PROPOSAL SIGNATURE FORM

THIS FORM MUST BE SIGNED BY THE PROPOSED PRINCIPAL INVESTIGATOR AND SUBMITTED ALONG WITH THE PROPOSAL. If the proposal has more than one investigator, this form must be signed by at least one of the investigators, and that investigator will ensure that Trustee Council requirements are followed. Proposals will not be reviewed until this signed form is received by the Trustee Council Office.

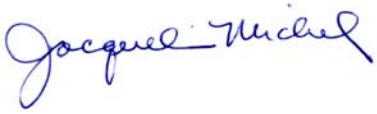
By submission of this proposal, I agree to abide by the Trustee Council's data policy

(*Trustee Council Data Policy**, adopted July 9, 2002) and reporting requirements

*(Procedures for the Preparation and Distribution of Reports***, adopted July 9, 2002).

PROJECT TITLE: Identify and Evaluate Oil Remediation Technologies Applicable to Lingering Oil in Prince William Sound, Alaska

Printed Name of PI: Jacqueline Michel

Signature of PI:  Date: 9 March 2005

Printed Name of co-PI: _____

Signature of co-PI: _____ Date _____

* Available at http://www.evostc.state.ak.us/pdf/admin/datapolicy.pdf

** Available at http://www.evostc.state.ak.us/pdf/admin/reportguidelines.pdf

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Project No: _____
Date Received: _____

GEM PROPOSAL SUMMARY PAGE
(To be filled in by proposer)

Project Title: Identify and Evaluate Oil Remediation Technologies Applicable to Lingering Oil in Prince William Sound, Alaska

Project Period: FY05-FY06

Proposer(s): Jacqueline Michel (email = jmichel@researchplanning.com)
Research Planning, Inc.

Study Location: Prince William Sound, AK

Abstract: Based on studies conducted in 2001, there are 7.8 hectares containing an estimated 56,000 kilograms of subsurface oil in Prince William Sound. This lingering subsurface oil is the source of bioavailable material that continues to threaten sensitive resources. This study will answer the following question: "Is there a clean up strategy that can feasibly be implemented for sub-surface oil in Prince William Sound that would be better than natural recovery?" The study objective is to determine if there are feasible, effective, and environmentally sound cleanup methods that can speed the removal of subsurface oil over that of natural recovery. A systematic evaluation of feasible cleanup methods will be conducted, using criteria based on effectiveness, implementability, operational considerations, and costs. The methods that are of highest feasibility will be further evaluated so as to assess the likely environmental impacts and benefits of remediation, including natural recovery, and the associated costs.

Funding:

EVOS Funding Requested: FY 05 $49,100
(must include 9%GA)

TOTAL: $49,100

Non-EVOS Funds to be Used: FY 05 $36,085

TOTAL: $36,085

Date: 9 March 2005

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Oil from the 1989 *Exxon Valdez* oil spill (EVOS) has persisted to this day, as both surface and subsurface oil residues. Surface oil occurs as highly weathered, asphaltic residues that pose little continuing ecological risk. Subsurface oil, however, occurs as moderately weathered, bioavailable oil residues, and may be causing on-going exposure to intertidal resources in Prince William Sound (PWS). There have been numerous studies on the distribution and persistence of oil in Prince William Sound in the early years after the *Exxon Valdez* oil spill (Gibeaut and Piper, 1998; Neff et al., 1995; Gilfillan et al., 2001; Boehm et al., 1995; Hayes and Michel, 1990). A detailed list of applicable references is included in Section IV. These studies were generally of two types:

1) SCAT surveys (Shoreline Cleanup Assessment Teams) where teams walked the shoreline to document the extent of visual oil, including digging of trenches based on the experience of the team to look for subsurface oil (surveys were conducted in 1989, 1990, 1991, and 1992); and
2) Multi-disciplinary surveys over time at selected sites.

In 2001, the EVOS Trustee Council funded a study to quantify the extent of oil residues in PWS (known as the "big dig"). The key results of this study, published by Short et al. (2004), included:

- There are an estimated 11.3 hectares of lingering oil in PWS
- Of this, 7.8 hectares are contaminated with subsurface oil, with an estimated volume of 56,000 kilograms of oil
- Most of the subsurface oil was visually described as lightly oiled residue (62%) or oil film (11%); only 21% was described as moderately oiled, and 6% as heavily oiled
- Most of the subsurface oil was moderately weathered, with a median concentration of polynuclear aromatic hydrocarbons (PAH) of 68.6 µg/g (excluding the samples described as having only an oil film)
- All of the subsurface oil was fingerprinted as matching oil from the *Exxon Valdez*
- More oil was found in the mid- and lower-intertidal zones than in the upper-intertidal zone
- Most of the subsurface oil occurred in sheltered embayments

Based on the 2001 studies, further field work was funded: the objective of SCAT II was to assess the bioavailability of the lingering oil, and of SCAT III was to more accurately estimate the amount of oil remaining in the northern Knight Island area where otters seem to be recovering slowly. Another objective of SCAT III was to confirm the hypothesized distribution of subsurface oil in the lower intertidal zone (Jeff Short, pers. comm., 2005). These study results have not yet been published.

