studies.

A discussion of ship availability produced the idea that Coast Guard vessels might assume part of the task of transporting and accommodating scientists and providing some hydrographic ability for the water sampling. Otherwise, ship availability in an area as large as Alaska may be a problem.

OBJECTIVE 1: SUPPORT TO THE OSC

A. Available Expertise

A number of agencies within Alaska were identified as having a cadre of experts available for oil spill impact work. These include EPA, BLM, NOAA, NMFS, NWS, Forest Service, Department of Environmental Conservation, University of Alaska, Dames and Moore as well as other consulting firms. The specific names supplied below derive from current work on OCS Environmental Assessment carried out under NOAA auspices, possibly representing the largest body of data dealing with the various regions:

Ichthyoplankton -- All regions
Dr. T. S. English
Department of Oceanography
University of Washington, Seattle, Washington

Gulf of Alaska, Bering Sea
Dr. R. T. Cooney
Institute of Marine Science
University of Alaska, Fairbanks, Alaska 99701

National Marine Fisheries Laboratory
Auke Bay, Alaska

Zooplankton --

Prince William Sound	Dr. R. T. Cooney
Cook Inlet	Dr. R. T. Cooney
Kodiak-Aleutian	Dr. R. T. Cooney
Bering Sea	Dr. R. T. Cooney
Arctic Coast	Dr. T. S. English
S. E. Alaska	Dr. Herb Bruce, NOAA, Juneau

Phytoplankton --

S. E. Alaska	Dr. Herb Bruce, NOAA, Juneau Dr. Herb Curl, ERL, Seattle
Prince William Sound	Dr. Vera Alexander IMS, University of Alaska, Fairbanks, Alaska 99701
Cook Inlet	Dr. Jerry Larrance
Kodiak-Aleutians	PMEL, Seattle
Bering Sea	Dr. Vera Alexander
Arctic Coast	Dr. Rita Horner c/o T. S. English University of Washington, Seattle, Washington

Meroplankton -- Dr. R. T. Cooney

The list above is not exhaustive, and probably more expertise is available.

B. Guidelines on Implementation of Mitigation Activities

Oil spills in open water are not expected to have severe effects on planktonic populations because of limited areal extent, mixing and dispersal. Fishes are believed to avoid oil contaminated areas, and therefore, with some exceptions to be given below, extensive action is not required. Unless the oil is likely to contaminate a coastal area, the use of dispersants is more likely to produce deleterious effects in the water column than the oil itself. Mechanical means of cleanup are more desirable from the water column point of view.

In no case should dispersants be used in shallow lagoons which can be designated as critical oil spill impact areas. Another critical area is the ice edge in the Bering Sea during the spring bloom period, although it is recognized that the total area covered by a spill during this time is not likely to impact a significant proportion of the ice edge. Not enough is known about the effect of a spill here or in the Beaufort-Chukchi Seas during ice cover in spring with respect to effects of the grazing population under the ice, which includes zooplankton and juvenile fishes. In the case of ichthyplankton and meroplankton, seasonal and regional considerations may be critical. Information derived from OCS studies will be useful. Seasonal drift of year-class across specific locations is the type of information needed to assess impact. Meroplankton are especially difficult to deal with, with our present knowledge of distribution.

In the case of adult fish, although avoidance may be the general rule, what would be the impact if migratory fish must pass through a spill region? In addition, would there be a homing problem for salmon? Specific areas might be designated critical on this basis.

OBJECTIVE 2: DAMAGE ASSESSMENT

See proposed projects for damage assessment.

OBJECTIVE 3: RECOMMENDED RESEARCH

The following projects are suggested to take advantage of unique research opportunities afforded by accidental oil spills:

1) Effects of oil on migratory fishes including the impact on homing ability.

2) The relationship between ichthyplankton distribution and oil spills (see Hartford Workshop report).

3) The impact of oil spills on benthic communities through meroplankton.

4) The effect of oil spills on neuston.

5) The effect of oil spills on primary production in connection with ice (epontic populations and ice-edge spring blooms) and on the grazing of zooplankton and ichthyoplankton in these ice related systems.

6) The effects of various treatments of oil spills on water column biology, particularly on planktonic populations.

WATER COLUMN BIOLOGY PANEL

Recommended Projects

1. Water column sampling - environmental damage assessment.
2. Net sampling of water column for oil impact assessment.
3. Effects of oil spills on resident fish communities.

PANEL: WATER COLUMN BIOLOGY
PROJECT NO: 1
PRIORITY RANK: 1a

1. Project Title: Water Column Sampling - Environmental Damage Assessment

2. Project Description:

This project consists of sampling the water column inside and outside the oil spill in order to assess the impact on the planktonic community. Briefly, a transect of hydrographic stations is to be run across the front of an oil spill (out of oil) and across the center of the oil spill, with stations at reasonable intervals, depending on the extent of the spill. At each station, a depth series of samples should be taken using a Niskin bottle, with a wide range of procedures to be carried out on each sample. Suggested depth sampling could be at five meter intervals for the first 25 meters, with additional samples at greater depths.

The following procedures would be carried out:

a. Primary productivity determinations under constant light conditions on deck at surface seawater temperature, short incubation time using ^{14}C.

b. Phytoplankton standing stock and population composition, samples to be preserved for later analysis.

c. Chlorophyll a and phaeophytin content.

d. Hydrocarbon content of phytoplankton.

e. Zooplankton populations - look for ingestion of hydrocarbons and physiological effects. Also to be sampled by net methods (see next project).

f. Light penetration into the water column to be determined in and away from oil-affected region - licor meter or equivalent.

g. Continuous sampling of water surface for chlorophyll content using fluorometry, also with depth if suitable pumping system is available.

h. Carry out photosynthesis: light curve in and away from oil on at least one station.

References...methodology in general according to Strickland and Parsons (1972?).

The purpose of this project is to determine whether any measurable effects have resulted from the oil spill.

3. Performing Organizations:

A variety of organizations are capable of carrying out this work...Institute of Marine Sciences, University of Alaska; Department of Oceanography, University of Washington; PMEL, NOAA, Seattle, Washington; Oregon State University, Corvallis, Oregon. The University of Alaska or PMEL could respond most quickly.

4. Applicable Habitats:

Pelagic systems.

Lagoon systems.

5. Applicable Conditions:

Oil spill in open water area not in immediate contact with sediment or shore.

Presence of ice could complicate the study, and revised procedures would be needed.

6. Applicable Oil Type:

Any.

7. Time Frame:

For each individual spill, at least a series of samplings at weekly intervals for three weeks would be desirable, starting as soon as possible after the accident. If this would entail too long a period at sea, then alternatively a week or ten days of intensive work might suffice.

8. Cost:

The basic cost for this would be 1 senior scientist for one month and 1 technician for two months for each spill. The size

of the spill would not necessarily influence the cost greatly. This, with supplies and travel, would amount to a project of about $35,000 per spill, divided as follows:

Salaries and Wages	$11,500.00
Benefits	2,300.00
	$13,800.00
Supplies	$ 3,000.00
Travel	$ 5,000.00
Services	$ 2,000.00
Communications	$ 500.00
Overhead	$11,040.00

Total Project per spill..... $35,340.00
(costs estimated at University of Alaska levels)
plus ship time to be added to this.

9. Equipment Needs/Equipment Available:

Scintillation counter.

Niskin bottle string or rosette to Niskin bottles.

Deck ambient-light incubator.

Graded light incubator.

Turner designs fluorometer to flow-through capability.

Millipore filtration apparatus to pump.

Submersible pump.

Freezer on board ship.

10. Facility Needs/Facilities Available:

Ship with oceanographic facilities, i.e., winch for hydrocast. Normal laboratory with radioscopic facilities.

11. Personnel Needs/Personnel Available:

Personnel have been identified in the introductory portion of the report. Phone numbers can be supplied later. One senior and one support person is needed.

12. Support Services:

Hydrocarbon analyses of water column distribution, also of biological samples. Concurrent nutrient analyses of water samples. Physical oceanographic data.

13. Payoff:

Determination of impact on planktonic components.

14. Limitations:

PANEL: WATER COLUMN BIOLOGY
PROJECT NO: 2
PRIORITY RANK: 1b

1. Project Title: Net Sampling of Water Column for Oil Impact Assessment

2. Project Description:

The purpose of this project is to determine the effects of an oil spill on the components of the planktonic and nektonic populations which can be effectively sampled by net tows.

Sampling is to be done by mid-water trawl under the oil spill to see whether any nektonic components are present and whether they have been affected by the oil. It is possible that schools of fish which persist under spilled oil (for example, herring) may be affected in spite of the general avoidance response.

Net tows for zooplankton and ichthyoplankton should be carried out, with a vertical tow at each station selected for Project No. 1. Populations will be examined for oil ingestion and oil content, and species composition and biomass will be determined. Shipboard operations will involve primarily preservation of samples. Bongo net sampling should also be done - sampling suggestions: standard sampling methods should be used.

3. Performing Organizations:

Possible performing organizations include the National Marine Fisheries Laboratory at Auke Bay, Alaska; PMEL, Seattle; Institute of Marine Sciences, University of Alaska, Fairbanks; Department of Oceanography, University of Washington, Seattle, Washington.

4. Applicable Habitats:

Pelagic systems - offshore and nearshore.

Lagoon systems would require a modified application and sampling.

5. Applicable Conditions:

Oil spill in open water area not in immediate contact with sediment or shore.

6. Applicable Oil Type:

Any.

7. Time Frame:

8. Cost:

About $35,000 for a single spill. Slightly increased for a large spill.

9. Equipment Needs/Equipment Available:

Nets for zooplankton and ichthyplankton sampling.

Formalin, jars.

Microscopes.

Trawls.

Sorting screens.

10. Facility Needs/Facilities Available:

See Project No. 1.

11. Personnel Needs/Personnel Available:

See Project No. 1.

12. Support Services:

See Project No. 1.

13. Payoff:

See Project No. 1.

14. Limitations:

PANEL: WATER COLUMN BIOLOGY
PROJECT NO: 3
PRIORITY RANK: 2

1. Project Title: Effects of Oil Spills on Resident Fish Communities

2. Project Description:

A. Determine hydrocarbon in resident species in and near site of spill.

B. Determine impacts of the spill on the resident species.

- Short-term possible studies include:

  - Instant mortality
  - Depuration rates (?)
  - Enzyme activity
  - Histopathology
  - Behavior analysis
  - Stamina testing and respiration rates
  - Tainting

- Long-term possible studies include:

  - Fecundity (eggs/gm/gravid female)
  - Behavior (avoidance included)
  - Stamina testing
  - Histopathology
  - Recruitment (sex ratios)
  - Condition coefficient gut analysis - respiration rates
  - Tainting

3. Performing Organizations:

NOAA/NMFS Laboratory, Auke Bay

University of Alaska, Institute of Marine Science

Department of Environmental Conservation

National Marine Fisheries Laboratory

Kodiak, Alaska Fisheries Research Institute

University of Washington

4. Applicable Habitats:

Pelagic and benthic resident fishes to the continental shelf.

5. Applicable Conditions:

Major spills per lead agency definition and safe sampling conditions.

6. Applicable Oil Type:

Any oil type except those of low flash points that would subject field crew to unnecessary hazards from inhalation or fire.

7. Time Frame:

Duration of the study depends on the conditions.

8. Cost:

$50,000 - 100,000 plus ship time depending on duration and location.

9. Equipment Needs/Equipment Available:

Standard sampling equipment.

10. Facility Needs/Facilities Available:

Ship with trawling capability.

Appropriate laboratory facilities.

11. Personnel Needs/Personnel Available:

12. Support Services:

A. Horizontal and vertical distribution of oil.

B. Oil analysis support.

C. Communications (mobile).

D. Freezer and shipping support.

E. Interaction with other activities and disciplines associated with that oil spill.

13. Payoff:

With a well coordinated interdisciplinary program, this project could assess the total impact of an oil spill on resident fish populations. Loss of resident fish populations may affect distribution and availability of migratory species. Total factors could have adverse local economic impacts.

14. Limitations:

It is difficult to determine whether detectable alterations to fish populations in the vicinity of an oil spill are related directly to that event.

MARINE BIRDS AND MAMMALS PANEL

Participants

J. Burns, Chairperson

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P. D. Arneson
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MARINE BIRDS AND MAMMALS PANEL

General Information and Guidance

- General Statement
- Objective 2: Damage Assessment - Birds
- Objective 2: Damage Assessment - Mammals

GENERAL STATEMENT

The marine bird and mammal panel was severely handicapped by several factors. First, the panel was small and the areas of expertise of its members did not cover all aspects that should be considered. For example, only one individual with marine mammal experience, none of which was in the Arctic, was present. Second, none of the members including the chairman received background material in time to make any preparations for the meeting. Highly qualified individuals with expertise in most important areas are available and they have a reasonably good body of information that could be used to develop at least an interim plan that would meet the three main objectives. Unfortunately, all of these resources were not available to the panel. Third, even if the panel membership had been more balanced and all of its members prepared, the format of the workshop would have limited the quality of the final product. Many of the questions asked of the panel can only be answered to a useful degree through a systematic review of existing information. Several agencies have spent years attempting to draw this information together.

Therefore, the panel does not feel that the material it produced is in any way complete. The workshop was in effect a planning effort and a very important one. The objectives presented to the workshop were well thought out. It is important that the final response plan be carefully prepared. This will require input from many more individuals to correct the very obvious deficiencies in this panel's efforts.

Several points were not specifically addressed by the panel but should be considered in the final plan:

(1) Fresh Water - The panel did not address inland impacts at all. Some of the comments made would apply to freshwater as well as marine incidents, however.

(2) Terrestrial Mammals - Several species of terrestrial mammals, including deer, bears, and some furbearers, may be

impacted, perhaps severely, by oil spills in the marine environment. Such a problem could be especially acute during the winter when these animals may be compelled to feed along beaches. These species should be addressed in the final plan.

(3) Organizational Structure - The panel avoided the area of agency responsibilities and lines of communication. It appears that many agencies have or are developing their own response plans. However, there appears to be little coordination between agencies especially outside of these federal agencies with very specific statutory responsibility. Cooperative agreements need to be worked out ahead of time to facilitate access to agency and privately administered land and the use of on-site facilities and equipment. Efficient use of available expertise requires better coordination between all agencies and in some cases academic and private institutions. The panel has presented one suggested chain of communication to assist the On-Scene Coordinator. A more formalized plan for interagency coordination, preferably with a simple structure, should be developed and included in the plan.

(4) Permits - A variety of specialized permits, both state and federal, are required to conduct some of the activities that will be conducted during an oil spill. In some cases, such as those required under the Marine Mammal Protection Act and the Endangered Species Act, these permits are difficult to obtain. The necessary permits should be identified and issued prior to attempts to evaluate the effects of an oil spill. The permit holders should be identified.

OBJECTIVE 2: GENERAL PROCEDURE FOR ASSESSING DAMAGE TO BIRDS

The Proceedings of the Montauk, L. I. Workshop, February 24-26, 1976, have been modified to accommodate Alaska conditions. Some of the general conclusions may not be appropriate for Alaska, and further revisions to this draft are necessary.

A. Introduction

The effects of oil on avifauna, especially pelagic seabirds,* has been the subject of numerous papers during the last four decades. From this literature, several conclusions can be drawn for the purposes of impact assessment:

*Although emphasis is placed on pelagic marine species; birds frequenting salt, brackish, and river environments are considered.

(1) Seabirds in general are: long-lived; have a very low reproductive potential, are often geographically isolated from man and predators (thus requiring a low level of annual replacement); disperse widely at sea; nest in colonies along the coast or on islands; frequently concentrate in huge flocks seasonally; are very vulnerable to major spills; and require long periods to recover from a severe population depletion (Nisbet, 1975; Reiger, 1975).

(2) Limited information is available on the abundance, distribution, and movements of most seabirds. Their distribution is related to the availability of suitable breeding sites and the distribution of food species (Croxall, 1975).

(3) Pelagic birds are usually associated with the distribution of major fisheries and the extent of the continental shelf (Nisbet, 1975). As a rule, populations are highest on the continental shelf, but many cold-water seabirds are common in areas where there is no fishery (e.g., the Arctic).

(4) Seabird populations exhibit both short-term and long-term fluctuations. Many man-made changes result in short-term perturbations which do not quickly change total population size, but reveal themselves through changes in first year survival rates or the number of young raised.

(5) Oil tends to have a disproportionate impact on specialized swimming species such as alcids, loons, grebes, and sea ducks. Rare, endemic, and high-risk species, however, could become endangered - especially from chronic oil discharges at sea or from spills affecting a population already stressed by ecological factors (Bourne, 1976b).

(6) Small fragmented populations of birds on the edge of their range or utilizing marginal resources in an area are especially susceptible to decimation from a spill or damage to their habitat (Croxall, 1975).

(7) Losses of both coastal seabirds and waterfowl from oil spills have been highest during the winter months when the species are abundant along coastal areas and concentrated on wintering grounds south of Alaska (Tuck, 1960; Erickson, 1963; Bourne, 1976b). In Alaska, spring and fall migrations result in massive concentrations for short periods at specific sites, i.e., Izembek Lagoon, Copper River Delta. Therefore, an inherent threat from oil spills to large populations of birds exists within small areas, and must be accommodated in contingency planning.

(8) Bird losses are not directly related to the volume of oil lost. Some large spills have produced only a relatively few deaths whereas smaller slicks have resulted in thousands of mortalities (Croxall, 1975).

B. Essential Information for Assessing Impact

(1) Historical data on the distribution, abundance, and behavior of a species in the region.

(2) Mortality data resulting from the spill, initial and secondary, including direct mortality and deleterious results from ingesting oil, contamination of food, eggs, and young on the species productivity and effects of oiled habitat, e.g., staging areas.

The accuracy of results is totally predicated on the existence of baseline information and the soundness of data collected. Initial mortality figures can be obtained by surveys, but secondary or delayed mortality may be considerable and involve a long period to assess accurately.

There is no "best method" for the collection and analysis of historical and mortality data. Techniques will vary with the amount and kind of oil and existing geographical and ecological conditions.

C. Historical Data on Distribution and Abundance

Distribution, abundance, and natural yearly fluctuation data for a species is essential for accurate assessments. Losses of an abundant species or a population with a broad distribution may be spectacular, but biologically insignificant in contrast to the effect on relatively small numbers of some species that inhabit restricted geographic areas.

D. Mortality Evaluation

(1) Factors Determining the Type and Extent of Impact

(a) Geographical Location

Experience indicates that the principal impact on birds occurs during the early stages of an oil spill, before the oil is reduced to a tarry residue. Direct effects of oil on wildlife usually occurs on the water before the oil comes ashore. Action must be taken as quickly as possible to assess the situation, initiate preventive efforts, and

census species in the area, including the number oiled (live and dead) and unoiled to establish populations at risk. Action and protective attention must be directed to nesting, feeding, or roosting areas, sanctuaries, and bird concentrations. Every effort also must be made to avoid disturbing nesting birds.

Monitoring mortality requires prompt and continuous action, because birds may be removed by rescue volunteers who may not keep records. The carcasses may also sink or become buried in sand or weeds on shore or be carried away by predators or tides, winds, and currents. Collections must be made for analysis and evidence.

- Open Sea and Continental Shelf

  Two critical factors in an open sea spill are its distance from bird concentrations and prevailing winds and currents. Large concentrations of birds are very local. The oil must be tracked in order to predict where and when oil may reach sensitive coastal areas inhabited by high bird numbers. Surveys by aircraft or ship to record the presence or birds and their status are recommended. Continental shelf waters are often important to gannets and alcids in the northern hemisphere and penguins in the south. Fulmars and shearwaters tend to range over the edge of the shelf.