Because the lingering subsurface oil is thought to pose continuing risks to intertidal resources, the EVOS Trustee Council has requested proposals to identify and evaluate currently available remediation technologies that may be applicable to lingering oil in PWS.

B. Relevance to the RFP

As stated in the Request for Proposals, this study will address the following question:

> "Is there a clean up strategy that can feasibly be implemented for the 28 acres of sub-surface oil in Prince William Sound that would be better than natural recovery?"

Our project will directly answer this question. We will first compile the data from Short et al. (2004) for re-analysis to support the operational analyses needed. We need to characterize the lingering subsurface oil in terms that will allow us to evaluate different remediation options, producing parameters such as likely areal distribution, patch size, tidal elevation, thickness of clean sediments above the oiled layer, thickness of the oiled layer, volume of oil per unit area, grain size on the surface and with depth, and degree of weathering. Based on preliminary analysis, it appears that the upper boundary of most oil horizons is 5-15 cm below the fine sediment surface, and the oil layers are 1-10 cm in thickness.

Using an objective and well-documented evaluation process, we will evaluate and screen potential technologies, then assess the costs and benefits of the most promising methods. The results will be presented in a clearly written and well-documented report and summarized in fact sheets suitable for lay audiences. Our team includes scientists and operational experts who are completely objective and have a high degree of credibility. At the end of this study, the EVOS Trustee Council and agency representatives will be able to confidently answer the above question.

II. PROJECT DESIGN

A. Objectives

The objective of the project is very straightforward:

> Determine if there are feasible, effective, and environmentally sound cleanup methods that can speed the removal of subsurface oil over that of natural recovery.

This work is important because of concerns that lingering oil continues to expose intertidal resources to EVO and is a factor in the recovery of injured resources. As long as the oil persists, particularly the subsurface oil which is only moderately weathered and still bioavailable, there will be concerns about its effects. Also, users of intertidal resources, including subsistence users, will continue to be concerned about the safety of these resources.

B. Procedural and Scientific Methods

The work will be conducted in the following tasks.

Task 1. Gather and re-analyze the data collected by Short and others during the 2001, 2002, and 2003 surveys in PWS on subsurface oil. These data will be used to generate site-specific measurements and summary statistics of areal distribution of oil in a shoreline segment, volume of oiled sediments to be treated, tidal elevation, thickness of clean sediments above the oiled layer, thickness of the oiled layer, volume of oil per unit area, grain size on the surface and with depth, and oil characteristics (n-alkane distribution, PAH distribution, weathering indices, etc.). Jeff Short provided the PAH data for 38 samples collected during the 2001 surveys that were fingerprinted as being EVO based on biomarkers. An initial review of these data shows that the PAHs ranged from 355 ng/g to 14.7 mg/g, with a medium of 68.8 µg/g. Also, the ratio of total PAH to total normal alkanes varies by a factor of 30 in these data, indicating the extent of microbial degradation (i.e., alkane loss) is unrelated to the extent of physical weathering (i.e., PAH loss). The relative rates of alkane and PAH loss are important indicators of the natural rates of microbial degradation and the factors that may be limiting this process. At the end of Task 1, we will have a clear understanding of the types of oil residues that remain in PWS in terms that will allow us to evaluate the effectiveness of different cleanup options.

We feel that these data will be sufficient for our analysis. We will work closely with Short and others to make sure that our analyses are appropriate considering the nature of the data. RPI has in-house data on the geomorphological conditions of the beaches where subsurface oil is likely. These data include 16 survey dates at the long-term monitoring stations that RPI studied for OR&R, NOAA, including detailed chemical characterization of the oil residues over time. Dr. Michel participated in each of these field surveys, as well as conducted SCAT-type surveys in 1989 and 1990. We also have the most recent ESI data for PWS. Dr. Michel conducted all the fieldwork to map the shorelines of PWS in 1999. Thus, Dr. Michel has extensive knowledge of the intertidal habitats in PWS, the nature of the initial oiling, the persistence of subsurface oil, and the issues associated with natural removal of the lingering oil. Mr. Zach Nixon is a Geospatial Data Analyst who has worked with similar types of data to estimate the spatial patterns in oil distribution in intertidal sediments. He was responsible for the extensive data analysis of the RPI study of 800 km of oiled intertidal habitat in along the Saudi Arabia shoreline. In this analysis, he worked with data on the subsurface oil layers as measured in 19,515 pits in oiled intertidal areas. This work required complex geo-spatial data analyses to estimate the volume of oiled sediments by habitat type. The end product will be a summary of the characteristics of the lingering subsurface oil in PWS.

Task 2. Conduct limited fieldwork to validate analyses of Short and others data on oil distribution at selected sites. Dr. John Whitney of OR&R, NOAA has agreed to provide boat support for a field visit as part of his annual survey of long-term monitoring sites in PWS. The field trip is set for June 21 through June 24 corresponding with a good spring tide during daylight hours. We will join this survey team for a few days, visiting a select number of sites to validate the submerged oil data analysis based on the 2001 and 2003 data from Short and others. Either Jeff Short or Mandy Lindeberg have agreed to join us on this survey, to transfer their knowledge of the lingering oil sites and their insights on factors controlling oil persistence.

During this trip, Dr. Michel will meet with the State of Alaska and Federal Agencies and the EVOS Trustee Council to discuss progress and present preliminary findings.

Task 3. Generate a list of promising cleanup technologies that may effect the removal of submerged oil, including natural recovery. Table 1 lists response methods for gravel beaches, as ranked according to their relative environmental impact in the publication "Characteristic Coastal Habitats: Choosing Spill Response Alternatives" published by NOAA (2000). These rankings generally apply to the cleanup of the oil shortly after the spill event, although may of the environmental considerations are applicable even many years later. The lingering subsurface oil in PWS is likely to have chemical and physical characteristics between oil categories III and IV.

The cleanup methods in Table 1 are listed individually, however implementation of cleanup would likely be as a combination of methods, such as sediment reworking and nutrient enrichment, or sediment reworking, flushing, and use of sorbents. The innovation in this project will come from combinations of promising methods. Based on our knowledge of the subsurface oil characteristics in PWS, we will create a list of all feasible cleanup methods and appropriate combinations for removing subsurface oil from porous substrates. These methods will then be characterized as to their description, method for application, and general costs.

Dr. Michel has performed this kind of cleanup evaluation on numerous occasions, including work as the oil spill expert to the World Bank developing cleanup methods and costs for the Komi oil spill in the former Soviet Union that threatened to release oil to the Arctic Ocean. She provided technical oversight of the $55 million cleanup efforts. Based on the quality of her work on the Komi oil spill cleanup, the World Bank again asked her to assist in developing oil remediation strategies and costs for onshore oil pollution in the oil fields of Azerbaijan. She developed response and cleanup costs for worst-case releases from a drilling platform located about 9 miles south of the entrance to Apalachicola Bay, Florida for a project to determine liability requirements for an oil lease owner. On this project, she will use standard rate information for different response equipment, labor, and supplies used in oil spill cleanup, adjusted for costs in Alaska.

Often there is hope that recent developments in oil spill remediation have led to new and promising technologies. In 2003, RPI completed a comprehensive study of the oil remaining along the intertidal habitats in Saudi Arabia where there are 8 million cubic meters of oiled sediments. There are over 7,700 hectares of "dead marsh" with another 5,500 hectares of impacted marsh. All feasible remediation technologies were evaluated. This recent work will greatly facilitate our ability to conduct a comprehensive evaluation of the most promising technologies.

Task 4. Evaluate and screen technologies for applicability to the subsurface oil conditions and habitats in PWS. We will generate a matrix of evaluation criteria based on effectiveness, implementability, operational considerations, and costs. Listed below are the types of criteria that we will use in the matrix, to be modified for the different technologies and combinations.

Table 1. Relative environmental impact from response methods for GRAVEL BEACHES. From the NOAA Marine Manual.