- Coastal

  The coastal zone is inhabited by large concentrations of many bird species at certain times of the year. Surveillance by aircraft and/or ship is required. Location of birds and vulnerable habitat should be identified. Shoreline surveys should be initiated in the immediate area of any slick before it arrives to establish baseline data.

- Estuaries and Embayments

  Large numbers of birds may concentrate in estuaries or embayments, and surveillance is required. This may be especially important during periods of migration, brood rearing and, in some areas, during the winter. Preventive measures in these areas may be useful in reducing exposure of the birds to the oil or moving them out of its path. Movements of both oil and birds with the tide must be considered.

- Rivers

  Many rivers provide wintering habitat for migratory waterfowl and heavy concentrations of ducks and geese are not unusual. River spills can rapidly foul such birds and cause severe losses. Speed is essential to repel birds ahead of the slick and to employ booms if practical. The breakup of ice dams and excessive flood plain inundation could seriously hamper assessment or rehabilitation measures. Accurate appraisal of mortality differs due to the rapidity with which carcasses or oil-fouled birds are swept downstream. Shoreline surveys are necessary since many birds will seek the shore when oiled.

(b) Type of Oil

Light oils, such as diesel fuel, are usually less damaging to birds than the heavier Bunker C and crudes. Such oils are usually involved in smaller spills and dissipate by dissolution and evaporation before they can affect a large number of birds. The rate of dissipation of J P-S and other kerosene-type fuels remains in question in colder arctic and subarctic waters. Heavy seas are believed to contribute to the rapid disappearance of slicks of light oil. Heavy oils are more persistent and "tarry" and remain a threat over a longer period, particularly in cold waters. At higher temperatures, the volatile elements in heavy oil soon evaporate and dissolve and the residue forms solid lumps or "tar balls" which are less harmful to birds. Most serious spills, to date, have involved Bunker C and crude oils.

(c) Seasonal Distribution of Birds

A substantial body of information exists on the abundance of migrating waterfowl throughout the year. Historical data on band returns from game species and routine waterfowl surveys are available dating back many decades. More recently additional surveys have been initiated on the seasonal abundance and distribution of non-game aquatic birds. Such information, periodically updated, may be useful in contingency planning. General comments on seasonal distribution follow:

- Winter

  During winter, many species concentrate at lower latitudes in coastal environments, estuaries, lakes, and rivers, bays and often close to industrial areas and shipping lanes.

- Spring and Fall Migration

  Dense populations of migratory species routinely gather at staging areas or migration stops along the coast or on inland waters and marshes. (Cite examples here.) A spill in such a location could directly affect large numbers of birds immediately and over a period of time as migrants move through. Further, as a result of exposure to oil, delayed physiological changes could adversely affect significant numbers of birds throughout their range.

- Breeding Season

  Some birds are especially vulnerable to oil during their breeding season. Oil can affect reproductive success. Pelagic species concentrate at coastal and island breeding sites and feed and rest in waters adjacent to these nesting grounds or scores of miles from their breeding colonies. Of particular concern are the hundreds of pelagic bird colonies in the Western Gulf of Alaska and Peninsula region, and the thousands of square miles of oceanic feeding areas associated with those colonies. Unnecessary disturbance of nesting colonies by any means, including oil spill cleanup operations, could cause more harm than oil (Bourne, 1976a).

- Late Summer

  The adults of many species are moulting and young are still learning to fend for themselves. Flightless chicks often swim with adults to feeding grounds and would be vulnerable to spills. Auks, loons, grebes, ducks, geese, and swans are flightless while they are renewing their wing feathers, thus making them particularly susceptible to oil. Cormorants do not become flightless during moult.

(d) Susceptibility of Species

Habitat preferences and social behavior of species increase or decrease their relative susceptibility to oil contamination. Theoretically, species at greatest risk should be those that are social and congregate in flocks during the breeding season and on the wintering grounds and those that frequent offshore waters and/or migrate near busy shipping lanes. Endemic species, limited to small areas are particularly vulnerable, as well as species near the edge of their range or utilizing marginal resources. A general ranking of those groups of birds that have been affected by oil spills, starting with those of greatest susceptibility is: (1) alcids, grebes, loons, pelicans, sea ducks (eiders, scoters), cormorants, puffins, and swans; (2) geese, ducks, shore birds; (3) gulls, terns, cranes, and herons (Bourne, 1968; Clark, 1969; Croxall, 1975; Nelson-Smith, 1970; Stanton, 1975).

(2) Assessing Mortality

(a) Aerial Surveys

A light, high-winged airplane and helicopter is best for reconnaissance purposes. Aircraft speed should be less than 150 mph and, for most purposes, preferably about 100 mph, thus giving preference to helicopters. Usual altitudes are from 100 to 500 feet, depending on environmental conditions and survey intent. Surveyors should avoid approaching too close to large bird concentrations such as breeding colonies. Unnecessary disturbance must be avoided at all times.

The observer should be a knowledgeable ornithologist in order to properly identify species and record behavioral characteristics and other pertinent observations. Accurate records must be kept at all times. Also, utilize a tape recorder and detailed maps. For a particular survey or transect flight, time, speed of aircraft, location of birds, their condition, species involved, and any abnormal behavior and weather and sea state should be recorded.

It is also prudent to take advantage of opportunities to record biological observations although they may not appear related to an oil spill.

Some species are very difficult to spot from the air and in such cases, infrared photography may prove useful.

(b) Surveys by Ship

Ship surveys can be useful in obtaining estimates of the effect of oil at sea, but it is difficult to cover large areas in a short period. Data may be obtained on species numbers and distribution, and proportions of live, dead, oiled, and clean birds.

Ship surveys are usually conducted along transects chosen as representative of conditions over a wide area. The distance between transects will depend upon the distance the birds are visible in either direction from the prow of the ship. Corpses are seldom visible beyond 1/3 of the distance one can see live birds. Binoculars (8 x 40) are most useful. Bird numbers may be recorded by locations, distance, intervals traveled, or by time interval. If times and locations are recorded carefully, the results are interchangeable. The best method will depend upon weather conditions, the abundance of birds, the location of the spill, and logistical factors. Mortality calculations from such sampling can be extrapolated over a much larger area and combined with or used to verify estimates made by other survey methods (Jones et al., 1970).

From a ship it may be possible to observe the degree of contamination of birds and their behavioral responses; this may not be evident from the air. Weather conditions and sea state are major impediments.

(c) Ground Surveys

Shoreline or beach surveys can be conducted by aircraft or boat, and often are the only practical method for surveying large wetlands. However, the best method for obtaining quantitative data is to walk the length of shoreline that may contain oiled birds. An advantage of ground surveys is that accurate species identification is possible along with other observations and specimens can be obtained for analysis. Oiled birds frequently seek the shelter of vegetation or rocks to hide and may be difficult to locate. Carcasses also may wash into marsh grass and not be found except from a boat or by wading.

Many factors influence the rate at which carcasses are washed ashore. They include wind direction and velocity, currents, degree of oiling, species, size, and magnitude of predation. Some sink before reaching shore and, thus, the extent of loss cannot be actually determined by those that are found ashore (Clark and Kennedy, 1968; Tanis and Morzer Bruijns, 1968). (See Appendix A for Standard Report Form for Shoreline Bird Surveys.)

(d) Habitat Surveys

During aerial and ground surveys, photograph and record habitat conditions. Follow-up studies should be planned to investigate suspected or potential habitat degradation. Environmental alterations such as the destruction of marsh vegetation may require long-term monitoring.

(d) Volunteer Rescue Efforts

Citizens with strong humanitarian motives will spontaneously collect oiled birds as soon as they come ashore. They should be informed via radio or TV where bird reception centers are located. Records should be obtained from the volunteers as to where and when they found the birds. A wing should be taken from each bird that dies with details of its origin and history.

(3) Interpretation of Data

Spill data are to be collected for comparison with historical and pre-spill abundance figures in order to arrive at a partial determination of the impact. However, it may never by possible to accurately quantify the effects that actually result from a particular level of contamination on a particular population of birds. In most situations, reported information on bird mortality is often only an educated guess.

On the open sea and over the continental shelf where oiled birds may not reach shore, the kill might be estimated by pre-spill counts or transect surveys. With that information, and a reasonable knowledge of the surface area affected, a minimum kill can be estimated.

In coastal and inland locations, oiled birds will usually reach the shoreline, and fairly accurate counts made. Bird

numbers on or near the shore will provide only a minimum kill figure. Since it is not always possible to conduct counts along an entire affected coastline, representative portions of shoreline (such as a 1-mile length) can be surveyed and the counts extrapolated to estimate a minimum mortality. Allowances must be made for birds washed out to sea, dispersion by flying, or swimming, and those so covered by oil as to be barely visible or completely invisible.

(4) Collecting Specimens

The following carcasses should be carefully labeled and retained for study: (1) all banded birds; (2) rare species; (3) birds with unusual plumage or moult; (4) representative carcasses of different species that are in a good state of preservation. (As an alternate to collecting the whole carcass, the right wing may be clipped and retained.)

An adequate sample of representative carcasses should be autopsied. Additional information may be obtained on parasites, stomach contents, degree of oil in the digestive tract, etc.

(5) Bird Corpse Drift Experiments

If the opportunity arises, it may be useful to collect bird carcasses exhibiting varying degrees of oiling, record that information bank, tag or spray paint them, and release the bodies at the spill source along its track or at the site of mortality (Jones et al., 1970). This may aid in determining the proportion of bodies lost compared to the number washed ashore, the locations of recovery, and the rate at which the bird carcasses traveled in the sea in relation to winds, curents and tides. The procedure requires the release of a minimum of 100 tagged carcasses in different situations and weather conditions. This can be very time-consuming.

Generally, it has been found that oil moves with the wind at three or four percent of the latter's velocity and that dead birds travel more slowly than the floating oil, depending upon their size.

(6) Measures to be Used in Dealing with the Fouling of Marine Birds

Cleanup of oiled birds has immense popular appeal; however, it is rarely effective in mitigating the impact of an oil spill on a population. Even when experienced workers with good facilities and easy access to the impacted area are employed, only small numbers of birds have been successfully rehabilitated. The majority of birds caught are beyond help and the cleaning procedure is such that even the most elaborate facilities cannot handle the thousands of birds that might be oiled - much less feed or hold them. In Alaska, poor access to most potential spill areas and a lack of facilities make it highly unlikely that an effective cleaning effort could be mounted. In fact, the effort could be detrimental where it tied up logistic support or created additional disturbance.

A decision to clean should be based upon the rarity of the species, number involved, physical limitation of cleaning stations, availability of labor and expertise, the ability to transport oiled birds to the stations, the likelihood of survival and release, and whether or not it would be more humane to destroy certain oiled birds.

(7) Dispersal and Deterrent Techniques

Efforts should be made to keep birds from getting oiled. Birds inhabiting an area threatened by oil or simply migrating through may be persuaded to leave if persistently disturbed by noise or movement. This is especially effective if used on birds in ice leads or where they are confined to open water in broken ice cover. Helicopters or boats may serve that purpose as well as numerous audio techniques such as carbide guns, strobe lights, shell crackers, and specially designed, commercially available alarm systems.

Birds usually will leave only if they have another suitable place to go. Migrants, however, may move on permanently. Alternate sites can be made more attractive by supplying abundant food and keeping disturbance there to a minimum.

APPENDIX

REPORT FORM FOR SHORELINE BIRD SURVEYS

1. Observer's name and address

2. Area covered - start, finish, distance traveled (maps of area traversed)

3. Time and date

4. Weather conditions (visibility, winds, tides, etc.)

5. Amount of oil present along shoreline and its physical state and location

6. Number of live oiled birds encountered

7. Number of live oiled birds captured for cleaning (applicability will vary)

8. Number of dead oiled birds

9. Number of dead birds collected, buried, etc.

10. For live and dead birds record

    Degree of oiling - (a) clean (no visible oil on plumage)

    (b) slight (small patches up to 1/4 of bird)

    (c) moderate (up to 1/2 of plumage)

    (d) heavy (more than 1/2 of plumage)

    Location of oil on bird (oil only on the breast indicates contact while swimming; oil on the chin indicates preening)

    Species
    Age
    Sex
    Plumage characteristics such as moulting
    Record whether carcass or a wing was retained

11. Other organisms, their names, locations, and numerical abundance.

OBJECTIVE 2: GENERAL PROCEDURE FOR ASSESSING DAMAGE TO MARINE MAMMALS

A. Introduction

The impact of oil pollution on marine mammals is a subject of much conjecture, but little documented information. Existing knowledge is from a scattering of observations of a few oiled animals. No information exists on the effects of petroleum on whales and dolphins, and there is no record of any of these having died directly from the effects of spilled oil. There is very limited experimental data on the effects of oil on mammals (Smith and Geraci, 1975).

Evidence to date contends that an oil spill never has severely affected a marine mammal population, but resident colonies of certain species could be highly vulnerable. Several observations have been made:

- Sea mammals have a notable ability to avoid petroleum pollution (Kenyon, 1974).

- Grey and fur seals and sea lions have frequently been observed near major spill areas, but do not become contaminated. Deliberate avoidance may be involved (Baker, 1976; Mansfield, 1970).

- Fur seals in the open sea rarely come in contact with petroleum products, although contamination may occur when they enter busy shipping lanes.

- There is no record of a fur seal on the Pribilof Islands, where 40-50,000 are taken annually, having oil or tar in its pelage. The absence of fur seals contaminated by oil on breeding grounds suggests that either the oiled animal did not survive to return to the grounds, that none became contaminated during migration, or that they cleansed themselves en route. Although large numbers of hair seals have come into contact with oil, no mortalities were observed (Morris, 1970; Hess and Trobaugh, 1970; Muller-Willie, 1974).

- Mortalities have been reported in seals contaminated by Bunker C or fuel oil, but the report did not indicate that the mortality was definitely linked to contact with oil.

- Sea otters could be threatened by a major spill, and would die if contaminated.

- Fur seals are insulated by both a layer of blubber and dense underfur. Otters have no insulating blubber layer and depend upon an air blanket trapped in their dense underfur for protection. Oil causes the fur to mat, destroying its water repellency and natural insulation and death through exposure would quickly follow (Kenyon, 1974).

- Elephant seals contaminated by crude oil in the 1969 Santa Barbara spill evidenced no significant immediate nor long-term (1-15 months later) deleterious effects on their health and no oil-related deaths were reported. The studies included postmortems and biochemical tests. No mortality among seals, sea lions, or cetaceans was found that appeared abnormal or could be attributed to the Santa Barbara oil spill (LeBoeuf, 1974; Brownell and LeBoeuf, 1971; Simpson and Gilmartin, 1970).

- Data on seal mortality from all causes is very limited because fur seals usually occur well offshore and the animal's body is heavier then water and would tend to sink rather then wash ashore (Kenyon, 1974).

- The effects of a massive oil spill on a specific colony of marine mammals would vary with the species, season of the year, the amount and kind of oil, and the duration of the spill.

- The effect of spills on marine mammals in ice dominated Arctic conditions is largely unknown. Cetaceans, for example, may encounter oil in confined leads where their options for avoidance are restricted. Oil from a spill circulated under the ice in the early spring could have catastrophic effects on the seals of that area (Pimlott, 1974).

- Experimental oil contamination studies on harp and ringed seals in Canada concluded that: offshore oil pollution could adversely affect the ringed seal population of th Beaufort Sea; 24-hour exposure to crude oil does not cause permanent damage to healthy animals; seals are apparently able to cleanse themselves by swimming; ingestion of up to 25 ml of crude oil proved to have no deleterious effects; vulnerability of ringed seals to oil is a function of exposure time and is magnified by the additional stress of moulting; unfavorable climatic conditions resulting in low food production could further complicate the effects of oil by selectively affecting the stressed seals in poor nutritional conditions; oil fouling did not cause any mechanical damage such as stocking of the flippers or plugging of the body openings; body

temperatures of oiled seals showed no trends indicating increased thermal stress; eye irritation was the most significant physical finding, but it subsided soon after the seals were returned to clean water, although prolonged contact would likely result in permanent eye disorders. Pre-weaned seals (2 months old and under) inhabiting subnivean birth lairs will be more susceptible to the thermal effects of oil than post-weaned seals which rely on blubber rather than hair for insulation. Oil fouling during the birthing and nursing months of April-June may have a serious effect on that age class (Geraci and Smith, 1976; Smith and Stirling, 1975).

B. Impact Assessment

Accurate assessment of impact from an oil spill depends upon valid historical population data for comparison with mortality figures from the spill. In Alaskan waters, baseline surveys have been and are currently being conducted. However, the magnitude of the Alaska coastline and interior precludes a data base for many regions.

Since few species of marine mammals are still harvested, their population dynamics cannot be studied in the classical resource management sense. Where capture or whaling data are available, it is of very limited use for determinng possible petroleum/marine mammal interactions (Hester, 1974).

As a more sophisticated technology is developed in aerial censusing, more accurate population counts will be possible. Severe mortality to a sea otter population, for example, could easily be evaluated, but the difficulties of accurately assessing impacts to marine mammals in the open ocean are virtually insurmountable at the present time.

With the limited knowledge we possess today on the effects of oil on marine mammals, we can conclude that: (1) oil pollution has not been a major source of mortality to marine mammal populations; (2) local populations of sea otters, and to a lesser degree, fur seals, and polar bears would be highly vulnerable to a major spill; (3) prolonged contact with oil could cause severe eye disorders and physiological complications with adult seals and have a serious impact on the young; (4) the lack of detailed population data on most marine mammals precludes an accurate basis for mortality assessment and impact evaluation.

C. Measures to be Considered in Dealing with the Oiling of Marine Mammals

Prospects of teating oiled marine mammals are even poorer. Of all the species, probably only sea otters would be found along beaches

in large numbers. The facilities needed to handle even a small number of sea otters would be extremely costly and even when techniques for cleaning sea otters are developed they will probably be no more effective than those presently used for birds.

Oiled cetaceans and pinnipeds are not likely to occur where they can be easily captured. Possible exceptions are fur seals in the Pribilof Islands and pup pinipeds in other areas. A concentrated effort to capture oiled pup seals and sea lions would probably cause more pups to die through induced abandonment than would through the effects of oil.

Therefore, cleaning of oiled wildlife would be extremely costly in Alaska and seldom would benefit a population significantly. However, it should be recognized that it is an activity that the public will expect at least in populated areas. The panel recommends that an extensive commitment of funds, logistic support or manpower to this activity not be made except in the case of endangered species or where public demand warrants a cosmetic effort.

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MARINE BIRDS AND MAMMALS PANEL

Recommended Projects

1. Aerial and shipboard surveys on bird populations in areas of offshore oil spills.

2. Breeding bird population and productivity studies to monitor the effects of oil at sea in relationship to colonial nesting birds.

3. Marine bird and mammal mortality assessment.

4. Effectiveness of avian scare device techniques in repelling marine birds from an oil spill area.

5. Bird mortality during spring migration (Beaufort and Chukchi Sea) in relation to ice conditions (from Ward and Tull, 1977).

6. Mortality and moulting sea ducks in the Beaufort Sea (from Ward and Tull, 1975).

7. Effects of oil spills on birds of the Arctic coastal flood plain in the Chukchi/Beaufort Seas.

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 1
PRIORITY RANK: 1

1. Project Title: Aerial and Shipboard Surveys of Bird Populations in Area of Offshore Oil Spill

2. Project Description:

A. Objective:

Determine species composition, density, and distribution of marine bird and mammal populations in area of oil spill, and the proportion of each marine bird and mammal species which is visibly contaminated with oil.