	Category				
Response Method	*I*	*II*	*III*	*IV*	*V*
Natural Recovery	A	A	B	B	B
Barriers/Berms	-	B	B	B	B
Manual Oil Removal/Cleaning	D	C	B	B	A
Mechanical Oil Removal	D	D	C	C	C
Sorbents	–	A	A	B	B
Vacuum	–	-	B	B	B
Debris Removal	–	A	A	A	A
Sediment Reworking/Tilling	D	B	B	B	B
Vegetation Cutting/Removal	–	-	-	-	-
Flooding (deluge)	A	A	B	C	C
Low-pressure, Ambient Water Flushing	A	A	A	B	C
High-pressure, Ambient Water Flushing	–	-	B	B	B
Low-pressure, Hot Water Flushing	–	-	C	B	B
High-pressure, Hot Water Flushing	–	-	C	C	C
Steam Cleaning	–	-	D	D	D
Sand Blasting	–	-	-	-	-
Solidifiers	–	-	B	-	–
Shoreline Cleaning Agents	–	–	B	B	B
Nutrient Enrichment	–	A	A	B	B
Natural Microbe Seeding	–	I	I	I	I
***In-situ* Burning**	–	–	C	C	C

Category Descriptions

I – Gasoline products
II – Diesel-like products and light crude oils
III – Medium grade crude oils and intermediate products
IV – Heavy crude oils and residual product
V – Non-floating oil products

The following categories are used to compare the relative environmental impact of each response method for the specific environment or habitat for each oil type:

A = May cause the least adverse habitat impact.
B = May cause some adverse habitat impact.
C = May cause significant adverse habitat impact.
D = May cause the most adverse habitat impact.
I = Insufficient Information - impact or effectiveness of the method could not be evaluated.
— = Not applicable.

Effectiveness

- Oil removal
- Ability to treat different oil concentrations
- Ability to meet cleanup goal
- Number of waste streams generated and requiring treatment or disposal
- Relative volume or mass of solid and liquid wastes
- Number of treatment processes needed to treat byproducts
- Relative volume of waste to be disposed

Implementability

- Demonstrated effectiveness based on number of full-scale applications completed
- Mobilization time required
- Time to complete
- Climatic sensitivity; Proven ability to work in sub-Arctic conditions
- Complexity of equipment
- Chemical additives
- Safety of operation
- Safety restrictions

Operational Considerations

- Personnel needs
- Complexity of operation/training
- Complexity of operation/maintenance
- Energy/power demand

Costs

- Personnel
- Equipment and supplies
- Logistics
- Waste handling and disposal

A scoring system will be developed to assign points based on a total number of points for each criterion. For example, for the criteria of Safety Restrictions: A score of 0 will be given if personal protective equipment (PPE) requirements include respirator use. Lower PPE requirements will be credited with a higher score (up to 10 points) based on a comparison among technologies. A matrix will be used to evaluate each technology. A minimum total score (75 percent of the maximum possible points) will be required for that technology to be considered appropriate for treating subsurface oil in PWS. We will rely on our own experience in shoreline cleanup at hundreds of oil spills, as well as summary reports such as Zhu et al. (2004) "Literature Review on the Use of Commercial Bioremediation Agents for Cleanup of Oil-Contaminated Estuarine Environments." This recent literature provides the most up-to-date synthesis of the factors controlling and limiting microbial degradation in estuarine settings, including detailed

product evaluations. It will be an important source of guidance on how to evaluate the feasibility of using nutrient augmentation to speed natural recovery of lingering oil residues in PWS. We will consult with Dr. Al Venosa of the USEPA on the appropriateness of bioremediation on the lingering oil in PWS. He was involved in the 1989/90 studies of nutrient augmentation in PWS and has conducted extensive research on use of nutrient augmentation in intertidal habitats since then.

Task 5. Complete costs and benefits analysis. For those methods that are scored above the minimum total score will be further evaluated as to the likely environmental impacts and benefits of remediation, including natural recovery, and the associated costs. Again, a matrix and scoring system will be developed to provide objective evaluations. Listed below are the types of criteria to be included in the costs and benefits matrix.

Effectiveness

- Fraction of oil removal
- Time to complete oil removal

Environmental Impacts

- Length of time needed for disturbed sediments to return to normal distribution
- Length of time for intertidal communities to return to pre-cleanup health
- Potential for acute and chronic toxicity off-site
- Degree of fish and wildlife disturbance during implementation
- Amount of bioavailable oil remaining after termination of cleanup
- Length of time for intertidal communities to return to pre-cleanup health

We will rely on published studies of the recovery of intertidal habitats following the cleanup in PWS after the *Exxon Valdez*, such as Driskell et al. (1996), Lees et al. (1996), and Houghton et al. (1996).

Task 6. Prepare draft final report on study results. The report will describe the candidate oil cleanup technologies evaluated and the methods used completing in the evaluation matrices. To minimize travel costs, we propose to meet the requirement for an oral presentation of the draft final report by teleconference.

Task 7. Prepare a final report that is responsive to comments received. The final report will address all comments on the draft. We will also prepare fact sheets and other summary materials for distribution to the public and other stakeholders.

Task 8. Presentation at the EVOS Symposium. We will present the study results at the 2006 EVOS Symposium.

Task 9. Publication of the study results in the peer-reviewed literature. We will prepare a technical manuscript for publication in an appropriate peer-reviewed journal as soon as the final report is accepted. We will follow EVOS Trustee Council guidelines for acknowledgements. To

reach the appropriate scientific audience, we will consider submitting the manuscript to Marine Pollution Bulletin or Environmental Science & Technology.

C. Data Analysis and Statistical Methods

We will be working mostly with existing data and data compilations. No additional sample collection will be necessary because of the extensive sampling and chemical analysis conducted by Short and others at the NOAA Auke Bay Laboratory during their SCAT I, II, and III surveys in 2001, 2002, and 2003.

D. Description of Project Area

The project area will include those segments of shoreline in PWS where lingering subsurface oil persists.

E. Coordination and Collaboration with Other Efforts (f available)

This proposed study will be conducted in close collaboration with the study Short and others on the amount of lingering oil in PWS. We will rely heavily on the 2001, 2002, and 2003 data collected by Short and others, and we will work closely with them to make sure that we appropriately analyze their data to generate the summaries on subsurface distribution and condition.

We also will be coordinating with researchers from the Office of Response & Restoration, NOAA on the field component. Dr. John Whitney has invited us to join him and others on scientific cruise of PWS to revisit some of the key subsurface oil sites.

III. SCHEDULE

A. Project Milestones

April 1, 2005	Receive notification of project award
June 2005-January 2006	Quarterly reports due
November 16, 2005	Preliminary draft report
November, 2005	Peer Review
January, 2006	Final Report

B. Measurable Project Tasks

FY 05, 3rd quarter (April 1, 2005-July 31, 2005)

Task 1. Gather and re-analyze the data collected by Short and others during the 2001 and 2003 surveys in PWS on subsurface oil
To be completed by 1 June 2005

Task 2. Conduct limited fieldwork to validate analyses of Short and others data on oil distribution at selected sites
To be completed by 30 June 2005

FY 05, 4th quarter (July 1, 2005-September 31, 2005)

Task 3. Generate a list of promising cleanup technologies that may effect the removal of submerged oil, including natural recovery
To be completed by 1 August 2005

Task 4. Evaluate and screen technologies for applicability to the subsurface oil conditions and habitats in PWS
To be completed by 1 September 2005

Task 5. Complete costs and benefits analysis
To be completed by 31 September 2005

FY 06, 1st quarter (October 1, 2005-December 31, 2005)

Task 6. Prepare draft final report on study results
To be completed by 16 November 2005

FY 06, 2nd quarter (January 1, 2006-March 31, 2006)

Task 7. Prepare final report
To be completed by January 2006

Task 8. Present results at 2006 EVOS Symposium
To be completed by January 2006

Task 9. Submit manuscript to peer-reviewed journal
To be completed by January 2006

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

1. How will affected communities be informed about the project and be given an opportunity to provide their input?

We propose to meet with members of Chenega during the site visit in June 2005, to discuss the project goals and solicit their input. We propose to work most closely with Mr. Pete Komkoff who has been involved with the work by Jeff Short and others on the lingering oil in PWS. Several members of Chenega and Tatitlik were involved in the field work on these studies, responsible for excavation of the many thousands of trenches to find the lingering oil. They have first-hand experience in how much oil remains, where it occurs, and the difficulty of working on the cobble-boulder beaches in the intertidal zone in PWS. We have asked that the staff at the

NOAA Auke Bay Laboratory who worked with them on the previous projects assist us in re-establishing communications with members of Chenega and Tatitlek and solicit their input.

2. How will research findings and other project information be communicated to local communities?

We will produce fact sheets and other summary materials that will be made available to local communities. We will rely on guidance from the EVOS Trustee Council on the best methods for distribution of these materials.

3. To what extent will local hire be used for the acquisition of such things as vessels, technicians, and equipment?

There is no need for local hire because no local work or services are being contracted out.

4. To what extent will traditional and local knowledge be incorporated into the project?

We have made plans to visit with members of Chenega village during the site visit in June 2005, to explain the current project and solicit their input.

B. Resource Management Applications

There are no direct resource management applications associated with our proposed project.

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Sugai, S.F., J.E. Lindstrom, and J.F. Braddock. 1997. Environmental influences on the microbial degradation of *Exxon Valdez* oil on the shorelines of Prince William Sound, Alaska. Environmental Science and Technology, Vol. 31(5), pp. 1564-1572.

Zhu, X., A.D. Venosa, and M.T. Suidan, 2004. Literature review on the use of commercial bioremediation agents for cleanup of oil-contaminated estuarine environments. EPA/600/R-04/075, National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, 56 pp.