B. Procedure:

By aerial surveillance the species composition, density, and distribution of bird populations in the area of the spill will be estimated using a fixed-wing aircraft flown over a pre-selected grid to randomly sample bird populations present on contaminated and adjacent areas. This technique involves using 2 observers and one recorder (in addition to the pilot) in a twin-engine hi-wing aircraft flown at 100 feet above sea level at 120 mph. A 100m transect the distance determined using GNS-500. Densities (birds/km^2) will be extrapolated using species abundances per area sampled. (This technique is being utilized by the USFWS - OBS/CE, 800 A St., Suite 110, Anchorage, AK 99501 - Project Leader - Calvin Lensink.)

Determine percent of each species visibly contaminated with oil from shipboard surveys by using 10-minute counts of total numbers of each bird species within sight of the ship (Reference: BLM/NOAA OCSEAP Research Unit 337, Seasonal distribution and abundance of Marine Birds in Alaskan Marine Waters Contact: Lensink, USFWS, 800 A. Street, Suite 110. Anchorage, AK. Specific formats for sampling and compilation of data on computerized data sheets are discussed in the references above. Behavioral response of marine birds and mammals to oil slicks and notes on the degrees (i.e., light, medium, or heavily oiled) of plumage contamination and areas of body affected (i.e., nape of neck, breast, belly, etc.,) will be recorded in the 10-minute count format.

When oil approached the coast, shoreline aerial surveys will be conducted both on exposed coast and in embayments. Shoreline flights and/or total counts will be conducted in path of the proposed trajectory of oil spills. At that time shoreline ground counts could also be conducted.

Utilizing density estimates determined from aerial surveillance and percents of specific populations visibly contaminated from concurrent shipboard surveys, estimates of immediate direct damage to bird populations can be made.

3. Performing Organization:

U.S. Fish and Wildlife Service, OBS-CE, Anchorage, AK (Contact: C. J. Lensink ([907]265-5401) and Alaska Department of Fish and Game, Anchorage, AK (Contact: P. Arneson [907]344-0591). These organizations presently have the capability, experience and available manpower to perform such a study.

4. Applicable Habitats:

All offshore and near shore habitats.

5. Applicable Conditions:

Presence of bird populations in area of spill. The only conditions necessary for completion of study are the use of aircraft and surface vessels able to contend with weather/climate and geographical conditions. Ecological conditions with the bird component of the ecosystem are strictly limited to ocean surface and air strata. An organization like Manomet Bird Observatory can presently supply trained manpower to meet study requirements with internal funds for one week. Equipment such as aircraft and surface vessels must be supplied.

6. Applicable Oil Type:

Any oil type or group of oils.

7. Time Frame:

Inclusive period of short-term assessment requires period from oil spill to one month after spill has visibly dissipated and can no longer be traced by air. Daily to weekly surveillance flights depending on season of year will be necessary. One-week sampling periods per month from shipboard surveys will be necessary. Depending upon size of spill more than one survey ship

may be necessary. Sample work-up and data analysis requires an additional 2 months per year. Note: This time frame does not consider any long-term effects.

8. Cost:

A. Aircraft - $400/hour in Alaska per day.

B. Surface vessels - range $500 - $3000 per day, 7-10 days on study area per vessel desired.

C. Personnel:

(1) Aircraft - 2 observers and 1 recorder per flight.

(2) Surface vessels - 2 observers.

Extra cost of Manomet Bird Observatory observer = $100 per day (includes salary ($12K/year) and 57% overhead) - does not include travel and per diem costs.

D. Equipment:

May sometimes be provided by certain institutions or agencies, but for this project proposal it is assumed that the NRT will provide necessary equipment.

(1) Photographic - $2000 per kit. One kit includes: SLR 35-mm camera with motor drive and data back; 200-400 mm zoom lens with gunstock mount; 10 rolls @ 36 exp Tri-X film; 10 rolls @ 36 exp. Pus-X film. (One kit per aircraft and surface vessel needed).

(2) Cassette tape recorders @ $75 (2 recorders per aircraft (back-up necessary) and surface vessel needed).

(3) Optics - 1 pair 8 x 40 WA binoculars @ $75 (1 pair per observer needed).

(4) Film processing - grossly estimated at $1000.

E. Automatic data processing, if necessary, Key punch and statistician's time grossly estimated at $1500 for a spill of similar size and duration as Argo Merchant incident.

F. Phone, Xerox, etc., costs (if University based study) grossly estimated at $500.

G. Principal investigator: Salary range, $15 - $25K per year. Mean - $20K per year. Daily consultant rates based on USFWS scale = $\frac{\text{salary per year}}{260}$ Daily pay rate = $77 per day.

Based on one month duration spill and three months, data analysis and report writing - 4 month with 20 working days per month = 80 days.

$77 x 80 = $6160 total P.I. salary.

P.I. at 33% of time for 4 months = $2033.

9. Equipment Needs/Equipment Available:

A. This project is largely observation oriented, little equipment will be required beyond optical and recording materials. One kit with the following materials will be required for each crew (aircraft or ship):

(1) single lens reflex camera with data back and motor drive unit;

(2) 200-400m 200m lens w/gunstock attachment;

(3) cassette tape recorder with tapes; and

(4) 8X40 binoculars.

B. All these materials are potentially available through the appointed institutions, but are not guaranteed to be accessible at the moment of a spill. Therefore, kits should be prepared in advance.

10. Facility Needs/Facilities Available:
Facility needs involve aircraft and ship transport:

A. Aircraft - hi-wing, 2 engine, float equipped preferred, VFR/IFR, deicing, communications, and navigational capability appropriate to pelagic survey, room for two observers, recorder, and pilot suggest USDI, OAS Super Godse, N-780 with GNS-500.

B. Surface Vessels - from 1-3 vessels of similar design or observational capability, range and construction suitable to open ocean work in poor sea conditions for 10 day minimum (port to port); location electronics equal to Loran A or better; VHF radio with sea-air, sea-sea, sea-land capability;

lifeboat or skiff with capability in cabin to moderate seas; berth for 1-2 observers.

11. Personnel Needs/Personnel Available:
Discussed in parts 3 and 8(C).

The principal investigator and associates chosen from list of performing organizations will delegate staff for the project.

12. Support Services:

A. Relevant long-term and cause-and-effect studies can be associated with and after this study. Baseline data necessary for background and more accurate ecological assessments are discussed in part $14 (Limitations).

13. Payoff:

A. The study will provide capability to clearly respond to public sentiment regarding impact on bird populations. More specifically, it addresses:

(1) estimates of direct mortality per bird and marine mammal species at spill site;

(2) probable estimates of indirect mortality due to spill;

(3) estimates of bird and mammal populations in spill area;

(4) behavioral response of marine birds and mammals to oil slicks; and

(5) limitations in estimating long term or more accurate assessments are discussed in part $14 (Limitations).

14. Limitations:

A. Our capability to assess environmental damage to marine bird populations associated with these spills is dependent on necessary baseline information.

B. These populations are highly mobile. Even with the best baseline data present capabilities can provide, statistically significant measurements ($P < .05$) may not be possible.

C. Weather and sea state may severely disrupt the effectiveness of the project.

D. Initial counts of direct mortality at spill site may be misleading. Oiled birds may die thousands of miles away, may sink before being counted, may float out to sea unobserved (opposed to washing ashore). They also may be more likely to be counted because of behavioral factors (flight and feeding characteristics; spending more time on water). All oiled birds may not be contaminated from same source.

E. Cost predictions listed for this study may not be considered feasible (e.g., aircraft and vessel costs) with available funds. Most of these high-cost facilities necessary, may be dovetailed with USCG operations and other research groups. However, the quality of data collected may be reduced. To what extent data quality will be impaired is unknown.

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 2
PRIORITY RANK: 2

1. Project Title: Breeding Bird Population and Productivity Studies to Monitor the Effects of Oil at Sea in Relationship to Colonial Nesting Birds

2. Project Description:

A. Background:

We feel impact assessment information may be most readily obtained by monitoring the breeding success of colonial nesting birds. This project should take advantage of past and current NOAA-OSCEAP studies. The Outer Continental Shelf Environmental Assessment Program has been actively pursuing a large number of marine/coastal bird studies covering a wide range of habitats and species (colonial seabirds, shorebirds, waterfowl) from the Gulf of Alaska to the Beaufort Sea. These studies have gathered a wide range of baseline information on species composition, numbers, distribution, productivity, and food habits; the data may be used for valuable comparative purposes. Some colonies, concentrations and habitats still require study - data gaps can be readily identified in most cases by reviewing past, present and on-going OCSEAP work.

The project is adapted from Project No. 2, Hartford Workshop and takes advantage of baseline information already acquired (and to be acquired in future years). A number of factors will help determine the scale and scope of the study. These include the timing and magnitude of the spill, direction of movement, ultimate fate, and its general location relative to bird concentrations. The thrust of this project in Alaska is aimed at determining and measuring significant changes in colonial bird numbers and productivity (including species composition) at sites such as seabird colonies in relationship to spilled oil. The project may specifically address two somewhat different problems either together or separately: 1) that of determining and documenting significant declines and changes in a population as a result of oil at sea after such a spill occurs in the immediate vicinity or area of the breeding bird concentration or in the wintering location; and 2) that of documenting and measuring the rate of recovery of a colony after a major perturbation in the

environment - i.e., a colony gets hit heavily and directly and is drastically reduced over a short time. As is implied, this project emphasizes the use of "spills of opportunity".

3. Performing Organizations:

Performed through a lead-coordinating agency - e.g., USFWS*, BLM, ADF&G. Such projects may be efficiently contracted out to various organizations, including institutions and private contractors. In the Alaskan Region many past and current NOAA-OCSEAP investigators and contractors would be available to form a body of expertise.

4. Applicable Habitats:

Offshore islands and mainlands, sandy beaches, sea cliffs, stacks and wherever colonial seabirds are found nesting, but particularly where some baseline data are available.

5. Applicable Conditions:

Successful completion would depend on availability of necessary manpower, operation platforms, equipment, and other logistical considerations. The scope of the project may be limiting to some extent in some areas, however, experience gained through NOAA-OCSEAP studies suggest it is feasible in most cases. Even though the accuracy of data generated will be limited principally by weather in some areas in some years, the NOAA-OCSEAP studies suggest that this will not necessarily be the overriding factor in the decision to initiate such a study.

The specific applicable condition that will determine when, where, and how such a project is initiated, will be the discharge of oil into the marine environment at or near a colony; at a location (down current for instance) that will bring the oil into the foraging range, etc., of the colony; or in a known or strongly suspected foraging area or wintering area/zone.

6. Applicable Oil Type:

All oil types from sea transport sources, shore based facilities, or exploration/production sites.

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*Preferred organization.

7. Time Frame:

After oil discharge a brief reconnaissance may determine that significant numbers of birds are missing from a colony. With this information in hand, Phase I is implemented. A brief reconnaissance may determine that numbers appear generally unchanged, but if oil has reached the vicinity of a colony or a significant foraging area, effects on productivity may be in question and Phase I is initiated for at least one year.

Phase I (immediate short-term evaluation):

A. Total scope of project: 2 years.

B. Annual scope of project:

(1) Field activities: 1 May - 1 October.

(2) Preparation: March - April.

(3) Data processing/analyses: October - December.

Phase II (follow-up evaluation):

A. Total scope of project: 3 to 8 years dependent on species and individual case.

B. Annual scope of project:

(1) *Field activities: occasional periods between 1 May and 1 October, with emphasis on July - August in more northern waters and June - July in more southern waters.

(2) *Preparation: March - April.

(3) *Data processing/analyses: October - December.

*Above effort does not imply full-scale continuous operation; necessary preparation, data gathering and analysis would be of much shorter term (specific monitoring efforts for certain data groups) within these time periods.

8. Cost:*

Variable from area to area and case by case. NOAA-OCSEAP projects (taking inflationary factors into consideration) can serve as general guidelines for reference at this time.

Initial recon estimated to vary in range of $2,000.00 to $5,000.00-8,000.00.

Phase I estimated to vary in the range of $30,000.00 to $100,000.00 per year (general estimate $50,000.00 - 70,000.00).

Phase II estimated to vary in the range of $10,000.00 to $40,000.00 per year (general estimate $20,000.00 - 30,000.00).

Logistics would be an important portion of some budgets (aircraft use including light twin fixed-wing, single engine fixed-wing, light and occasional heavier helicopter; possibly ships in a few cases; and establishing fuel caches/camps are major items).

9. Equipment Needs/Equipment Available:

Major equipment needs often would include field rations and tents/camp gear - food supplies.

Available equipment often would include camp gear, optics/photographic.

10. Facility Needs/Facilities Available:

Major facility needs often would include zodiac rafts, outboard motors, three-wheel Hondas; also use of aircraft and possible ships in some cases (see logistics comments above); also living accommodations (at staging areas and in-field - valuable use could be made of DEW Line sites and Air Force ACW Squadron bases in many cases).

11. Personnel Needs/Personnel Available:

Possible Principal Investigators may include some agency personnel (USFWS), some institutional personnel and some private contracting firms (consultants).

*These are estimates and there is a need for further, more detailed evaluation and the construction of several basic budgets. These estimates take into consideration personnel, logistics and equipment.

NOAA-OCSEAP P.I.'s and contractors may serve as an initial pool of personnel.

Additional observer/technician personnel may be available from other sources.

Adequate personnel should be available on short notice. Established contracting firms may be able to respond more rapidly than some institutional personnel.

12. Support Services:

A. Aerial/brief on-ground recon of study area helpful in determining which colonie(s) should be considered as a target for this project (see comments under "Time Frame").

B. Valuable prior and concurrent studies could include mapping distribution of oil in relation to colony, determining fate of oil (i.e. - sunk to bottom in certain locales, became incorporated in bottom or beach sediments in certain locales), surveys to determine fate of certain invertebrates, surveys to determine if hydrocarbons have been incorporated into some prey organisms and the birds themselves, studies to enumerate initial kill, if it occurred at time of spill or shortly after, etc.

C. Review of census methods, including those utilized by OCSEAP, to establish better standardization of methodology.

D. Studies to improve/refine census techniques.

13. Payoff:

Payoff in Phase I would include documentation and measurement of significant fairly rapid changes in seabird numbers and productivity at a colony in relation to a known oil spill. Such information would not only be useful to assessing impact but could be valuable in determining if further study is warranted (including Phase II).

Payoff in Phase II would yield information on long-term impact related trends, and in various potential cases, yield valuable information not only on declines but on recovery rates, trends in numbers and reproductive success.

14. Limitations:

A. Some sites will be logistically more difficult than others.

B. Resolution: Phase I may not detect and/or clearly document small changes (i.e., a decline on the order of only 10 percent). It will detect larger changes (probably reliable for 20 percent +).

(Phase II is designed to follow-up Phase I to give better resolution to trends/rates of change.)

NOTE: We disagree with the Hartford statement that it is impossible to document numbers of birds in colonies due to the difficulties in obtaining accurate number of estimates! This is currently being done in Alaska with a fair degree of success by some NOAA-OCSEAP Research Units. Estimates resulting from such work must be treated as minimum ones, but it appears that reliable indices can be established, particularly with some statistical treatment and refinement.

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 3
PRIORITY RANK: 2

1. Project Title: Marine Bird and Mammal Mortality Assessment

2. Project Description:

Since carcasses of marine birds and mammals float and are relatively durable, they are frequently washed ashore following their death at sea, and their appearance on beaches provide an index of mortality. The death and littering of beaches with carcasses of oiled marine birds and mammals has historically been the most visible biological and emotional impact of oil pollution at sea.

A. Objectives:

(1) To help assess damaging impacts of an oil spill on marine birds and mammals, beach and pelagic surveys will be conducted to record oil pollution-related bird and mammal mortality. The types of information collected on beach surveys will be geographic distribution, species composition, number, age class, sex, weight, degree of oiling, and status of health. Pelagic observations will include geographic distribution, species composition numbers, degree of oiling, and status of health (i.e., dead or dying).

(2) Carcasses of oiled birds and mammals will be collected to provide specimens for physiological experiments and other allied projects.

(3) To determine floatation periods for various species of oiled marine birds.

B. Method:

(1) Beach observations and collections: the technique involved in conducting beached carcass surveys is relatively simple and have become well established through long experience of such organizations as the British Seabird Group and Point Reyes Bird Observatory. An observer will systematically sample at least a 2 Km stretch of a selected beach on either a regular daily basis or, in the case of large numbers of carcasses

coming ashore, twice daily. For comparison purposes, it will be important to systematically sample the same transect at regular intervals. A beach should be sampled throughout the spill incident and thereafter until birds are no longer appearing on the beach. Selection of beaches should be based on the spill trajectory analyses, accessibility, and on a reconnaissance of the area to detect where dead birds are beaching. When applicable, it is particularly important to survey those beaches identified in Item 4 since those areas are already part of beached carcass baseline effort. Two passes will be made along each transect by covering the low tide line on the first pass and higher up the shore on the return trip. Data such as species, number, sex, age, degree of oiling, status of health, and location will be recorded. USFWS/OCSEAP beached bird and mammal computer format should be used to record and store all data. (Reference: Computer format and format instructions for Beached Bird and Mammal Survey, USFWS, OBS-CE, Anchorage, AK.) All dead animals will be examined for leg bands or color markers. Rare specimens will be retained. After examination, all carcasses will be deposited above the high tide mark or otherwise removed from the beach. To determine the persistence or movements of carcasses on the beach a sample of dead birds will be marked and left on the beach. To determine floatation times for various species a sample of dead birds will be banded and weighed, and visually described and released at sea in the vicinity of the oil spill. Such specimens will be recorded when resighted on the beach, weighed to determine weight loss, and visual appearance described. Other oiled specimens will be retained and provided to other investigators for allied projects.

(2) At sea observations and collections: observers will record species, number, degree of oiling, water temperature and status of health. Sex, age class, and weight will also be recorded for collected specimens. At sea, specimens will be collected and provided to other investigators for allied projects.

3. <u>Performing Organization</u>:

A. U.S. Fish and Wildlife Service
Office of Biological Services -
Coastal Ecosystems

800 A Street, Suite 110
Anchorage, AK
(907) 265-5401.
Contact: Dr. C. J. Lensink.

This organization is presently involved in a beached marine bird and mammal survey project in the northeast and northwest Gulf, Alaska and lower Cook Inlet. They have available depth in experience and manpower.

B. Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, AK.
(907) 344-0541.
Contact: K. Schneider.

4. Applicable Habitats:

Pelagic and accessible beaches. If applicable, the following beaches should be surveyed in southcentral Alaska to allow baseline data at those beaches to be integrated with oil pollution incident data.

A. Lower Cook Inlet:

- Whiskey Gulch
- Anchor River
- Chisik Island
- Swamp Creek (Kulgin Is.)
- Cope Kasilof
- Homer Spit (west side)
- Coal Bay
- Amakdedori River
- Clam Gulch
- Douglas River

B. Northeast Gulf of Alaska:

- Middleton Island
- Hook Point
- Patton Bay
- Nuchek Beach

C. Kodiak:

- Narrow Cope
- Kalsin Bay
- Bushy Point
- Middle Bay

- Mayflower Creek
- Happy Beach
- English Point

5. Applicable Conditions:

   A. Physical accessibility of beaches dependent on weather and logistics.

   B. Sea state $\leq$ 1 m for at.sea observations and collections.

   C. Presence of carcasses on beaches and at sea for collection purposes.

   D. Availability of manpower and experience.

6. Applicable Oil Type:

   All types or groups of oil.

7. Time Frame:

   Duration of the spill including the period when oiled carcasses continue to appear on beach transect.

8. Cost:

   A. Logistics:

   Aircraft: Twin engine (if applicable) - $300/hr
   Single engine (tail dragger with balloon tires) - $100/hr.

   Ship: Can be piggy-back with ship requirements of other projects such as Bird and Mammal Project No. 1, "at sea observations of density distribution."