JACQUELINE MICHEL, PH.D.
Geochemist, President of Research Planning, Inc.
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EDUCATION

Ph.D., Department of Geology, University of South Carolina (USC), Columbia (1980).
M.S., Department of Geology, USC, Columbia (1976).
B.S., Department of Geology, USC, Columbia (1974).

PROFESSIONAL CREDENTIALS

Phi Beta Kappa
First in graduating class (August 1974), USC
Carolina Geological Society
Sigma Xi
Distinguished Alumni Achievement Award, 2002, College of Science and Mathematics, USC
Registered Geologist, South Carolina
Member, Ocean Studies Board, National Academies 2001-present
Chair, NRC Committee on Spills of Emulsified Fuels: Risks and Response (2002)
Chair, NRC Committee on Dispersants Effectiveness and Effects
Member, NRC Committee on Oil in the Sea III (2003)
Member, NRC Committee on Spills of Nonfloating Oils: Risks and Response (1999)
Lifetime Associate, National Academies
Member, Science Advisory Panel to the U.S. Commission on Ocean Policy (2004)
Co-creator of the concept of Environmental Sensitivity Index (ESI) mapping; has mapped many shorelines, including Prince William Sound (1999), Southeast Alaska, Southern Alaska Peninsula, Cook Inlet and Kenai Peninsula, and Bristol Bay
Wrote the Shoreline Assessment Manual for NOAA, which includes SCAT procedures and recommended cleanup methods for all shoreline types
Has responded to hundreds of oil spills, providing recommendations for shoreline cleanup, including manual, mechanical, chemical, *in-situ* burning, and biological technologies.

FIVE RECENT PUBLICATIONS RELATED TO THE LINGERING OIL PROJECT

Hayes, M.O. and J. Michel, 2001. A primer for response to oil spills on gravel beaches. 2001 International Oil Spill Conference, API Publ., American Petroleum Institute, Wash., D.C., pp. 1275-1279.

Michel, J. and M.O, Hayes, 1999. Weathering patterns of oil residues eight years after the *Exxon Valdez* oil spill: Marine Pollution Bull., Vol. 38, pp. 855-863.

M.O. Hayes and J. Michel, 1999. Factors determining the long-term persistence of *Exxon Valdez* oil in gravel beaches: Marine Pollution Bull., Vol. 38, pp. 92-101.

Michel, J. and B. Benggio, 1999. Guidelines for Selecting Appropriate Cleanup Endpoints, in Proc. 1999 Intl. Oil Spill Conference, American Petroleum Institute, Wash., D.C.

Michel, J. and M.O. Hayes, 1996. Evaluation of the condition of Prince William Sound shorelines following the *Exxon Valdez* oil spill and subsequent shoreline treatment: volume II: 1994 geomorphological monitoring survey, July 1994. Prepared for the Hazardous Materials Response and Assessment Division, NOAA, Seattle, Wash., 120 pp. + appendices.

PERSONS WITH WHOM DR. MICHEL HAS COLLABORATED ON A PROJECT OR PUBLICATION WITHIN THE LAST FOUR YEARS:

Al Allen, Spiltec, Inc.
Ann Heyward Walker, Scientific & Environmental Associates, Inc.
Barry Drucker, Minerals Management Service
Brad Benggio, Office of Response & Restoration, NOAA
Bruce Stein, NatureServe
Charlie Henry, Office of Response & Restoration, NOAA
Christina Sames, Office of Pipeline Safety, DOT
Cortis Cooper, ChevronTexaco
Dan Walker, Ocean Studies Board, National Academies
Dagmar Etkin, Environmental Research Consulting
Dave Andersen, National Park Service
Debbie French, Applied Science Associates, Inc.
Debbie Scholz, Scientific & Environmental Associates, Inc.
DeWitt Braud, Louisiana State University
Don Aurand, Ecosystem Management & Associates, Inc.
Doug Helton, Damage Assessment Center, NOAA
Ed Owens, Polaris Applied Sciences, Inc, (co-author, IOSC paper on ESI mapping in the Arctic)
Gordon Watts, Tidewater Atlantic Research, Inc.
James Coleman, Louisiana State University
James R. Payne, Payne Environmental Consultants, Inc.
Jay Johnson and Dale Hardin, Applied Marine Sciences, Inc.
Jon Brolin, Louisiana Oil Spill Coordinators Office
Jon Waldron, Blank Rome Law Firm
Keith Michel, Herbert Engineering
Maria de Fatima Guadalupe Meniconi, Petrobras
Mark Curry, Industrial Economics, Inc.
Mark Griswold, Tetra Tech, FW, Inc.
Norman Meade, Damage Assessment Center, NOAA
Pat Cuty, U.S. Coast Guard
Peter McGowan, US Fish and Wildlife Service
Richard Greer, Golder Associates, Inc.
Rob Nairn, Baird & Associates, Inc.
Robert Urban, PCCI, Inc.
Trevor Gilbert, Australian Maritime Safety Authority
Vernica Verela, US Fish and Wildlife Service