   B. Equipment:

Shipping boxes	-	$ 100.00
Plastic bags	-	50.00
Burlap bags	-	50.00
Dip net	-	20.00

Scale	-	$ 50.00
Cold and warm field camp gear and expendables	-	2,530.00
Communications	-	3,000.00
Total		$5,800.00

C. Personnel:

PI - $150/day plus $70/day per diem.

Other investigators - $125/day plus $70/ day per diem.

Others such as Government agency personnel will likely be provided gratis.

D. Total Cost of Project (based on 45 days):

Personnel:		
	PI (1)	$ 6,750/or no cost
	Other investigators (3)	13,500/or no cost
	per diem	12,600/or no cost
Logistics:		
	Ship - No cost (piggy-back operation)	$ 0
	Aircraft - 200 hrs @ $100/hr	20,000
	25 hrs @ $300/hr	7,500
Equipment:		5,800
Total Cost:		$45,900 to $66,150

9. <u>Equipment Needs/Equipment Available</u>:

A. Aircraft - single-engine, tail dragger with balloon tires.

B. Aircraft - small twin-engine.

C. Field camp gear - (warm and cold weather).

D. Communications.

E. See equipment list in Item 8.

10. Facility Needs/Facilities Available:

See Items 8 and 9.

11. Personnel Needs/Personnel Available:

Principal investigator and associates will be selected from within the performing organizations listed in Item 3.

A. Principal Investigator (1).

B. Co-investigators (3).

12. Support Services:

A. Coordination of collection efforts of onshore and offshore mortality surveys will be required.

B. Data exchange will be essential between offshore and onshore mortality observations and offshore/nearshore species density distribution information.

C. Data from ocean currents, local weather and wind patterns, and water temperature will be required from oceanographers.

13. Payoff:

A. Beached marine bird and mammal information will provide a known tally of bird and mammal losses from an oil spill which will prove quite useful in the litigation phase of such an incident. The surveys will help provide data which will answer basic biological questions such as:

(1) Which species are impacted and which are most severely impacted;

(2) What the estimated number is of birds impacted for a given oil spill;

(3) What the longevity is of oiled bird carcasses in subarctic and arctic waters;

(4) What the drift rate is of bird carcasses at sea;

(5) What percentage of carcasses at sea appear on beaches, and thereby narrow the confidence limits of mortality predictions;

(6) What the correlation is between at sea density distributions and carcass numbers and species composition found on beaches;

(7) What the weight loss is of bird carcasses over time, i.e., this will provide an index that will help establish how long a carcass has been on a beach or in the water; and

(8) What age classes are most impacted?

B. Collection of live and dead specimens will provide samples to other investigators for determining physical and physiological effects of oil on birds and mammals.

14. Limitations:

A. The incidence of beached birds and mammals will vary with the direction of prevailing winds and ocean currents, degree of scavenging by predators, relative size of populations at sea, and at-sea floatation time of carcasses. Numbers may also fluctuate with the occurrence of storms and other natural phenomena as well as with the release of petroleum products in the marine environment.

B. Weather and sea state will limit logistic support, i.e., access to beaches, and at sea observations of carcasses.

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 4
PRIORITY RANK:

1. Project Title: Effectiveness of Avian Scare Device Techniques In Repelling Marine Birds from An Oil Spill Area

2. Project Description:

A. Objectives:

Avian repelling/dispersing methods include acoustic and visual harassment devices, chemical devices, and physical barriers or a combination of such equipment. Underwater sounds may also be effective in repelling diving type seabirds.

The purpose of this project will be to evaluate various avian scare devices in relation to their effectiveness in dispersing and repelling marine birds from specific areas and their application for offshore, nearshore, and terrestrial deployment. Repelling birds from an area that is contaminated with oil has to allow time for cleanup without wholesale mortality to birds. It must be more efficient and far easier to keep birds out of a contaminated area than to try and clean birds after they have become contaminated with oil or otherwise harmed. Specifically the project will address the following objectives:

(1) Determine the effectiveness of various avian scare devices in repelling marine birds from a specific area.

(2) Determine the spatial and temporal effectiveness of various devices.

(3) Prepare avian scare device plans which will be used during various types of oil spill situations and geographic areas.

B. Techniques:

This study should consist of two phases: a mobile phase and fixed phase. The mobile phase will consist of presenting acoustic stimuli from a boat which patrols a test area.

The fixed phase will be conducted by presenting stimuli from a fixed location. Test areas will include various offshore, nearshore (bays and salt marshes) and terrestrial habitats. A complete count and identification of birds present in the test habitats will proceed the presentation of the stimulus or combinations of stimuli. A complete count and species composition will follow the presentation of the stimulus. Temporal and spatial effectiveness for each device used and combination of devices will be determined.

3. Performing Organization:

Any government organization or private institution with in-house expertise in ornithology, statistics, and computer processing should be able to conduct this study. Suggested organizations include: U.S. Fish and Wildlife Service, Office of Biological Services, Anchorage, Alaska, Department of Fish and Game, Anchorage, University of Alaska, Fairbanks, and other private institutions.

4. Applicable Habitats:

A. Offshore.

B. Bays and Lagoons.

C. Coastal Salt Marshes.

D. Mud Flats.

5. Applicable Conditions:

A. Physical accessibility of habitats is dependent on weather and logistics.

B. Sea state $\leq$ 1 m for offshore tests.

C. Availability of various scare devices.

6. Applicable Oil Type:

All types and groups of oil.

7. Time Frame:

This project is not dependent on an oil pollution situation for initial tests. Six months would be required for initial

testing and preparation of a report. If certain devices and techniques are found to be effective in dispersing/repelling birds then they will be used during an oil spill situation and until spill cleanup is terminated or accumulations of oil disappear from critical habitat areas.

8. Cost:

Equipment:

Acoustic devices	$ 5,000
Other devices	1,000
Field gear	2,500

Logistics:

Aircraft support	$ 10,000
Vessel support	15,000
Zodiac and motor	2,500

Personnel:

PI (1)	$ 20,000
Co-Investigators (2)	20,000
Total Cost:	$ 62,500

9. Equipment Needs/Equipment Available:

A. Aircraft - Twin engine amphibian.

B. Vessel - 65-foot.

C. Field camp gear.

D. Communications.

E. Scare devices.

10. Facility Needs/Facilities Available:

See Item 9.

11. Personnel Needs/Personnel Available:

Principal investigator and associates will be selected from within the performing organizations listed in Item 3.

A. Principal Investigator (1).

B. Co-investigators (2).

12. Support Services:

None.

13. Payoff:

The results of this study will determine the effectiveness of various scare devices and their overall usefulness in an oil spill situation. Should it be determined that scare devices are effective protection mechanisms, a scare device plan(s) will be prepared that could be used during spill situations by the petroleum industry and by those governmental organizations charged with wildlife protection responsibilities.

14. Limitations:

Weather, sea state, and availability of scare devices are limiting factors for a successful operation.

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 5
PRIORITY RANK:

1. Project Title: Bird Mortality During Spring Migration (Beaufort and Chukchi Sea) in Relation to Ice Conditions (from Ward and Tull, 1977).

2. Project Description:

A. Objectives:

(1) To determine the species and numbers of water birds that are killed as a result of the presence during spring of oil-contaminated ice and leads.

(2) To determine the reactions of migrant birds to oil pools on the ice surface and to oil-covered leads.

(3) To determine the extent of utilization of oiled birds by scavengers (e.g., arctic fox).

B. Methods:

Aircraft (helicopter or fixed wing) surveys of oil-covered leads and of pools of surface oil within the contaminated area would be flown twice weekly. If numbers of oiled birds are able to move out of the oil onto the ice or into oil-free water it will be possible to survey them from the air. If a helicopter is used, it will have to be landed frequently in order to determine numbers of birds actually in the oil (where they will be difficult to see), to identify heavily oiled birds, and to mark dead birds (by removal of a wing). Dead birds would be marked in order to determine both the rate of scavenging and the number of additional birds that had died.

On several occasions the observer would spend time in a white blind on the ice in the vicinity of oil-covered leads or surface pools of oil in order to study the reaction of flying (migrant) birds to the oil. The observer would record the species, flock sizes, directions and heights of flight, and behavior with respect to the oil.

The specific methodology of the surveys will be determine by the extent of the contaminated area, the degree of success of attempts to burn the oil, and the ease with which oiled birds can be observed (if at all) from the air.

3. Performing Organization:

Agency: U.S. Fish and Wildlife Service
Office of Biological Services
800 A Street
Anchorage, Alaska 99501

Contact: Calvin Lensink

4. and 5. Applicable Habitats and Conditions:

Observations would be initiated if aerial reconnaissance indicated the presence of oil-covered leads or surface pools of oil during the spring migration period. Because of the apparent attraction that surface pools of oil and oil-covered leads could hold for water birds, it would be useful to conduct this study whenever any such areas occur. Limited observations suggest that even a few small pools of oil could cause considerable bird mortality (Barry 1970; NORCOR 1975). If only a small amount of oil were present, the study would be scaled down accordingly.

6. Applicable Oil Type:

All types.

7. Time Frame:

May and June for field study.

8. Cost:

Preparation:

Survival gear	$ 1,000
Blind	100
Miscellaneous	500
TOTAL	$ 1,600

Implementation:

Aircraft	$ 33,700
Air fare	836
Accommodation	9,900
Fuel caches	2,000
Native guide	4,500
TOTAL	$ 50,936

9. Equipment Needs/Equipment Available:

On site in readiness--none.

On hand elsewhere--Arctic winter survival gear
-2 tape recorders
-spare batteries, tapes
-spotting telescope
-blind.

10. Facilities Needs/Facilities Available:

100 hrs of Aircraft (helicopter or fixed wing) [estimated].
2 months, accommodation for three persons (biologist, assistant and pilot).

11. Personnel Needs/Personnel Available:

One (possibly two) experienced bird survey biologist would be required to conduct surveys, to analyze and interpret the data, and to write up the report. He should be accompanied by a native assistant during all surveys on or over the ice.

12. Support Services:

The implementation and the extent of this study will depend on information from aerial reconnaissance of the spill and information on ice movement. In the event of a very large contaminated area of ice, the results of a study recording the areal extent of oil on the ice surface will be important to the interpretation of results from this study.

13. Payoff:

During May and June, tens of thousands of water birds (predominantly eiders and Oldsquaw) are known to migrate into or through the Beaufort Sea area via coastal and offshore routes (Richardson et al., 1975; Searing et al., 1975). During this migration period these birds are dependent for resting and feeding on the presence of patches of open water, ice leads, and melt ponds in the transition zone (cf. Barry, 1968). A major oil well blowout during May or June, particularly in the transition zone, could result in the presence of many oil-covered leads and of numerous pools of oil on the ice surface along the migration route of these birds. It is expected that migrant water birds would mistake these areas for open water and land in them (cf. Barry, 1970; NORCOR, 1975; Milne and Smiley, 1976). The resulting mortality could be substantial.

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 6
PRIORITY RANK:

1. Project Title: Mortality and Moulting Sea Ducks in the Beaufort Sea (from Ward and Tull, 1975)

2. Project Description:

A. Objectives:

(1) To determine the numbers, species, and distribution of water birds (particularly diving ducks) present in coastal areas before (if possible) and after an oil spill reaches these areas.

(2) To determine the species and numbers of dead and oiled birds relative to the species and numbers of birds that could potentially have encountered the oil.

(3) To assess the responses of the birds to the oil.

(4) To determine the extent of utilization of the carcasses of oiled birds by scavengers (e.g., foxes, gulls).

B. Methods:

Aerial surveys would be conducted of the coastline in threatened areas in order to establish the species, numbers and distribution of sea ducks both before (if possible) and after any oil reaches the threatened areas. These surveys should be designed to obtain total counts of birds in the coastal areas and should be initiated as soon as possible after the spill occurs. The surveys should be conducted at weekly intervals, particularly in those coastal areas where the threat of oil-contamination is high.

Ground surveys of the numbers of dead birds along beaches (beached bird surveys) would also be conducted immediately after the oil reaches the coast and at weekly intervals thereafter. The following information would be recorded during the beached bird surveys: species, numbers, location, and condition of oiled birds; evidence of scavengers; and quantity and location of oil (e.g., on the beach, in the water, etc.). By marking dead birds during each beached bird survey (e.g., removing a wing) and by repeating the surveys, information could be obtained on the removal of

dead birds by scavengers. Comparative information on normal mortality could be obtained by surveying a similar but uncontaminated area.

3. Performing Organization:

U.S. Fish and Wildlife Service
Office of Biological Services
800 A Street
Anchorage, Alaska 99502

Contact: Calvin Lensink

4. and 5. Applicable Habitats and Conditions:

This study should be initiated almost immediately after any major oil spill during July and August that will possibly result in oil reaching coastal areas.

6. Applicable Oil Types:

All types.

7. Time Frame:

Mid-July to mid-September for field study.

8. Costs:

Preparation: none

Implementation:

Aircraft	$ 10,870
Air fare	1,672
Accommodation	6,600
TOTAL	$ 19,142

9. Equipment Needs/Personnel Available:

Two biologists experienced in conducting aerial surveys of water birds and familiar with conducting beached bird surveys would be required during the late summer if there were a threat of oil reaching coastal areas.

10. Facilities Needs/Facilities Available:

-50 hr fixed-wing aircraft (Cessna 185) for aerial surveys.

-10 hr helicopter (Bell 206) for transportation to survey sites for beached bird surveys.

-Accommodation for two months (two people).

-Air fare.

11. Personnel Needs/Personnel Available:

Two biologists experienced in conducting aerial surveys of water birds and familiar with conducting beached bird surveys would be required during the late summer if there were a threat of oil reaching coastal areas.

12. Support Services:

The implementation of this study will depend on the results of a study on the movement of oil. The results of studies on the movement of oil into the coastal zone and on the effects of oil on coastal ecosystems will provide important information for interpreting the results of the aerial and beached bird surveys.

13. Payoff:

During July and August, tens of thousands of diving ducks (predominantly scoters and Oldsquaw) are known to congregate along the Beaufort Sea coast, particularly in bays and lagoons, in order to undergo their annual wing moult (Searing et al., 1975). They are flightless at this time and are thus particularly vulnerable to oil spills. In the event of a major oil spill in the Beaufort Sea during this period, oil could be blown into coastal areas where it could cause substantial mortality to these birds.

14. Limitations:

PANEL: MARINE BIRDS AND MAMMALS
PROJECT NO: 7
PRIORITY RANK:

1. Project Title: Effects of Oil Spills on Birds of the Arctic Coastal Flood Plain in the Chukchi/Beaufort Seas

2. Project Description:

A. Objectives:

To assess the impact of broods of water birds and on moulting water birds from oil contamination caused by a storm surge.

B. Methods:

Immediately after the storm surge aerial surveys by aircraft (helicopter or fixed-wing) would be made of a portion of the contaminated area and of a similar control area in order to determine the numbers of broods, the numbers of moulting birds and the numbers of oiled birds visible. A second survey would be conducted one week later.

3. Performing Organization:

Agency: U.S. Fish and Wildlife Service
Special Studies
813 D Street
Anchorage, AK 99501

Contact: Dirk Derksen

4. and 5. Applicable Habitats and Conditions:

Any storm surge that carries oil inland during the period from July to early September. After early September, the results of a study on the movement of oil into the coastal zone would be used to determine the need for a study during the nesting season of the next year.

6. Applicable Oil Types:

All types.

7. Time Frame:

July to early September, for field study.

8. Cost:

Preparation:	None
Implementation:	
Aircraft	$ 5,055
Accommodation	770
Air fare	418
TOTAL	$ 6,243

9. Equipment Needs/Equipment Available:

On site in readiness -- None.

On hand elsewhere -- tape recorders (2)

-- batteries, tapes.

10. Facility Needs/Facilities Available:

15 hours Aircraft (helicopter [Bell 206] or fixed wing).

Accommodation for 2 weeks for pilot and observer.

Air fare: (1 fare).

11. Personnel Needs/Personnel Available:

An experienced waterfowl survey biologist would be required for the surveys.

12. Support Services:

The implementation of this study would depend on the results of aerial reconnaissance. The results of the study on oil in the coastal zone would be necessary for the interpretation of the results of this study.

13. Payoff:

Storm surges that carry oil inland to contaminate tundra, lakes, and delta areas could cause mortality to birds that nest or feed in these areas. Most major storm surges occur in late September of October when most birds have left the Beaufort Sea area. However, the occurrence of a storm surge in July or August, in combination with a major oil spill, could result in mortaility to breeding birds, to young, or to staging or migrating birds that were present in the affected areas. It may be difficult, however, to assess directly the magnitude of any such mortality. Lightly oiled birds will probably hide in vegetation; heavily oiled dead birds will probably be mixed with oil or oiled vegetation where they will be difficult to see. Scavengers will probably remove some of the oiled birds.

Moulting birds and broods of water birds would be particularly sensitive to oil contamination because they are flightless and hence unable to escape from the oil. The mortality to these birds could be measured indirectly by conducting surveys in the contaminated area and in a similar control area. Comparisons between the two areas would provide a crude measure of the impact on young and on moulting birds.

A storm surge in late September or October will not directly affect birds, but the oil deposited in nesting areas could create a problem for birds during the next breeding season. If a storm surge were to contaminate an extensive area of nesting habitat, a study should be implemented the next year to determine the impact on nesting birds.

14. Limitations:

SOCIOECONOMIC PANEL

Participants

J. Gissberg, Chairperson

T. Baker
R. Carroll
R. DuBey
B. Gallagher
S. Hum
J. Kross
J. Nauman
P. Parker
B. Paulus
F. Therrell
F. Tupper
J. Rowley

SOCIOECONOMIC CONSIDERATIONS PANEL

Recommended Projects

1. Survey of socioeconomic interests and values which may be vulnerable to oil pollution.

2. Survey of harvest and marine plant and animal resources for non-comercial uses by people in Alaska.

3. Survey of harvest of freshwater plant and animal resources for non-commercial uses by people in Alaska.

4. Determination of local assistance to on-scene coordinator.

5. Survey of social and economic experts with experience in Alaska.

6. Location of oil spill response equipment stores and the designation of beaching areas for off-loading damaged vessels (same as Hartford No. 10).

7. Study of oil storage sites and oil transportation routes in Alaska.

8. Development of models for the assessment of socioeconomic damage following spills.

9. Equipment standardization.

10. Effectiveness of U.S. laws in restricting oil tankering traffic in waters off Alaska to structurally sound U.S. vessels.

11. Study of the effect of oil pollution on lives of local residents.

12. Baseline studies on commercial fishing industry.

13. Analysis of the cost effectiveness of oil spill cleanup operations (same as Hartford No. 10).

14. Determination of actual amount damage awards which is made available to private claimants.

15. Comparative study of damage compensation programs.

16. To be provided at a later date.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 1
PRIORITY RANK: 1

1. Project Title: Survey of Socioeconomic Interests and Values Which May Be Vulnerable to Oil Pollution

2. Project Description:

   A. Objectives:

      1. Identify uses of the marine environment and their socioeconomic values.

      2. Identify areas and uses particularly vulnerable to oil pollution.

      3. Rating of areas by likelihood of oil spills.

      4. Prioritize listing of interest, by importance of interest, vulnerable to oil spills.

   B. Implementation - Review of NOAA OCZM regulations.

   C. Anticipated Results - Prioritize listing of critical/susceptible.

3. Performing Organizations:

   Department of Transportation (Office of Pipeline Safety) NOAA (OCZM).

4. Applicable Habitats:

   Focus on 5, 6, 7, 8.

5. Applicable Conditions:

   None.

6. Applicable Oil Type:

7. Time Frame:

   Twenty-four (24) months.

8. Cost:

$125,000, update every five years. $35,000.

9&10. Equipment and Facility Needs/Availability:

On-site surveys
Map
Literature review

11. Personel Needs/Personnel Available: (Participating agency)

All interested state, federal agencies and affected communities.

12. Support Services:

13. Payoff:

Study will prioritize critical habitats and vulnerable areas.

14. Limitations:

Broad scope of study to effect all socioeconomic interests.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 2
PRIORITY RANK: 2

1. Project Title: Survey of Harvest of Marine Plant and Animal Resources for Non-Commercial Uses by People in Alaska

2. Project Description:

A. Objectives:

Determine quantity and species of plants and animals harvested in Alaska for sports and other personal use purposes by marine areas and season of harvest.

B. Implementation:

1. Questionnaire and interviews.

2. Historical literature review.

C. Anticipated Results:

Determine areas of significant sports and "subsistence" harvests of marine platns and animals (including fish, shellfish, mammals, etc.) in Alaska.

3. Performing Organizations:

University of Alaska Marine Advisory Program

4. Applicable Habitats:

All marine habitats utilized for non-commercial purposes by man in Alaska.

5. Applicable Conditions:

Eductional preparation to convince local residents of need to disclose private information.

6. Applicable Oil Type:

7. Time Frame:

1-1/2 years (Jan. 1978 - June 1979) with continuing update through questionnaires.

8. Cost:

Unknown

9&10. Equipment and Facility Needs/Availability:

- Questionnaire preparation by socioeconomic and legal consultants.
- Data analysis equipment.

11. Personnel Needs/Personnel Available:

A. Native corporations (regional and local).

B. Local schools and teachers.

C. Bureau of Indian Affairs.

D. Alaska Department of Fish and Game.

E. Commercial Fisheries Entry Commission.

F. Department of Commerce and Economic Development.

G. Coastal Zone Management Offices (state, federal).

H. Department of Community and Regional Affairs.

I. Bob DeArmound (Historian).

12. Support Services:

13. Payoff:

On-Scene Coordinator will be advised of important non-commercial areas which need protection in event of oil spill; study will define resource use beyond commercial catch statistics.

14. Limitations:

Data submitted to be confidential.

PANEL: *SOCIOECONOMIC CONSIDERATIONS*
PROJECT NO: 3
PRIORITY RANK: 3

1. Project Title: Survey of Harvest of Freshwater Plant and Animal Resources for Non-Commercial Uses by People in Alaska

2. Project Description:

   A. Objectives.

      Determine quantity and species of plants and animals harvested in Alaska for sports and other personal use purposes by freshwater areas and season of harvest.

   B. Implementation.

      1. Questionnaire and interviews.

      2. Historical literature review.

   C. Anticipated Results.

      Determine areas of significant sports and "subsistence" harvests of freshwater plants and animals (including fish, shellfish, mammals, etc.) in Alaska.

3. Performing Organizations:

   University of Alaska

4. Applicable Habitats:

   All freshwater habitats subject to oil spills.

5. Applicable Conditions:

   Educational preparations to convince local residents of need to disclose private information.

6. Applicable Oil Type:

7. Time Frame:

   1-1/2 years (Jan. 1978 - June 1979) with continuing update through questionnaires.

8. Cost:

Unknown.

9&10. Equipment and Facility Needs/Availability:

- Questionnaire preparation by socioeconomic and legal consultants
- Data analysis equipment

11. Personel Needs/Personnel Available:

A. Native corporations (regional and local).

B. Local schools and teachers.

C. Bureau of Indian Affairs.

D. Alaska Department of Fish and Game.

E. Department of Commerce and Economic Development.

F. Department of Community and Regional Affairs.

G. Bob DeArmound (Historian).

12. Support Services:

13. Payoff:

On-Scene Coordinator will be advised of important non-commercial areas which need protection in event of oil spill; study will define resource use beyond commercial catch statistics.

14. Limitations:

Data submitted to be confidential.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 4
PRIORITY RANK: 4

1. Project Title: Determination of Local Assistance to On-Scene Coordinator

2. Project Description:

A. Objectives.

1. Designate local liaison in every community subject to oil spill threats.

2. Prepare list of residents willing to assist On-Scene Coordinator in observing and defining oil spill, predicting behavior on sea, helping in cleanup effort and encouraging mechanical cleanup.

3. Compile list of equipment and facilities available in each community (boats, planes, equipment, etc.) as well as availability of professional services, housing, etc.

4. Listing of equipment needs in each community.

B. Implementation.

Questionnaires and interviews to determine local liaison representative, availability of equipment and interest of local residents.

C. Anticipated.

On-Scene Coordinator will have the name of a local person to start the response effort when weather or other factors delay government action. Equipment can be supplied to local areas for observation, sampling and cleanup purposes.

3. Performing Organizations:

Alaska Disaster Office.

4. Applicable Habitats:

All areas of state subject to oil spills.

5. Applicable Conditions:

No applicable.

6. Applicable Oil Type:

7. Time Frame:

Continuing update.

8. Cost:

Unknown.

9&10. Equipment and Facility Needs/Availability:

A. Sampling kits with labels and forms.

B. Equipment necessary to collect essential data.

C. Infra-red cameras.

D. Pocket secretaries.

11. Personnel Needs/Personnel Available:

A. Boat owners.

B. Bush pilots.

C. Fishermen.

D. Conservation groups.

E. Local schools and organizations.

F. Local companies.

G. All local residents.

12. Support Services:

See Water Column Panel recommendations.

13. Payoff:

A. Accelerate response to oil spills delayed by great distances in State of Alaska.

B. Reduce reliance upon chemical cleanup by making local residents available for mechanical cleanup efforts.

C. Satisfy desire for local participation.

14. Limitations:

None.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 5
PRIORITY RANK: 5

1. Project Title: Survey of Social and Economic Experts with Experience in Alaska

2. Project Description:

   A. Objective.

      1. List experts in fields of social and economic sciences.

      2. Availability of expert to offer assistance and advice to OSC.

   B. Implementation - Contact known experts by letter.

   C. Anticipated Results.

      1. List of experts
      2. Addresses
      3. Availability
      4. Fee schedule

3. Performing Organizations:

   EPA

4. Applicable Habitats:

   Not applicable.

5. Applicable Conditions:

   Not applicable.

6. Applicable Oil Type:

7. Time Frame:

   Two months.

8. Cost:

   $1,000

9&10. Equipment and Facility Needs/Availability:

None.

11. Personnel Needs/Personnel Available:

A. George Rogers (Economist, Univ. of Alaska, Juneau).

B. Don Collinsworth (Economist, ADFG - Juneau).

C. Arlon Tussing (Economist, Univ. of Alaska, Fairbanks).

D. Robert DeArmound (Historian, Juneau).

E. Richard Carroll (Sociologist, BLM, Anchorage).

F. Richard Cooley (Sociologist, Univ. of ____?____, California).

G. Institute for Marine Studies (Univ. of Washington, Seattle).

H. James Crutchfield
Edward Wenk
Edward Miles

12. Support Services:

None.

13. Payoff:

Immediate availability of socioeconomic consultants.

14. Limitations:

None.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 6
PRIORITY RANK: 6

1. Project Title: Location of Oil Spill Response Equipment Stores and the Designation of Beaching Areas for Off-Loading Damaged Vessels (Same as Hartford No. 11).

2. Project Description:

A. Objectives.

1. Same as Hartford No. 11.

2. Computer printout capability of equipment sites.

B. Implementation.

Survey of areas most susceptible to oil pollution in Alaska.

C. Anticipated Results.

Determination of best storage sites, most favorable beaching sites and equipment availability (including tankers and offshore rigs, and on-board cleanup capability).

3. Performing Organizations:

USCG
EPA

4. Applicable Habitats:

All.

5. Applicable Conditions:

None.

6. Applicable Oil Type:

7. Time Frame:

Six months.

8. Cost:

$20,000

9&10. Equipment and Facility Needs/Availability:

- Maps
- On-site inspections.

11. Personnel Needs/Personnel Available:

A. USCG.

B. EPA.

C. ADFG.

D. Tonnevolds Redia Co., Oslo, Norway (has on vessel self-contained booms, etc.).

E. I. P. Sharp Co., Vancouver (computer summaries of equipment and spill analysis).

F. Department of Fisheries and Environment, Ottawa, Jim Kingham.

G. Native Corporations.

H. Local communities.

I. Fishermen, etc.

12. Support Services:

None.

13. Payoff:

A. Locate equipment in sites to promote efficient development.

B. Determine areas where successful beaching could favor rapid cleanup with minimal damage to environment.

14. Limitations:

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 7
PRIORITY RANK: 7

1. Project Title: Study of Oil Storage Sites and Oil Transportation Routes in Alaska

2. Project Description:

   A. Objectives - Same as Hartford No. 12.

   B. Implementation - Study pipelines, truck routes.

   C. Anticipated Results - Oil concentration network to be described.

3. Performing Organizations:

   Department of Transportation
   USCG

4. Applicable Habitats:

5. Applicable Conditions:

   None.

6. Applicable Oil Type:

7. Time Frame:

   Two months.

8. Cost:

   $10,000

9&10. Equipment and Facility Needs/Availability:

11. Personnel Needs/Personnel Available:

   - Local federal and state government personnel and local transportation
   - Oil and power companies.

12. Support Services:

   None.

13. Payoff:

Determine sites most vulnerable to oil spills.

14. Limitations:

Available if information from private companies.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 8
PRIORITY RANK: 8

1. Project Title: Development of Models for the Assessment of Socioeconomic Damage Following Spills

2. Project Description:

   A. Objectives - Same as Hartford No. 13.

   B. Implementation - Use of computer models.

   C. Anticipated Results - Immediate access to critical criteria to study in event of oil spill.

3. Performing Organizations:

   University of Alaska

4. Applicable Habitats:

   All.

5. Applicable Conditions:

   Oil spills.

6. Applicable Oil Type:

7. Time Frame:

   Four (4) months.

8. Cost:

   $30,000

9&10. Equipment and Facility Needs/Availability:

   Computer.

11. Personnel Needs/Personnel Available:

   - University of Alaska
   - ADFG

12. Support Services:

13. Payoff:

Ability to dispatch experts to spill area to survey damage.

14. Limitations:

Access to computers.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 9
PRIORITY RANK: 9

1. Project Title: Equipment Standardization

2. Project Description:

   A. Objectives

      Determine capability of equipment in designated storage sites, communities and countries (Canada) vulnerable to oil pollution.

   B. Implementation

      Review of kinds of equipment being used.

   C. Anticipated Results

      (1) Propose standardization of equipment.
      (2) Universal connectors for booms, skimmer hookups.
      (3) Making cleanup programs economically efficient.

3. Performing Organizations:

   EPA or private environmental consultant (not associated with equipment manufacturer).

4. Applicable Habitats:

   Not applicable.

5. Applicable Conditions:

   None.

6. Applicable Oil Type:

7. Time Frame:

   Six (6) months.

8. Cost:

   $40,000

9&10. Equipment and Facility Needs/Availability:

Secretarial.

11. Personnel Needs/Personnel Available:

A. All equipment manufacturers.

B. Oil spill control organizations.

C. Panel of experts to determine.

12. Support Services:

13. Payoff:

Economize cleanup operations.

14. Limitations:

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 10
PRIORITY RANK: 10

1. Project Title: Effectiveness of U.S. Laws in Restricting Oil Tankering Traffic in Waters off Alaska to Structurally Sound U.S. Vessels

2. Project Description:

A. Objectives

(1) Pinpoint loopholes in U.S. laws which could allow ships of convenience into Alaska waters and untrained crews.

(2) Determine number of "convenience" tankers in waters off Alaska and qualifications of pilot and crew.

(3) Review whether or not inspections are current and sufficient USCG personnel assigned to inspection responsibilities.

B. Implementation

Review of USCG records.

C. Anticipated Results

(1) Loopholes may allow substandard ships in waters off Alaska.

(2) Number of flag of convenience ships in Alaska.

3. Performing Organizations:

USCG

4. Applicable Habitats:

All marine.

5. Applicable Conditions:

None.

6. Applicable Oil Type:

7. Time Frame:

1 year survey.

8. Cost:

$30,000

9&10. Equipment and Facility Needs/Availability:

Secretarial.

11. Personnel Needs/Personnel Available:

- USCG
- All private shipping companies.

12. Support Services:

None.

13. Payoff:

Illuminate oil pollution threats from substandard oil ships.

14. Limitations:

Ownership of vessels and equipment standards is often restricted information.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 11
PRIORITY RANK: 11

1. Project Title: Study of the Effect of Oil Pollution on Lives of Local Residents

2. Project Description:

   A. Objectives

      1. Determine socioeconomic effect of oil spills on daily life of local residents.

      2. Subsequent job and residence satisfaction.

      3. Determine adequacy of compensation schemes.

   B. Implementation

      Long-term study of local residents who have had to abandon place of residence or jobs due to oil spills.

   C. Anticipated Results

      Not predictable.

3. Performing Organizations:

   University of Alaska
   University of Washington

4. Applicable Habitats:

   Areas of human habitation.

5. Applicable Conditions:

   Major oil spill.

6. Applicable Oil Type:

7. Time Frame:

   One year with annual review.

8. Cost:

$50,000 for ftravel for interviews, preparation of reports.

9&10. Equipment and Facility Needs/Availability:

Secretarial.

11. Personnel Needs/Personnel Available:

Affected residents.

12. Support Services:

13. Payoff:

A. Learn actual social consequences of oil spill on individuals.

B. Determination of adequacy of compensation schemes.

14. Limitations:

Cooperation of residents.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 12
PRIORITY RANK: 12

1. Project Title: Baseline Studies on Commercial Fishing Industry

2. Project Description:

   A. Objectives

   Determine availability of information sought by Hartford baseline studies 2-8.

   B. Implementation

   Check by letter and interview for data collected and maintained by ADFG, Alaska Departments of Revenue and Economic Development, NMFS, etc.

   C. Anticipated Results

   Commercial importance of fisheries in Alaska is well finished; sports uses for fish and game less subject to economic summary.

3. Performing Organizations:

   EPA
   NMFS

4. Applicable Habitats:

   All.

5. Applicable Conditions:

   Not restricted.

6. Applicable Oil Type:

7. Time Frame:

   One (1) month.

8. Cost:

   $3,000

9&10. Equipment and Facility Needs/Availability:

Secretarial.

11. Personnel Needs/Personnel Available:

A. ADFG.

B. Department of Revenue.

C. Department of Commerce and Economic Development.

D. Commercial Fisheries Entry Commission.

12. Support Services:

None.

13. Payoff:

Confirm availability of information necessary to assess damages in event of oil spill.

14. Limitations:

Some Alaska laws require correct order to release such information (see e.g. AS.16.05.815).

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 13
PRIORITY RANK: 13

1. Project Title: Analysis of the Cost Effectiveness of Oil Spill Cleanup Operations (same as Hartford No. 10)

2. Project Description:

   A. Objectives

   Identify social or public relations aspects of oil spill cleanup.

   B. Implementation

   Evaluate benefits achieved by oil spill cleanup projects.

   C. Anticipated Results

   Effectiveness of cleanup efforts may not depend on money expended; cleanup may be required for public relations and political purposes.

3. Performing Organizations:

   University of Alaska

4. Applicable Habitats:

   All vulnerable to oil pollution.

5. Applicable Conditions:

   Oil spills.

6. Applicable Oil Type:

7. Time Frame:

   Three (3) months.

8. Cost:

   $30,000

9&10. Equipment and Facility Needs/Availability:

11. Personnel Needs/Personnel Available:

Corps of Engineers (C/B analysis).

12. Support Services:

None.

13. Payoff:

More efficient cleanup efforts.

14. Limitations:

None.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 14
PRIORITY RANK: 14

1. Project Title: Determination of Actual Amount Damage Awards whch are made Available to Private Claimants

2. Project Description:

A. Objectives

Determine proportion of damage awards which successful claimants must pay to lawyers and expert witnesses.

B. Implementation

Study by interview and review of all court files all previous awards given to successful plaintiffs in environmental damage suits and other analogous tort cases.

C. Anticipated Results

Substantial damage awards may be eroded by expenses in pursuing claims.

3. Performing Organizations:

State and Federal legal offices or
Stipend to graduate students

4. Applicable Habitats:

Not applicable.

5. Applicable Conditions:

None.

6. Applicable Oil Type:

7. Time Frame:

Two (2) months.

8. Cost:

$8,000

9&10. Equipment and Facility Needs/Availability:

Access to federal (and state) records.

11. Personnel Needs/Personnel Available:

Attorneys who participated in prior litigation.

12. Support Services:

None.

13. Payoff:

Determine whether or not reliance upon new statutory compensation schemes is justified.

14. Limitations:

None.

PANEL: SOCIOECONOMIC CONSIDERATIONS
PROJECT NO: 15
PRIORITY RANK: 15

1. Project Title: Comparative Study of Damage Compensation Programs

2. Project Description:

   A. Objectives

      1. Describe compensation schemes in other countries (Canada, U.K., Norway, Scotland, Iceland, Japan, New Zealand, etc.).

      2. Evaluate effectiveness of foreign programs.

      3. Enumerate policies appropriate to U.S.

   B. Implementation

      Comparative case study technique.

   C. Anticipated Results

      Foreign countries with more experience in compensating private claimants for oil spill damage can contribute to evaluation of effectiveness of present and pending U.S. programs.

3. Performing Organizations:

   Conservation Foundation (organized similar international land use study program in 1974).

4. Applicable Habitats:

   Not applicable.

5. Applicable Conditions:

   Not applicable.

6. Applicable Oil Type:

7. Time Frame:

   One-half (1/2) year.

8. Cost:

$80,000

9&10. Equipment and Facility Needs/Availability:

Secretarial.

11. Personnel Needs/Personnel Available:

Graduate students in environmental studies or law students with interest in environmental affairs.

12. Support Services:

A. Department of Transport (Mr. Buchanen), Vancouver, B.C.

B. Department of Fisheries and the Environment (Jim Kingham), Ottawa.

C. Japan Fishery Agency.

13. Payoff:

Promote evaluation of present and pending U.S. programs; generate recommendations to make present proposals more effective.

14. Limitations:

Language abilities.

EXECUTIVE COMMITTEE MEETINGS

Overview

An Executive Committee was established for overall evaluation of Workshop results and for developing the management framework of the Response Plan. The specific objectives of the Executive Committee were to:.

(1) Address organizational, administrative and coordination aspects of the scientific response program, such as:

(a) Reviewing, and amending as necessary, the organizational framework for scientific response outlined by the NRT Task Force on Ecological Damage Assessment.

(b) Establishing a mechanism to ensure a smooth integration of Federal and state scientific efforts during a spill situation.

(c) Designating agency points of contact and establishing a call-up structure to be implemented in the event of a spill.

(d) Establishing a mechanism for achieving close scientific coordination with Canada in spill situations which involve both countries.

(e) Discussing problems of funding and personnel availability which will need further attention after the workshop.

(2) Provide guidance to the panels by clarifying objectives, provoking discussion, assisting in the exchange of information and ideas among panels, etc.

(3) Lay out the steps required to finalize the scientific plan for Alaskan spill response.

(a) Developing a scientific response mechanism including call-up procedures.

(b) Identifying potential scientific response elements (e.g., experts, organizations, facilities).

The Executive Committee was comprised of responsible Federal and state officials who could potentially contribute to implementation of an ecological damage assessment response plan, and authoritatively consider matters of policy and resources. Members of the Committee are identified in Appendix D.

Summary Review of Meetings

A joint meeting of Panel Chairpersons and the Workshop Executive Committee was held on 27 November on the eve of the Workshop. It involved a general review of the Workshop format and post-Workshop activities, and announcement of minor schedule and room assignment changes. Written comments on the draft Hartford Workshop Report were submitted to Panel Chairpersons for guidance, and a summary draft of existing and proposed Federal laws pertaining to oil spill damage assessment was given to all attendees (see Attachment 1). Specific questions were raised pertaining to interaction between the Anchorage and Seattle components of the Workshop, the geographical scope of the Workshop, guidance from the National Response Team, and clarification of Workshop objectives.