BUDGET JUSTIFICATION

I. PERSONNEL: amount requested - $34,400.00

This section is broken down into cost for three individuals. They are as follows:

Dr. Jacqueline Michel – Principal Investigator
Dr. Michel is budgeted for 2.1 person-months of effort at a cost of $28,700.00. Dr. Michel will do the field work and generate the draft and final reports and make all presentations.

Zach Nixon – GIS/Data Analyst
Mr. Nixon is budgeted for 1.1 person-months of effort at a cost of $5,300.00. Mr. Nixon will analyze the data to estimate the spatial patterns in oil distribution in intertidal sediments.

Wendy Early – Word Processing
Ms. Early is budgeted for 0.1 person-months of effort at a cost of $400.00. Ms. Early will provide word processing support to the project.

II. TRAVEL: amount requested - $4,900.00

This section is broken down into costs for two trips for Dr. Michel at a cost of $3,500.00. One trip for NOAA Auke Bay lab staff at $700.00. One air charter to Prince William Sound for $500.00 and ground transportation cost for $200.00.

III. CONTRACTUAL: amount requested - $4,000.00

This section is to cover the required agency fee of 9%.

IV. COMMODITIES: amount requested - $500.00

This section is for the cost of field supplies ($100.00), communication ($100.00), mailing/shipping ($200.00) and miscellaneous costs ($100.00).

V. INDIRECT COSTS: amount requested – 15% of personnel costs or $5,200.00.

This section consists of a percentage of Research Planning, Inc.'s (RPI's) overhead rate. This rate is 120% based on its overhead costs less unallowable items shown as a percentage of its direct labor costs. Cost elements in the applicable pool include overhead salaries, supplies, communication, utilities, rent, accounting, and miscellaneous costs. The treatment of these costs is in accord with established accounting practices. Of RPI's 120% overhead rate we are requesting 15% ($5,200.00) to be budgeted for this project. The balance of RPI's overhead cost, 105% ($36,085.00) will be contributed as an in-kind contribution by Research Planning, Inc. to this project.

CURRENT AND PENDING SUPPORT FORM

The following information must be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jacqueline Michel	Other agencies to which this proposal has been/will be submitted: None

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Environmental Support Services – task order contract for ESI Mapping, Training, Spill Response

Source of Support: Hazardous Materials Response Division

Total Award Amount: $500,000/yr Total Award Period Covered: 2002-2007

Location of Project: USA wide

Months of Your Time Committed to the Project: FY05 2.5 FY 06 2 FY 07 2 Sumr: 6

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Natural Resource Damage Assessment Technical Support – task order contract

Source of Support: NOAA Damage Assessment Center

Total Award Amount: $ 100,000/yr Total Award Period Covered: 2002-2007

Location of Project: USA wide (currently working in Buzzards Bay and Delaware River)

Months of Your Time Committed to the Project: FY05 2 FY 06 2 FY 07 ? Sumr: 4

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Environmentally Sound Management and Development of Federal Offshore Sand Borrow Areas Along the US East and Gulf of Mexico Coasts

Source of Support: Minerals Management Service Sand and Gravel Unit

Total Award Amount: $ 450,000 Total Award Period Covered: 2000-2006

Location of Project: East and Gulf of Mexico coasts

Months of Your Time Committed to the Project: FY05 1 FY 06 1 FY 07 Sumr: 2

Support: x Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Pipeline Data Collection and Identification of Unusually Sensitive Areas

Source of Support: Office of Pipeline Safety

Total Award Amount: $ 1,500,000 Total Award Period Covered: 2001-2006

Location of Project: USA wide

Months of Your Time Committed to the Project: FY05 2 FY 06 1 FY 07 Sumr: 3

*If this project has previously been funded by another entity, please list and furnish information for immediately preceding funding period.