On November 28, the Executive Committee met to discuss the overall organizational structure of an Alaska response mechanism and the role of various agencies within that structure. A focus of discussion was the proposed organization of the Scientific Support Team to meet Alaska requirements. Other points of discussion included:

- Recognition of the lead role of NOAA in an Alaska response plan, in view of the substantial existing NOAA research program in Alaska coastal environments.

- Expansion of the definition of natural resources and ecological damage assessment to include chronic effects and socioeconomic impacts. Third party claims may also have to be addressed under proposed "superfund" legislation.

- Funding sources for response activities. It was pointed out that the assistance requested by the OSC in support of his operational responsibilities during containment and cleanup operations are reimbursable via the "revolving fund".

- Lead agency responsibilities within the Scientific Support Team. It was indicated that agency responsibilities applicable elsewhere may not apply to Alaska circumstances and that they may vary according to the function and nature of the response.

- Capabilities and flexibility of specific Federal agencies in relation to an Alaskan response plan. Agencies discussed included the Bureau of Land Management, U.S. Geological Survey, U.S. Fish and Wildlife Service, as well as NOAA and EPA. It was recommended that memoranda of understanding be prepared with each Federal agency involved regarding responsibilities and modes of participation.

- Recommended notification procedures and lines of communication. Considerable discussion was devoted to: call-up and implementation procedures; the roles of the NOAA Regional Director, the RRT, and the 24-hour Boulder and Alaska numbers; and the procedural relationships to various functions of the response plan.

- The need for a layered plan structure to include local, regional and national response capabilities.

- The need for a single scientific advisory point of contact with the OSC.

In order to clarify notification and implementation procedures, it was decided that the next Executive Committee meeting would include discussion of responses under various hypothetical oil spill scenarios.

The November 29 meeting of the Executive Committee addressed the following subjects:

- Lead Agency Responsibility. A proposed definition of lead agency responsibility (see Attachment 2) was circulated, discussed and modified. It was also noted that damage assessment may have two meanings: 1) in a narrow sense, as related to OSC support, and 2) in a broader context, covering post-spill activities that would involve the EPA member of the Regional Response Team.

- State Relationships. Both the Alaska Department of Environmental Conservation and the Alaska Department of Fish and Game expressed preference for integrating State activities in an effective overall response program. Existing Alaska Fish and Game Department on-scene response measures were described.

- Scientific Support Team. It was noted that the lead responsibilities for Team organization should be based on capabilities of individuals rather than according to agency. The following organizational changes were recommended: combining of Offshore Biology, Nearshore Biology and Lab Toxicity under a single Biology heading; and combining Ship and Aircraft Support with Shore Facilities and Communications under the single heading of Logistics Support (see Figure 1). Related points included: the need for identifying a single advisor for each area; the present development by the U.S. Coast Guard of a National Inventory System of Facilities that can be incorporated in the response plan; the need for a Logistics Support Coordinator, aside from the OSC; and the availability of the Coast Guard communications network (Channel 81) for spill response activities.

- Notification and Implementation Scenarios. The following notification and implementation procedure was recommended:

  Support to OSC - For minor spills, the OSC directly contacts locally available experts (e.g., Alaska Fish and Game Department biologist) with no regional (i.e., Alaska) involvement. For medium and major spills requiring scientific advice not available locally, the following chain of notification is implemented: OSC → USCG Area Headquarters → USCG District Headquarters (Juneau) → Regional Response Team (RRT) → NOAA Member of RRT → Scientific Support Coordinator/ Advisor (SCA) for Alaska. The SCA contacts appropriate members of the Scientific

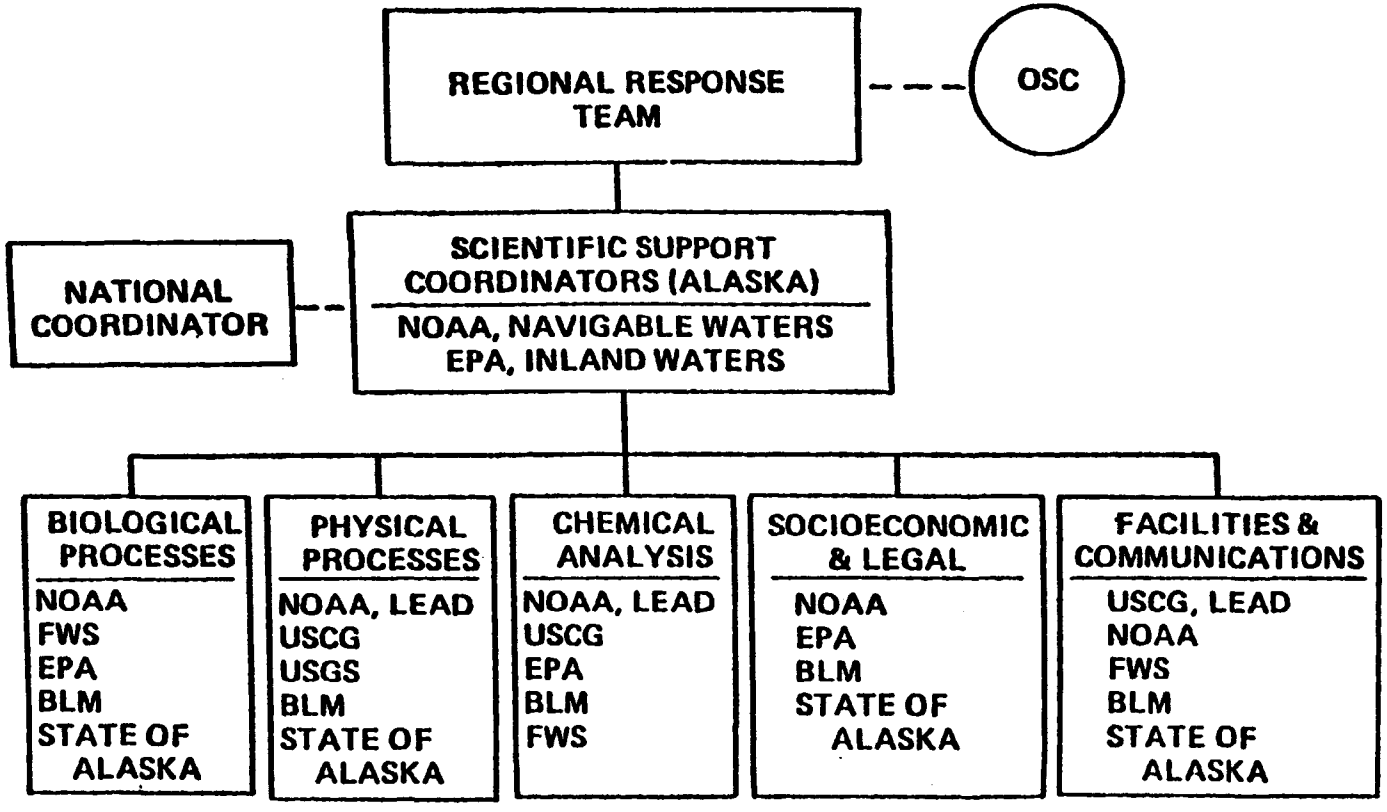

FIGURE 1

PROPOSED STRUCTURE AND ORGANIZATIONAL RELATIONSHIPS
OF THE ALASKA SCIENTIFIC SUPPORT TEAM

Support Team. The SCA may be contacted directly but requires clearance from the NOAA member of the RRT for participation. For major spills, the SCA will determine if additional support is required. In that event, the SCA will contact the National Coordinators.

Environmental Damage Assessment - EPA has primary responsibility for this function. The notification and implementation procedure is the same as for support to the OSC, except that the EPA member of the RRT is notified in the event of damage assessment requirements and then notifies the NOAA member of the RRT if additional support is required. Local damage assessment capabilities are developed by the EPA member of the RRT.

Ecological Research - In the event of a spill, research requests may originate from numerous sources, and will be considered by the SCA in consultation with the NOAA member of the RRT and the National Coordinators. The SCA will have sufficient contingency funding to initiate research. The NOAA member of the RRT will inform the OSC of contemplated research activities.

For further details on notification procedures, see the letter report to the National Response Team (Appendix E).

- Canadian Relationships. It was recommended that coordination with Canadian contingency plans be discussed with Canadian authorities following the development of the Alaska response plan. The U.S. Coast Guard has already established joint assistance arrangements with Canada for oil spill contingencies.

- Other Items. These included: the primary responsibility of the OSC for all public relations activities in regard to a spill; EPA lead agency responsibility for inland and freshwater spills; the potential contribution of Aleyeska to scientific response activities in connection with coastal spills in the Valdez area; and the potential use of the TAP Act funds for support of response plan activities.

A final meeting of the Executive Committee was held on November 30. Items discussed included: a schedule for preparation of the Workshop Report and the Response Plan by the MITRE Corporation; preparation of a letter report by the Workshop Chairman for the

National Response Team meeting of December 15 (included in Appendix E); anticipated designation by NOAA of an interim SCA for Alaska; and Geological Survey and Coast Guard responsibilities for spills occurring as a result of outer continental shelf resource development. It was also recommended 1) that the letter report to the NRT include a request for clarification of resources available to support implementation of the response plan via the "revolving fund", and 2) that the NRT be requested to support "superfund" legislation which provides funding for ecological damage assessment activities consistent with response plan requirements.

The Legal Panel then gave the Executive Committee an overview of legal issues pertaining to ecological damage assessment and the relationship thereto of scientific data gathering and reporting. The Panel did not reach a uniform consensus on an optimal approach for implementation of ecological damage assessment. Among the options discussed were: additional research to define the basis for claims of damage to natural resources; Federal rule-making procedures to establish a uniform basis for claims; allowing the courts to establish standards based on circumstances of individual spills and local conditions. It was noted that the State of Alaska presently assesses damages on the basis of the amount of oil spilled and the type of habitats impacted. The Legal Panel was requested to prepare a letter report to the NRT outlining the various legal

options available for environmental damage assessment and implications of these options.

ATTACHMENT 1

EXISTING AND PROPOSED FEDERAL LAWS RELEVANT TO OIL SPILL DAMAGE ASSESSMENT WITHIN ALASKA'S COASTAL ZONE*

Applicable Federal Law	Prohibited Acts	Geographical Jurisdiction	Extent of Liability	Legal Defenses to Liability	Legal Damages (Costs) Recovered	Fines and Penalties Available	Availability of Fund: Size and How Financed	Recovery Upon the Fund	Preemption of Federal or State Law
Rivers and Harbors Act of 1899 (Refuse Act) 33 USC §§407, 411)	Discharge from vessel or shore of any refuse water including commercially valuable oil §407	Tributaries of navigable waters and banks of navigable waters §407	See Fines and Penalties Vessels are liable in rem	Compliance with permit §411	None	$500-$2,500 or imprisonment for not more than one (1) year or both §411	None	None	None
Federal Water Pollution Control Act Amendments of 1972 (FWPCA) (33 USC §1321)	Discharge of oil or hazardous substances in harmful quantities (visible sheen) §1321(b)(1)	Waters of the U.S. including the territorial sea, adjoining shoreline and contiguous zone §1321(b)(1)	§1321(f) Vessel-up to $100 per gross ton or $14,000,000 whichever is less. Facility-up to $8,000,000. Where there is willful negligence or misconduct the spiller is liable for total cleanup costs §1321(f)	1) Act of God 2) Act of war 3) Negligence of U.S. 4) Act or omission of third party §1321(f)	Actual cost of removal incurred by the U.S. §1321(f)	Failure to notify up to $10,000 or one (1) year imprisonment or both§1321(b)(5) Failure to comply with regulations up to $5,000 for each violation §1321(i)(2)	Not to exceed $35,000,000 financed by recovery from spiller for costs of removal §1321(k)	Available to Federal agencies for cleanup operations §1321(l)	None §1321(o)
Senate Bill 1952, 95th Cong., 1st Sess., Amendments to §1321 of the FWPCA	Unchanged	Extended to water above the outer continental shelf or 200 miles §40(b)(1)	Vessel-up to $150 per gross ton or $1,500,000 whichever is greater Facility-up to $50,000,000 §40(d)	Unchanged	Actual cost of removal incurred by U.S. including the cost of restoration or replacement of natural resources. Spiller entitled by subrogation to all rights of U.S. to recover from third party §40(f),(g)(4)	Unchanged	Unchanged	Unchanged	Unchanged
FWPCA (33 USC §§1311, 1362)	Discharge of any pollutant by any person §1311	Waters of the U.S., including the territorial sea §1362	See Fines and Penalties	Compliance with permit §§1311, 1319	None	Criminal-$2,500-$25,000 per day of violation or imprisonment for not more than one (1) year, or both. Additional fines for subsequent offenses up to $50,000 per day or two (2) years or both. Civil Penalty-up to $10,000 per day of violation. False Statement-fine of $10,000 or six (6) months, or both. §1319	None	None	None so long as state actions are as stringent as Federal requirements §§1370, 1371

*Prepared by Richard A. Du Bey and Steven Helgeson.

ATTACHMENT 1 (Continued)

Applicable Federal Law	Prohibited Acts	Geographical Jurisdiction	Extent of Liability	Legal Defenses to Liability	Legal Damages (Costs) Recovered	Fines and Penalties Available	Availability of Fund: Size and How Financed	Recovery Upon the Fund	Preemption of Federal or State Law
Senate Bill 1952, 95th Cong., 1st Sess., Amendments to §§1101, 1167 of the FWPCA	Unchanged except for extention of time for compliance §26	Unchanged	Unchanged	Unchanged	Unchanged	Additional non-compliance fee equal to the economic value of a delay in compliance §369	Unchanged	Unchanged	Unchanged
Trans-Alaska Pipeline Authorization Act (43 USC §1651 et seq.) §1653	Pollution along or in vicinity of pipeline right-of-way; discharges from vessels loaded at Valdez	Covers the movement of Alaskan crude oil from the TAP to any U.S. port	Holders of right-of-way: limited to $50,000,000 for any one incident. Vessels: limited to first $14,000,000 per incident	1) Act of war 2) Negligence of U.S.	All damages (including cleanup costs) public or private, sustained by any person or entity, including resident of Canada	None. (Stipulation §75 provides for temporary suspension of operations to protect either public health or the environment Stipulation §75-Civil	Size limited to $100,000,000. Financed by 5¢ per barrel of oil loaded on a vessel at Valdez §1653(c)	Applies only to damage caused by vessel discharges. Available for claims exceeding $14,000,000 up to $100,000,000 §1653(c)	None, (however, no multiple recovery for same injury) §1653(c)
Deepwater Port Act of 1974 (33 USC §1501 et seq.) §1517	Discharge of oil in marine environment from a vessel which has received oil and discharges of oil from the port itself	The marine environment within any safety zone established around a deepwater port. §§1500, 1517	Vessel: up to $150 per gross ton or $120,000,000 whichever is less (vessel is liable in rem) §1514(c) Deepwater Port: up to $50,000,000 Gross negligence or willful misconduct will make spillers liable for full amount of all cleanup costs §1517(c)	1) Act of war 2) Negligence on part of U.S. 3) Caused by actions of 3rd parties §1517(g)	All damages to real or personal property sustained by any person including cleanup costs. Damages includes injury to natural resources of marine or coastal environment. §1517	Willful violation: up to $25,000 per day or one (1) year or both. Failure to notify up to $10,000 or one (1) year or both. §1517(b)	Size limited to $100,000,000 financed by 2¢ per barrel on all either loaded or unloaded at deepwater port. Exception - Alaskan oil §1517(i)	Applies to all damages and cleanup costs in excess of those compensated by spiller §1517(i)	None (however, no multiple recovery for same injury. §1517(b)

ATTACHMENT 1 (Concluded)

Applicable Federal Law	Prohibited Acts	Geographical Jurisdiction	Extent of Liability	Legal Defenses to Liability	Legal Damages (Costs) Recovered	Fines and Penalties Available	Availability of Fund: Size and How Financed	Recovery Upon the Fund	Preemption of Federal or State Law
National Oil Pollution Liability and Compensation Act of 1977, S.687, 95th Cong., 1st Sess.	Discharge of oil §3(g)	Waters of the U.S., including the territorial sea and the OCS and including the fishery resources of the fishery conservation zone §§2(a)(1),3(12), 3(13) & 3(14).	Vessels carrying oil in bulk- $300 per gross ton or $30,000,000 whichever is less. Facility-up to $100,000,000 spiller is liable for full amount of damages and cleanup costs where such discharge was the result of gross negligence, willful misconduct or a violation of applicable safety standards §5	1) Act of war 2) Negligence or willful act of claimant 3) Act or omission of third party 4) Act of God §5(d)	Cleanup costs and damage to or cost of restoring, repairing, or replacing any real or personal property, lost income due to damage to property including natural resources. Up to one (1) year loss of federal, state or local government tax, royalty, rented or net profit share revenue. §§6,10	Civil-up to $10,000 for facilities to pay oil facility fee into fund §4(b)(2),(c)	Size limited to $200,000,000. Financed by a fee up to 3 cents per barrel collected from facility owners when oil is loaded or unloaded §§4(b),4(b)(3)	All damages and cleanup costs not compensated by spiller. Except where damage was caused solely by claimant's own negligence or willful act. §5(a)(b)(c)	State Law- §9(e) Vessel and facility financial responsibility provisions are preempted. No other state preemption. Federal Law- Where conflict or inconsistency this act preempts other federal law. (No multiple recovery for same injury.) §17(a)&(b)

ATTACHMENT 2

LEAD AGENCY RESPONSIBILITY

Lead responsibility, if for purposes of revising the National Contingency Plan, defined as the agency providing the Scientific Support Coordinator (SSC). The SSC is provided by NOAA for spills originating outside the baseline from which the territorial sea is measured, and by EPA for spills originating inside the baseline.

In the special case of Alaska, NOAA shall provide the SSC for spills originating both inside and outside the baseline. EPA will provide the SSC for inland (freshwater and terrestrial) spills in Alaska.

The responsibility of the SSC has been described by the NRT in the November 4, 1977 letter from the NRT chairman to P. Lefcourt. These responsibilities are:

1. Perform liaison with the scientific community within the region to determine the availability and ability of the community to perform anticipated damage assessment requirements which may be necessitated by an oil spill.

2. Establish, in cooperation with the scientific community within the region, the various interests for accomplishing ongoing research in conjunction with a spill of opportunity.

3. Establish, in cooperation with the scientific community within the region, the kinds of research that are considered necessary to improve the existing capability to perform work in support of damage assessment activities.

4. Arrange for resources and coordinate as necessary requests for the performance of damage assessment activities made by the EPA member of the RRT.

5. Evaluate the potential for accomplishing research and development projects at spill of opportunity. Arrange for and coordinate as necessary such efforts as are deemed appropriate.

6. Coordinate all other scientific efforts being performed in the area of the spill by Federal and State agencies in conjunction with other programs or authorities.

7. Serve as the regional representative to the National Scientific Support Team.

APPENDIX A

ALASKA WORKSHOP SCHEDULE

WORKSHOP SCHEDULE

November 27-30, 1977

Sunday, November 27

7:00 - 11:00 p.m.	Registration, Westward Lobby
8:00 - 9:00 p.m.	Joint Meeting of Panel Chairpersons and Executive Committee

Monday, November 28

7:30 a.m. - 12:00 p.m.	Registration, Westward Lobby
9:00 a.m. - 12:00 p.m.	Plenary Session
9:00 - 9:15 a.m.	Workshop Introduction - John Robinson, Workshop Chairman Manager, Hazardous Materials Response Project, NOAA
9:15 - 9:25 a.m.	Welcoming Address - Wilmot Hess, Acting Deputy Administrator, NOAA
9:25 - 9:35 a.m.	State of Alaska's Responsibility Relative to Oil Spills - Ernst Mueller, Commissioner Alaska Dept. of Environmental Conservation
9:35 - 9:45 a.m.	Federal Involvement in Assessing Environmental Impact of Oil Spills - Kenneth Biglane, EPA, Office of Water & Hazardous Materials

****

9:45 - 10:05 a.m.	BREAK

****

10:05 - 10:25 a.m.	Crisis Science: Investigations in Response to the *Argo Merchant* Oil Spill - Andrew Pollack, Dallas Times Herald

10:25 - 10:55 a.m.	Cleanup Operations and Environmental Needs - Ray Morris, EPA, Region X, Alaska Operations Office - Lt. Michael Macie, U.S. Coast Guard Marine Safety Office, Anchorage
10:55 - 11:15 a.m.	State of the Art - Oil Spill Cleanup Equipment - Lt. Gordy Marsh, Project Officer U.S. Coast Guard Arctic Response Program
11:15 - 12:00 p.m.	Plan for Workshop - John Robinson - Charge to Panels - Organization - Planned Results of Workshop - Open Discussion - Announcements

****

12:00 - 1:00 p.m.	LUNCH

****

1:00 - 5:00 p.m.	Panels Meet to Address Objective #1 in Respective Break-Out Rooms

****

3:30 p.m.	BREAK

****

5:00 p.m.	Panels Terminate for Day
5:00 - 7:00 p.m.	Chairpersons Submit Handwritten Copy to Typists
7:00 p.m.	Reception - Cash Bar

<u>Tuesday, November 29</u>

9:00 a.m. - 10:00 a.m.	Plenary Session
9:00 a.m. - 10:00 a.m.	Legal Panel: Legal Guidance Discussion to Panel Members

****

10:00 - 10:20 a.m.	BREAK

****

10:20 a.m. - 5:00 p.m.	Panels Meet to complete work on Objective #1 and Address Objectives #2 and #3 in Respective Break-Out Rooms

****

12:00 - 1:00 p.m.	LUNCH

****

3:30 - 3:30 p.m.	BREAK

****

4:00 p.m.	Panels Terminate for Day

****

4:00 p.m. - 5:30 p.m.	Plenary Session - Panel Chairpersons Reports
4:00 - 4:10 p.m.	Physical Processes
4:10 - 4:20 p.m.	Chemical Analyses
4:20 - 4:30 p.m.	Water Column Biology
4:30 - 4:40 p.m.	Benthic Biology
4:40 - 4:50 p.m.	Marine Birds/Mammals
4:50 - 5:00 p.m.	Arctic Spills
5:00 - 5:10 p.m.	Inland Spills
5:10 - 5:20 p.m.	Socioeconomic Considerations
5:20 - 5:30 p.m.	Facilities
5:30 - 7:00 p.m.	Panel Chairpersons Submit Handwritten Copy to Typsits

<u>Wednesday, November 30</u>

9:00 a.m. - 2:00 p.m.	Panels Meet to Address Objective #3 in Respective Break-Out Rooms

****

10:30 a.m.	BREAK

****

2:00 p.m.	Panels Terminate for Day

2:00 p.m. Chairpersons Submit Handwritten Copy to Typists

2:00 - 3:00 p.m. Closing Plenary Session
- John Robinson, Workshop Chairman

****

SEATTLE PANELS

(Histology, Microbiology, Laboratory Toxicity)

Thursday, December 1 -- Friday, December 2

WATER COLUMN BIOLOGY

Dr. Vera Alexander
University of Alaska
Fairbanks, AK 99701

MARINE BIRDS AND MAMMALS

Mr. Karl Schneider
Alaska Dept. of Fish & Game
333 Raspberry Road
Anchorage, AK 99502

SOCIOECONOMIC CONSIDERATIONS

Mr. John Gissberg
Assistant Attorney General
State of Alaska
360 K Street
Anchorage, AK 99502

APPENDIX C

PANEL PROJECT FORMAT

Panel _____

Project #_____

Priority Rank _____

PANEL GUIDANCE FORMAT

1. Proposed Title of Project

2. Description of Project
   - Be brief! Outline the objectives of the study, how it is carried out, and anticipated results.
   - Give references if possible.

3. Performing Organization
   - Indicate the organization(s) the panel is certain has the capability to perform the study. Give names if possible.
   - Suggest possible performing organizations.

4. Habitats Applicable
   - Identify one or more from listing of Alaska habitats.

5. Conditions Applicable
   - Consider all possible conditions required for successful completion of study. For example, in a study of impact on benthic fauna some conditions are:
     - oil is incorporated in sediment
     - benthos at control site(s) is uncontaminated
   - Consider what weather/climate, geographical, ecological, economic or other condition(s) are necessary before putting this study into effect.

6. Oil Type Applicable
   - Specify what oils or groups of oils (e.g., crude, no. 6, no. 4, no. 2, gasoline, etc.) project applies.

7. Time Frame
   - Identify the total inclusive period of the study and the actual required work periods, e.g.:

     "The study requires a minimum five-year period consisting of four one-week sampling periods at one field sampling per season. Sample work-up and data analysis requires an additional 8 weeks/year for a spill of _____ size."

8. Cost
   - Estimate the intensive cost of the project, i.e., give a sliding cost based on the size of spill and area of impact, e.g.:

Area (Km^2)	Cost $
10	100,000
50	800,000
100	1,500,000

- Show how you arrived at your figures.

9. Equipment Needs/Equipment Available
   - Be specific! What kind and how much?
   - Available equipment means it can be used for the project with little advance notice.
   - Equipment means sampling gear, sample containers, field and laboratory instrumentation, glassware, communication equipment and various kinds of hardware.

10. Facility Needs/Facilities Available
   - Be specific by habitat and kind and size of spill.
   - Facilities means analytical laboratories, ships, boats, aircraft, land vehicles, living accommodations for lodging, staging and action center, etc.

11. Personnel Needs/Personnel Available
   - Identify if proper personnel are currently available. What response time is needed? Could they respond within the stated time frame?
   - Give names, addresses, tel. no. if possible.
   - If personnel are not available give indication of what disciplines, number are necessary. Suggest possible workers!

12. Support Services (Concurrent or Associated Studies)
   - Indicate the kinds of projects that must be performed to provide data essential for the proper functioning of this project.
   - For example, if project dealt with determining alterations in benthic community diversity a study mapping the distribution of oil in sediments would likely be desirable.
   - Another example might be the need for histological examination of selected organisms.

13. Payoff
   - Describe in adequate detail what the results of such a study would be in contributing to determining the overall ecological impact.
   - Consider the possible results from the perspective of: (1) scientific interest, i.e., how much of a unique contribution does the study make to our understanding of oil pollution impact on marine ecosystems and (2) how does the study lend itself to determining the economic ($) costs of damage to "natural resources"?

14. Limitations
   - This is a very broad category. Considerations of feasibility, utility and operational problems come to bear. Environmental factors, weather, location, ongoing clean-up operations, nature of oil, habitat type, season, etc. all play a role in determining the limitations.
   - Ask if the project answers all questions dealing with assessing ecological impact under all possible scenaries and conditions. Of course not! O.K., then what are the major flaw?

Alaskan Habitats

1. Pelagic system - including inland, coastal, offshore areas, and migratory species
2. Offshore bottom
3. Rocky shore
4. Sandy beach
5. Salt Marsh and sedge areas
6. Mud flats
7. Kelp and eelgrass areas
8. Lagoon systems

APPENDIX D

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APPENDIX E

ALASKA WORKSHOP REPORT TO NRT
(Letter from Workshop Coordinator)

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December 12, 1977

Mr. Kenneth Biglane
Chairman, National Response Team
401 M Street, N.W.
Washington, D.C.

Dear Ken:

This letter will provide you with a synopsis of accomplishments and recommendations resulting from the Alaska workshop on scientific response to oil spills held in Anchorage and Seattle November 28 through December 2, 1977. As you know, the Alaskan workshop was patterned along the lines of the earlier Hartford meeting, with some changes in direction and approach.

As at Hartford, the goals of the workshop were:

1) To provide On-Scene Coordinators with highly qualified scientific advice in mitigating the environmental and socioeconomic impact of oil spills.

2) To assess the damage resulting from such spills.

3) To maximize the research advantage offered by the spill situation, especially with respect to improving our capability for future response.

Our technical panels were provided with extensive guidance prior to the workshop, and were instructed to concentrate their efforts on objective 1, identifying those individuals who were qualified and able to respond on short notice to RRT requests for assistance. We also requested a detailed outline of preparatory steps which should be taken to make this response effective. I have received the information provided by the 10 technical panels in this respect and find it to be quite adequate.

The technical panels were further requested to review the damage assessment and research tasks outlined at Hartford and suggest modifications for Alaska. This effort was also completed effectively.

The work of the socioeconomic and legal panels was especially useful and I believe we are beginning to gain considerable insight as to the importance of these considerations in the overall response to major spills.

The workshop was hosted jointly by EPA Region X and NOAA. Approximately 177 individuals attended, representing a broad spectrum of Federal,

State of Alaska, Canadian, academic and private interests. We were fortunate, as at Hartford, to attract recognized experts in a broad range of environmental, socioeconomic and legal disciplines.

I would like to briefly outline several of the more significant accomplishments or actions taken by the workshop participants:

1) A scientific response organization was established for Alaska which I believe will very effectively meld the efforts of Federal, State and private scientists into a cohesive team, able to respond effectively to oil spill incidents.

2) We were able to leave the workshop with enough specifics as to the capabilities and availability of specific individuals so that we would be able to rapidly assemble a response team in the near future, if necessary.

3) A number of preparatory steps have been identified which should be taken in the next weeks and months to improve our capability as a scientific community to assist in the mitigation of impact and assessment of damage.

4) A simplified call-up structure has been devised which should enable us to promptly match OSC and EPA needs for outside scientific assistance with both regional and national scientific resources. This structure should provide an effective response with a minimum of confusion and redundant effort.

The following steps will be taken as follow-up to the Anchorage Workshop:

1) A preliminary report on the workshop will be presented to the NRT (and forwarded to the Alaska RRT) on December 15. At this meeting we would expect to discuss in some detail our results and recommendations for future action.

2) The MITRE Corporation will prepare a draft workshop report by approximately January 1. The draft will be submitted for wide review and comment.

3) NOAA and EPA will proceed to develop scientific response plans for coastal and inland Alaska with a final completion date of approximately July 1, 1978. Interim response arrangements will be available for review by the RRT within the next few weeks.

To facilitate implementation of the Alaskan plan and preparation for future workshops I would like to request that the NRT consider the following actions at the December 15 meeting:

1) Approval of proposed revisions in NOAA/EPA lead agency responsibility for scientific response in Alaska -- extending NOAA responsibility inside the "baseline" to all Alaskan waters navigable by deep draft vessels. This recommendation stems from consideration of extensive NOAA/BLM research activities in coastal Alaska.

2) Approval of proposed revisions in the Scientific Support Team structure for Alaska. These revisions, which will be discussed further on December 15, generally are for the purpose of simplifying the line of command and the accessibility of the Team to the Alaskan RRT.

3) Assistance in obtaining further definition of agency roles in damage assessment and their commitments to Scientific Support Team operations in the event of a major spill. We propose that NRT member agencies who will be involved in this effort begin working out memoranda of understanding regarding the accessibility of scientific resources in the event of a spill. In the case of Alaska, agreements with DOI are particularly important in view of the substantial internal and contract resources of that agency in Alaska.

4) Assistance in obtaining further definition of the constraints on the use of the contingency fund for Science Support Team operations. We are aware, of course, that use of the fund is limited to operations in support of the OSC during a spill event. We believe, however, that some elaboration on the types of scientific activity that fall within this general constraint would be helpful to both OSC's and the potential scientific response party.

5) Modifications of the National Contingency Plan with respect to references to the "Environmental Response Team. We believe such modifications are now timely from the standpoint of formalizing the establishment of the Scientific Support Team concept as well as broadening the purview of this effort to include hazardous substances.

6) Approval and implementation of the "call-up" structure proposed by the Executive Committee of the Alaska workshop. Action on the Alaskan proposal will rest with the RRT; however we request that the NRT consider broadening the approach as an interim solution for the remainder of the United States until such time as workshops are held and Science Support Coordinators appointed. The specifics of this proposal will be described December 15; however the basic elements are:

a) OSC access to the SST through the NOAA or EPA members of the appropriate RRT.

b) EPA initiation of all damage assessment activity required under the National Contingency Plan.

c) Central coordination by the SST of all requests for on-scene oil spill research.

7) Activation of the Task Force on Damage Assessment or establishment of a new interagency working group. The Executive Committee discussions at the Alaskan Workshop highlighted the need for an interagency staff group to discuss and staff papers on interagency problems related to scientific support operations. Problems that need to be addressed include both scientific and non science related issues. Such a group could:

a) Provide the staff for drafting the memoranda of understanding referred to previously (Item 3);

b) Begin the drafting of the annex(es) to the National Contingency Plan;

c) Provide oversight and review of the regional scientific responses and plans;

d) Provide a mechanism for exchanging information on agency scientific programs which could contribute to Scientific Support Team objectives, including the potential of "piggybacking" needed pre-spill studies onto ongoing agency studies; and

e) provide support to the National Scientific Support Coordinators.

We propose that NRT member agencies who will be involved in the scientific support effort designate individuals who can provide this type of expertise and support, as well as the necessary time.

8) Authorization for next workshop. We request authorization from NRT member agencies to proceed with the workshop for the Gulf Coast, tentatively to be held in late February, 1978. We also request that consideration be given to broadening the sponsorship of the workshop to include other member agencies of the NRT.

I very much appreciate the opportunity to have chaired the Alaskan workshop and look forward to your recommendations for future action.

Sincerely,

Signed by

John R. Robinson
Manager, Hazardous Material
Response Program

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Chairman, RRT/Alaska
USCG/Juneau

EPA Chm/Rhode Island

bcc: J. Angelovic
E. Epstein
W. Hess

ALASKA WORKSHOP ON THE SCIENTIFIC RESPONSE TO OIL SPILLS

PARTICIPANTS

ANCHORAGE (November 28-30)

78	FEDERAL AGENCY REPRESENTATIVES
3	CANADIAN REPRESENTATIVES
25	STATE OF ALASKA
11	ACADEMIC COMMUNITY
6	PETROLEUM INDUSTRY
24	OTHER PRIVATE INDUSTRY
5	PUBLIC PARTICIPANTS
152	

SEATTLE (DECEMBER 1-2)

12	FEDERAL AGENCY REPRESENTATIVES
1	STATE OF ALASKA
10	ACADEMIC COMMUNITY
2	PRIVATE INDUSTRY
25	

RESPONSE OBJECTIVES

1) TO PROVIDE ON-SCENE COORDINATORS WITH HIGHLY QUALIFIED SCIENTIFIC ADVICE IN MITIGATING THE ENVIRONMENTAL AND SOCIOECONOMIC IMPACT OF OIL SPILLS

2) TO ASSESS THE DAMAGE RESULTING FROM SUCH SPILLS

3) TO MAXIMIZE THE RESEARCH ADVANTAGE OFFERED BY THE SPILL SITUATION, ESPECIALLY WITH RESPECT TO IMPROVING OUR CAPABILITY FOR FUTURE RESPONSE

PANEL STRUCTURE

ANCHORAGE (NOVEMBER 28-30)

- PHYSICAL PROCESSES
- CHEMICAL ANALYSES
- WATER COLUMN BIOLOGY
- BENTHIC BIOLOGY
- MARINE BIRDS & MAMMALS

- LEGAL CONSIDERATIONS
- SOCIOECONOMIC CONSIDERATIONS
- FACILITIES

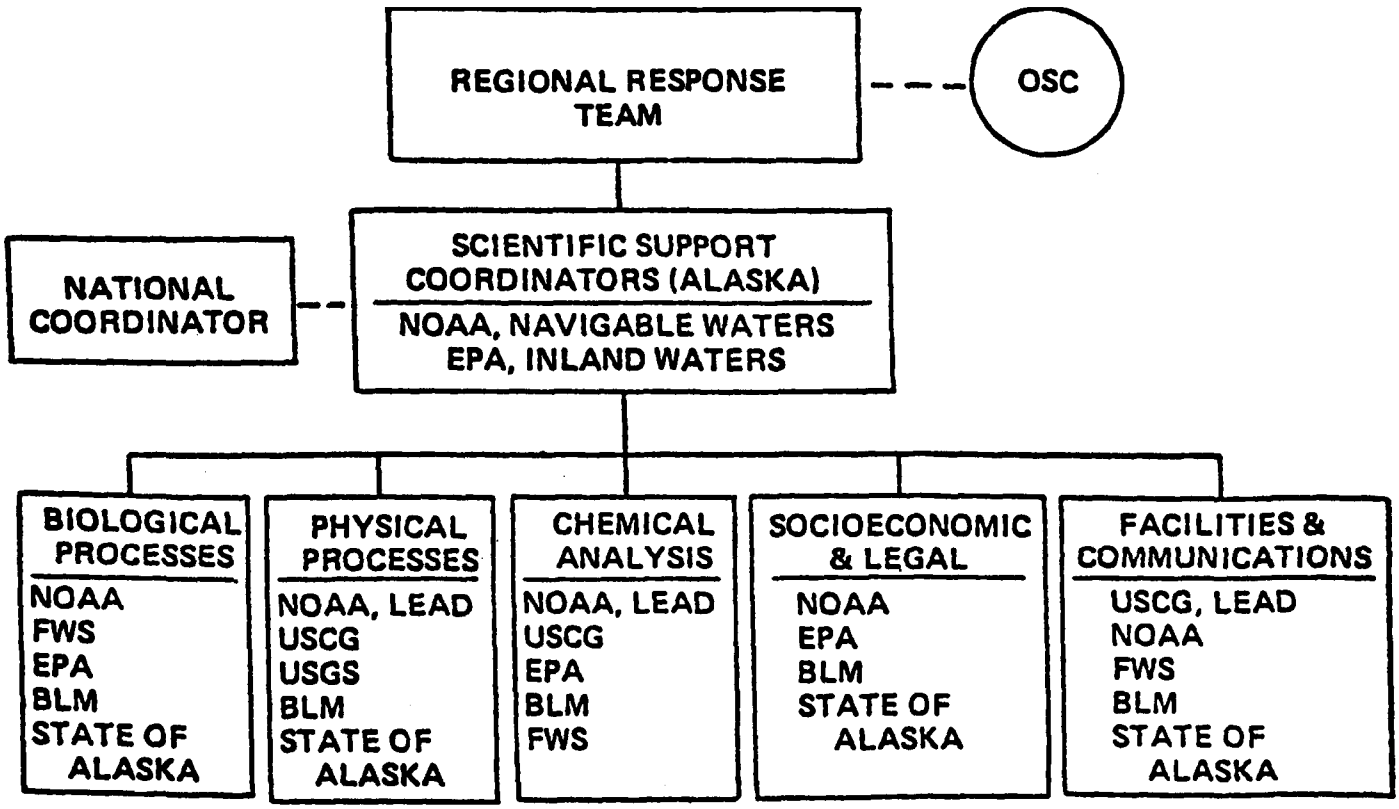
- ARCTIC
- INLAND

SEATTLE (DECEMBER 1-2)