The following information must be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jacqueline Michel	Other agencies to which this proposal has been/will be submitted: None

Support: ☐ Current X Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Natural Resources Damage Assessment – Obed Wild and Scenic River, Tennessee

Source of Support: National Park Service

Total Award Amount: $125,000 Total Award Period Covered: 2005-2006

Location of Project: Wartburg, Tennessee

Months of Your Time Committed to the Project: FY05 1.5 FY 06 1 FY 07 Sumr: 4

Support: ☐ Current X Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Natural Resource Damage Assessment – Guanabara Bay Oil Spill

Source of Support: Petrobras

Total Award Amount: $ 40,000 Total Award Period Covered: 2006-2007

Location of Project: Brazil

Months of Your Time Committed to the Project: FY05 0 FY 06 FY 07 0.5 Sumr: 0.75

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Months of Your Time Committed to the Project: FY05 FY 06 FY 07 Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Months of Your Time Committed to the Project: FY05 FY 06 FY 07 Sumr:

*If this project has previously been funded by another entity, please list and furnish information for immediately preceding funding period.

DATA MANAGEMENT AND QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) STATEMENT

All of the projects conducted by RPI undergo internal QA/QC review to assure that the final product is the highest quality possible. The QA/QC program has been developed over years of producing high quality applied research and reports. Because RPI often works with large data sets, data management is an integral component of most of our projects. On any given project, RPI's Project Manager works with a designated GIS analyst who is responsible for organization and management of the data.

Since we will be working with mostly with existing data and data compilations, no additional sample collection will be necessary. Re-analyses of existing data will be used to generate site-specific measurements and summary statistics of areal distribution of oil in a shoreline segment, volume of oiled sediments to be treated, tidal elevation, thickness of clean sediments above the oiled layer, thickness of the oiled layer, volume of oil per unit area, grain size on the surface and with depth, and oil characteristics using existing off-the-shelf statistical and other software packages. The emphasis in both the data management and the QA/QC components of this project will therefore be on accurate incorporation of these data into databases that will be used for further analyses and interpretation. All of the results will go through RPI's internal verification and validation processes to assure quality and accuracy.

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

Budget Category:	Proposed FY 05		TOTAL PROPOSED	
Personnel	$34.4		$34.4	
Travel	$4.9		$4.9	
Contractual	$0.0		$0.0	
Commodities	$0.5		$0.5	
Equipment	$0.0		$0.0	
Subtotal	$39.8		$39.8	
Indirect (rate will vary by proposer)	$5.2		$5.2	
Project Total	$45.0		$45.0	
Non-Trustee Agency (9% of Project Total)	$4.1		$4.1	
Total Cost	$49.1		$49.1	

Comments:
Indirect Costs: 15% of personnel costs overhead rate - $5.2

Cost Share Funds:
$36,085 In-kind contribution for personnel overhead by Research Planning Inc.

FY 05

Date Prepared:

Project Number: 050778
Project Title: Identify and Evaluate Oil Remediation Technologies Applicable to Lingering Oil in PWS
Proposer: Jacqueline Michel
Agency: NOAA

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

Personnel Costs:			Months	Monthly		Personnel
Name	Description		Budgeted	Costs	Overtime	Sum
Jacqueline Michel	PI		2.1	13.8		28.7
Zach Nixon	GIS/Data Analyst		1.1	4.8		5.3
Wendy Early	Word Processing		0.1	3.5		0.4
		Subtotal	3.3	22.1	0.0	
					Personnel Total	$34.4

Travel Costs:	Ticket	Round	Total	Daily	Travel
Description	Price	Trips	Days	Per Diem	Sum
Airfare for 2 RTs to Alaska - Michel	1.0	2	10	0.2	3.5
Airfare for 1 NOAA Auke Bay Lab Staff	0.5	1	4	0.1	0.7
Air Charter to PWS	0.5	1			0.5
Ground Transportation	0.2	1			0.2
				Travel Total		$4.9

FY 05

Project Number: 050778
Project Title: Identify and Evaluate Oil Remediation Technologies Applicable to Lingering Oil in PWS
Proposer: Jacqueline Michel
Agency: NOAA

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

Contractual Costs:	Contract Sum
Description	
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual Total**	$0.0

Commodities Costs:	Commodity Sum
Description	
Field Supplies	0.1
Communications	0.1
Mailing/Shipping	0.2
Miscellaneous	0.1
Commodities Total	$0.5

FY 05

Project Number: 050778
Project Title: Identify and Evaluate Oil Remediation Technologies Applicable to Lingering Oil in PWS
Proposer: Jacqueline Michel
Agency:NOAA

EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05 - FY 07

New Equipment Purchases:	Number	Unit	Equipment
Description	of Units	Price	Sum
		New Equipment Total	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY 05

Project Number: 050778
Project Title: Identify and Evaluate Oil Remediation Technologies Applicable to Lingering Oil in PWS
Proposer: Jacqueline Michel
Agency: NOAA