- LABORATORY TOXICITY
- MICROBIOLOGY
- HISTOPATHOLOGY

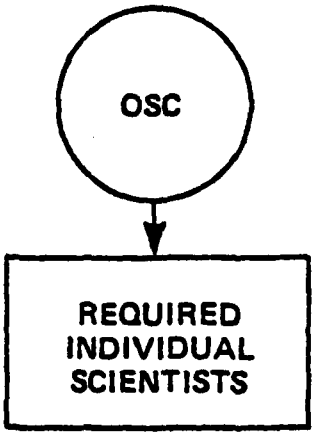
MAJOR ACCOMPLISHMENTS

- MODIFICATION OF THE SCIENTIFIC RESPONSE ORGANIZATION FOR ALASKA
- AGREEMENT ON THE INTEGRATION OF STATE OF ALASKA SCIENTIFIC EFFORTS
- AGREEMENT WITH CANADIAN PARTICIPANTS REGARDING JOINT ACTION ON INTERNATIONAL SPILLS
- AGREEMENT, IN PRINCIPLE, REGARDING THE APPLICATION OF DOI INTERNAL AND CONTRACT RESOURCES IN THE EVENT OF A MAJOR SPILL IN ALASKA
- IDENTIFICATION OF INDIVIDUALS PREPARED TO RESPOND IN SUPPORT OF THE OSC OR EPA
- IDENTIFICATION OF NECESSARY PREPARATORY STEPS IN ADVANCE OF A MAJOR SPILL
- MODIFICATION OF HARTFORD DAMAGE ASSESSMENT TASKS FOR ALASKA
- AGREEMENT ON CALL UP STRUCTURE
- ESTABLISHMENT OF PROCEDURES AND TIMETABLE FOR FINALIZING THE ALASKAN PLAN


REGIONAL RESPONSE TEAM
OSC
NATIONAL COORDINATOR
SCIENTIFIC SUPPORT COORDINATORS (ALASKA)
NOAA, NAVIGABLE WATERS
EPA, INLAND WATERS
BIOLOGICAL PROCESSES
NOAA
FWS
EPA
BLM
STATE OF ALASKA
PHYSICAL PROCESSES
NOAA, LEAD
USCG
USGS
BLM
STATE OF ALASKA
CHEMICAL ANALYSIS
NOAA, LEAD
USCG
EPA
BLM
FWS
SOCIOECONOMIC & LEGAL
NOAA
EPA
BLM
STATE OF ALASKA
FACILITIES & COMMUNICATIONS
USCG, LEAD
NOAA
FWS
BLM
STATE OF ALASKA

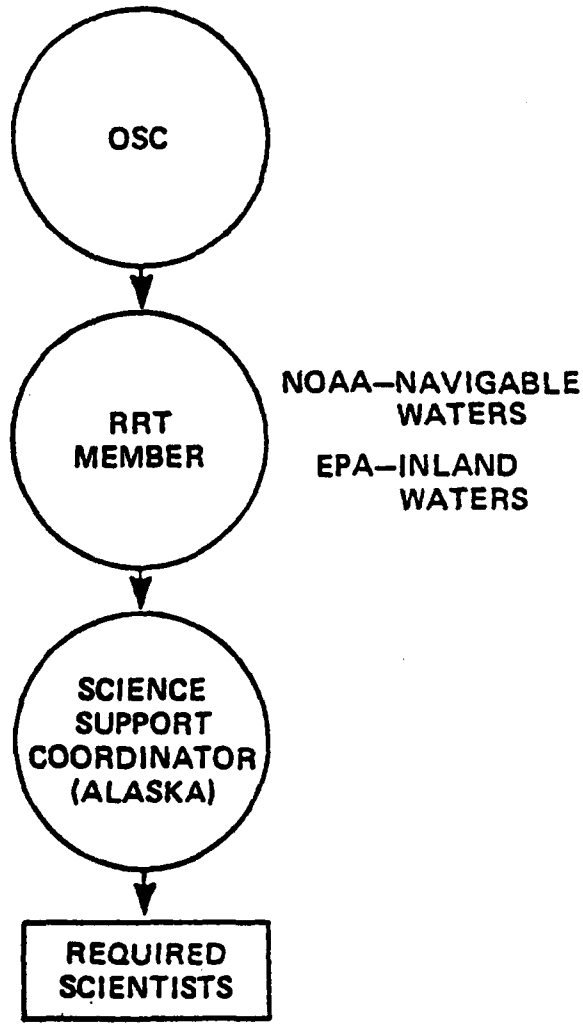
CALL UP STRUCTURE—CASE 1

SCIENCE SUPPORT FOR OSC—"MINOR" SPILL



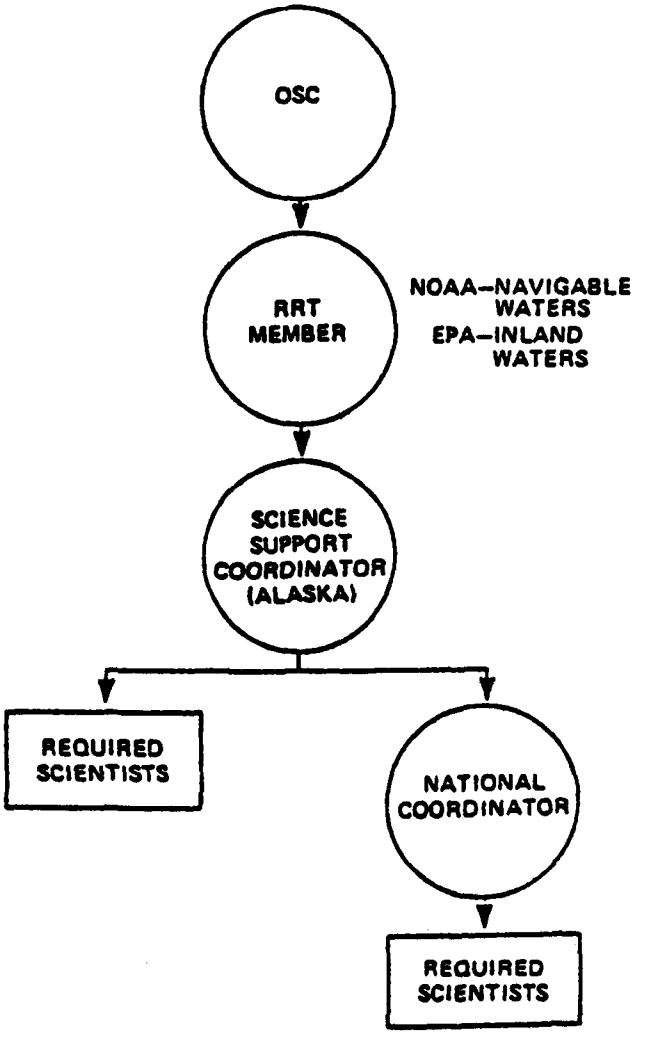
CALL UP STRUCTURE–CASE 2

SCIENCE SUPPORT FOR OSC–"MEDIUM" SPILL



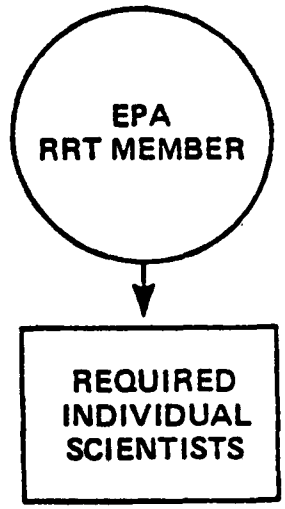
CALL UP STRUCTURE—CASE 3

SCIENCE SUPPORT FOR OSC—"MAJOR" SPILL



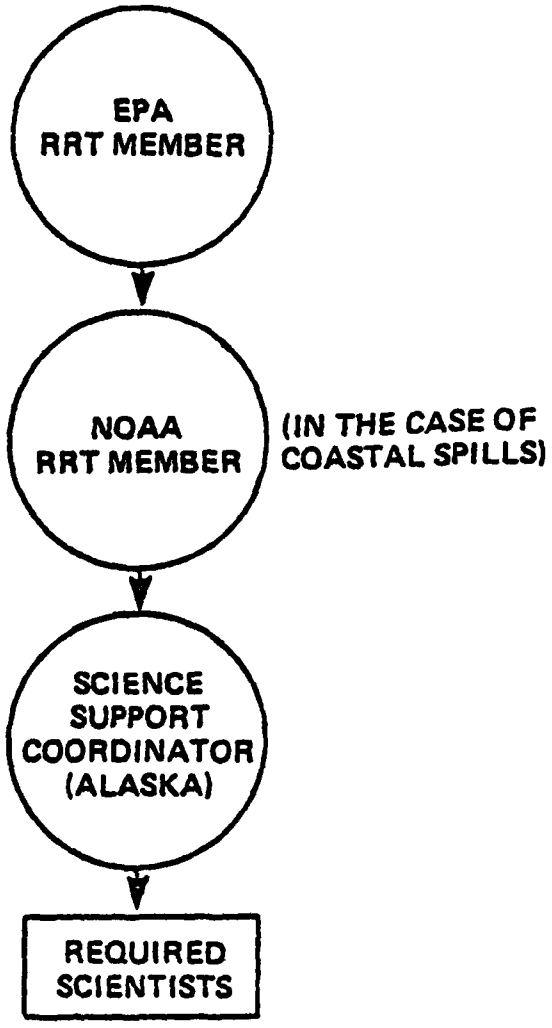
CALL UP STRUCTURE–CASE 4

DAMAGE ASSESSMENT–"MINOR" SPILL



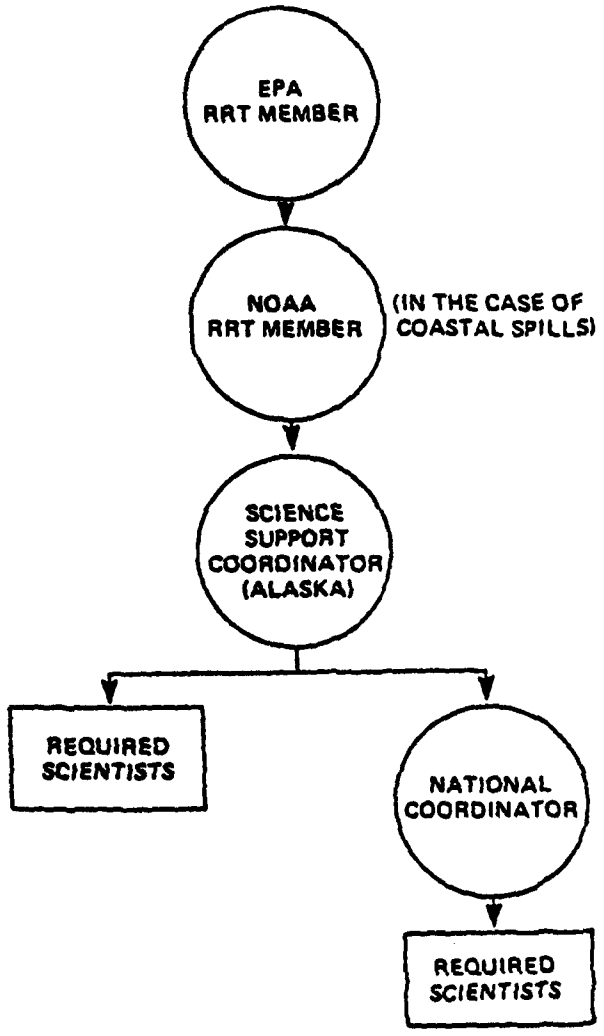
CALL UP STRUCTURE—CASE 5

DAMAGE ASSESSMENT—"MEDIUM" SPILL



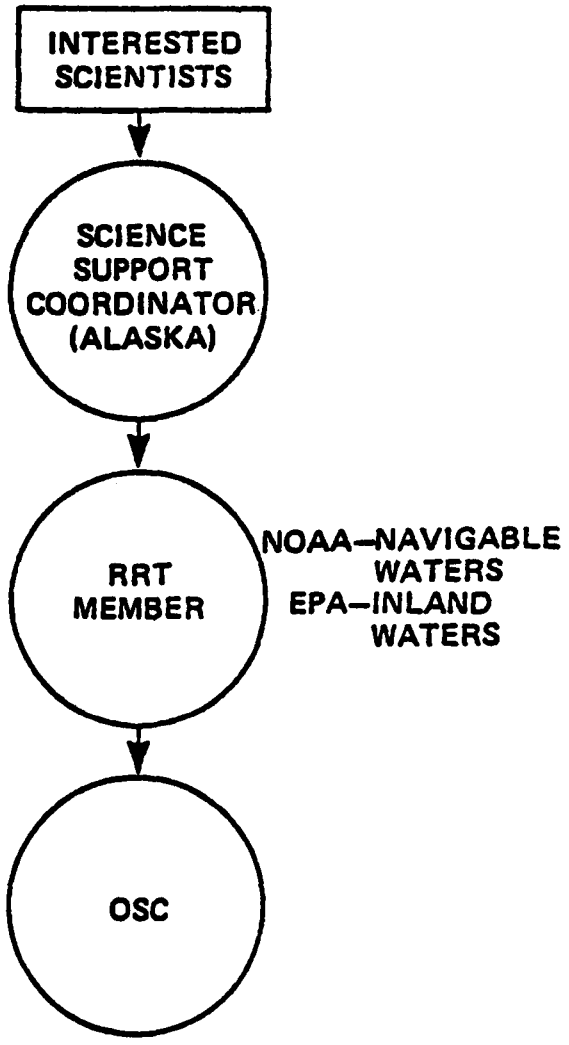
CALL UP STRUCTURE–CASE 6

DAMAGE ASSESSMENT–"MAJOR" SPILL



CALL UP STRUCTURE—CASE 7

RESEARCH

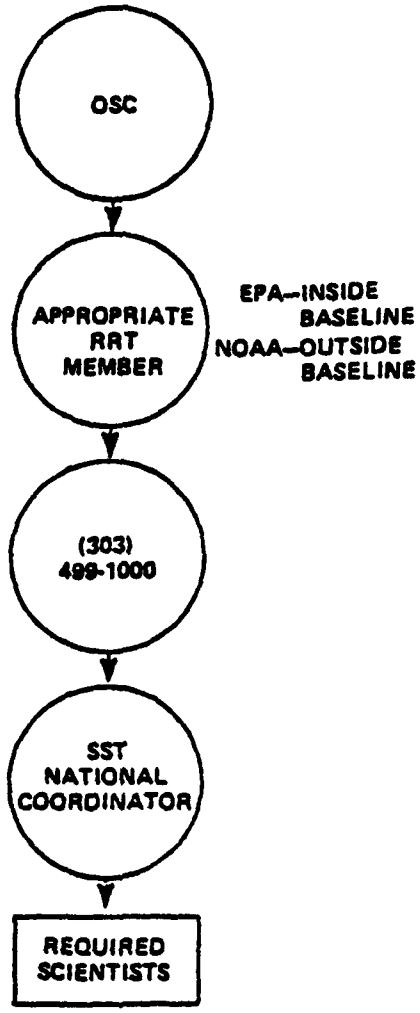


ACTIONS REQUESTED OF THE NRT

- APPROVAL OF PROPOSED REVISIONS IN NOAA/EPA LEAD AGENCY RESPONSIBILITY IN ALASKA—EXTENDING NOAA RESPONSIBILITY TO WATERS NAVIGABLE BY DEEP DRAFT VESSELS
- APPROVAL OF PROPOSED REVISIONS IN THE SCIENTIFIC SUPPORT TEAM ORGANIZATION FOR ALASKA
- ASSISTANCE IN OBTAINING FURTHER DEFINITION OF AGENCY COMMITMENTS TO SST DURING MAJOR SPILLS—THROUGH MEMORANDA OF UNDERSTANDING
- ASSISTANCE IN OBTAINING FURTHER DEFINITION OF CONSTRAINTS ON THE USE OF THE CONTINGENCY FUND FOR SCIENCE SUPPORT TEAM ACTIVITY
- MODIFICATION OF NATIONAL CONTINGENCY PLAN REFERENCES TO "ENVIRONMENTAL RESPONSE TEAM"
- APPROVAL AND IMPLEMENTATION OF PROPOSED CALL-UP ARRANGEMENT
- AUTHORIZATION FOR NEXT WORKSHOP

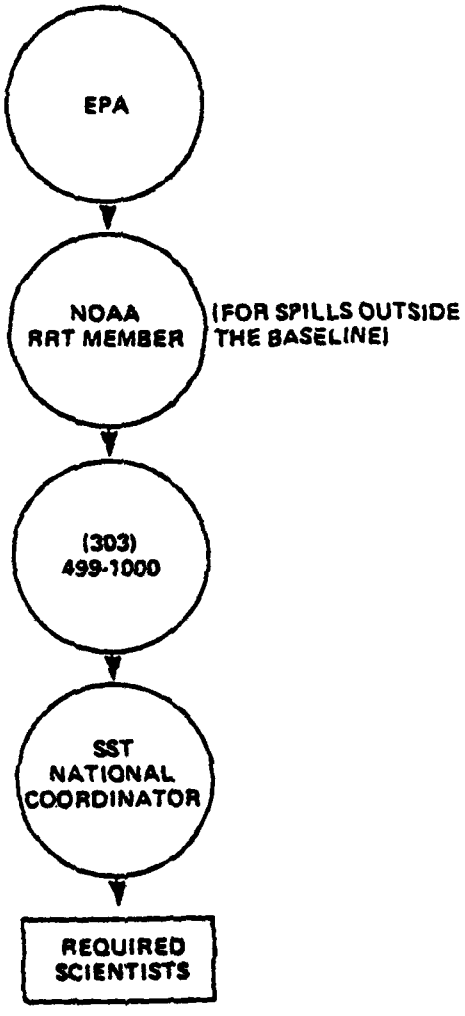
PROPOSED INTERIM CALL UP STRUCTURE
(OUTSIDE ALASKA)

CASE 1. SUPPORT FOR OSC



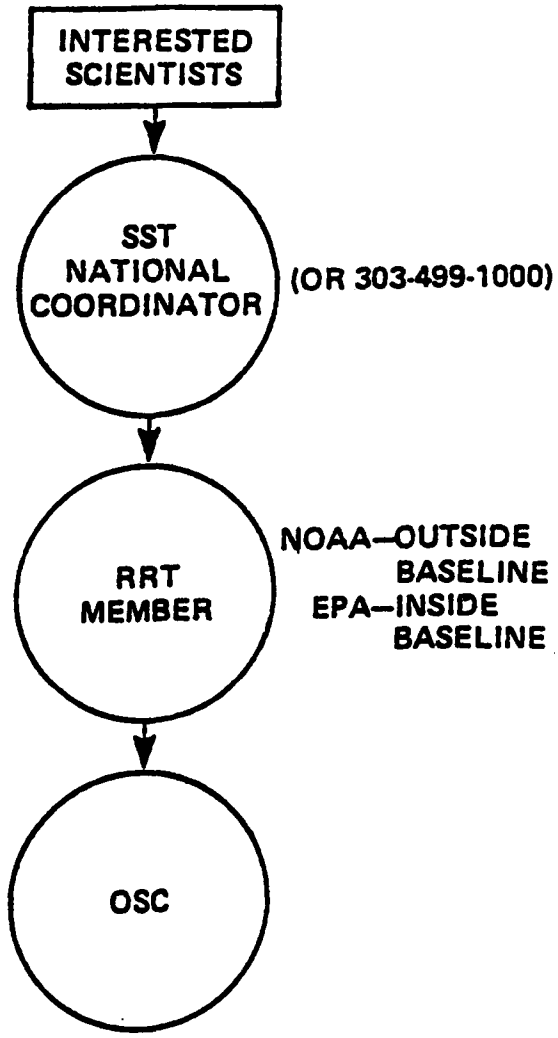
PROPOSED INTERIM CALL UP STRUCTURE
(OUTSIDE ALASKA)

CASE 2. DAMAGE ASSESSMENT ASSISTANCE



PROPOSED INTERIM CALL UP STRUCTURE
(OUTSIDE ALASKA)

CASE 3. RESEARCH



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Professor C. H. Gray
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