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MANAGING ENVIRONMENTAL RISKS

A Workshop for the Minerals Management Service Alaska OCS Region

MMS U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

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ABSTRACT

This report presents a summary of a risk management workshop held in Anchorage, Alaska during 1992. The workshop provided lectures and structured case-study exercises on three major topics critical to effective risk management: risk perceptions, risk communication, and risk negotiation. The five workshop faculty used techniques drawn from decision analysis, economics, and psychology to provide participants with experience in structuring risk problems, defining and measuring stakeholder objectives, and establishing tradeoffs as a means for evaluating the risks, costs, and benefits of project alternatives. Group discussions emphasized the potential for employees of the Minerals Management Service to improve current practices by adapting state-of-the-art techniques that attend to the process and procedures used in developing risk management policies as well as the expected outcomes of managers' decisions. The results of an example case study, based on proposed Lease Sale 149, are presented to illustrate insights provided by use of the recommended risk management techniques.

1. INTRODUCTION

The knowledge of environmental risk-management procedures is increasingly being viewed as an element critical to the success of federal resource management agencies. Not too many years ago the announcement of a new development activity, involving a proposal for exploration or extraction of a resource, would have generated very little controversy. Today that is no longer the case, and plans for the use of public resources typically are the subject of intense public scrutiny.

At the center of this concern are questions about the short- and long-term impacts of a proposed resource management action on human health and the natural environment. Over the coming decades, the economic success and social acceptance of resource management activities are likely to depend vitally on public attitudes and on the role played by both expert and public inputs to risk-management decision processes. For government as well as industry, this means that an appropriate range of perspectives on risk must be incorporated as part of any analysis of the costs and benefits of project alternatives. Understanding this diverse range of views, and knowing how to incorporate these different perspectives and values as part of an explicit resource management plan, is therefore an important skill that is quickly becoming a requirement for the successful resource manager (Morgan 1981a,b).

The workshop, *Managing Environmental Risks,* provided an in-depth review of risk-management procedures for employees of the Minerals Management Service (MMS) in Anchorage, Alaska and for some of the key stakeholders interested in the process and outcomes of MMS activities in Alaska. The workshop emphasized issues of risk perceptions, the use of decision and risk analysis, and negotiation with stakeholders in the context of risk-management decisions. In addition, the workshop examined several case studies designed to provide hands-on experience to MMS employees in the use of risk management tools and in the application of these tools as aids to defensible resource allocation decisions.

The workshop covered a number of topics considered to be key elements of an effective risk management strategy. The principal analytic focus was based on the techniques of decision analysis, which provides a useful conceptual framework and analytical tool kit for addressing difficult choices. Over the past three decades, decision analysis has proven its value in a variety of applications ranging from personal decisions to corporate strategy and government policy. Use of decision-analysis techniques focuses attention on three steps in the decision process:

a. Structuring the important issues in a risk-decision situation: who are the key interested parties or stakeholders? What are the important values? What are the key tradeoffs?

b. Identifying, understanding, and quantifying the principal source(s) of uncertainty: is uncertainty due to imperfect information? Limited expert knowledge? Expert disagreements?

c. Understanding how personal and social objectives relate to the decision situation and possible outcomes: What weights are attached to the objectives of key stakeholders? How do these various objectives relate to the alternative actions that can be taken by MMS and other resource-management agencies?

The workshop used this overall decision-aiding framework to address a number of specific issues relevant to MMS resource management decisions. These issues come from a variety of disciplinary backgrounds and require different, albeit complementary, tools. One important topic was public and community *risk perceptions*, which requires an understanding of the elicitation procedures

and survey results used to interpret public risk attitudes. Information on risk perceptions needs to be integrated with technical risk information as part of an integrated policy for risk management decision making. Another topic was *risk communication*, which addresses methods for two-way communication between experts and different public groups. Successful communication about environmental risks requires a sensitivity to the acceptability of alternative decision processes, to the importance of context in risk perception issues, and to the concerns of the media and the needs of a variety of stakeholder groups. Another topic was *negotiation and mediation*, which involves the interactive elicitation and balancing of health and environmental concerns among potentially affected parties. Details of the workshop schedule are provided in Section 3 of this report.

2. WORKSHOP OBJECTIVES

Detailed plans for the workshop were based on discussions with MMS officials over the past several years about the types of risk management problems typically faced by MMS resource managers. Workshop objectives were defined in terms of three central themes:

- **Basic Issues in Environmental Risk Management.** To provide workshop participants with information on the basic issues and techniques of risk management, the acceptability of risk decision processes, risk communication, risk perception, and risk amplification.

- **Techniques and Use of Decision Analysis.** To provide participants with experience in decision analysis, focusing on identifying stakeholder groups, defining objectives and measurable attributes, and establishing trade-offs as a means for evaluating the risks, costs, and benefits of project and action alternatives. Included as part of this task is information on working with stakeholder groups.

- **Approaches for Resolving Environmental Disputes.** To provide participants with hands-on experience in negotiation and mediation practices, using that experience in decision-analysis techniques to generate acceptable tradeoffs relating to the development of off-shore gas and oil resources.

  In each of these major topics the workshop provided access to a number of different related skills. These included:

  - a review of the relevant literature, stressing key concepts and recent trends among researchers and practitioners. A manual of risk-management techniques and procedures, emphasizing the risk management issues most relevant to offshore oil and gas lease decisions, was sent to all participants prior to the start of the workshop. This manual included extensive supplementary reading materials as well as an overview of the planned workshop.

  - an introduction to the relevant analytical skills, designed to provide a knowledge level sufficient to intelligently propose, interpret, and review studies.

  - a review of recent legislation that has a bearing on resource management activities.

  - hands-on experience in the use of risk management methods, techniques, and procedures.

  - a practical introduction to the processes and procedures for implementation of different risk management methods and studies.

3. ORGANIZATION OF THE WORKSHOP

The workshop took place in Anchorage, Alaska over nine days. Two three-day sessions took place during March, 1992 and a third three-day session, focusing on an in-depth illustrative case study, occurred in June. A detailed schedule for the workshop is shown in Appendix A.

Participants in the workshop were invited by the Alaska OCS Region, Minerals Management Service, and considered as stakeholders: persons who hold an interest in the process and outcomes of MMS decisions. Criteria for the selection of stakeholders included past participation in lease-sale assessment and evaluation processes as well as an expressed interest in the activities of the Alaska MMS. In addition, an attempt was made to provide a comprehensive range of the diverse values that might be associated with a proposed offshore gas or oil lease sale. Participants included representatives of federal and state government interests, fishing interests, local and community interests, native interests, local and national environmental interests, and oil exploration and development interests; names of participants are shown in Appendix B. We encouraged the attendance of more than one representative from each of the groups, so as to allow for a broad-based discussion of each stakeholder's perspective. At the same time, we wanted to keep the total number of participants at twenty-five or less in order to facilitate discussion.

Before the start of the workshop, a letter was sent from MMS to each of the designated groups. The letter explained the purpose of the stakeholder workshop, indicated the importance of participation by the group, and asked for the names of committed representatives. The workshop was described as a tutorial in risk-management methods, which would not itself be making any decisions but that instead would provide information about stakeholder objectives and lease-sale alternatives. The letter also described the location of the workshop and case study, its duration, and essential logistical information.

The first two sessions of the workshop were based on a series of 60-90 minute presentations by the workshop staff on various aspects of risk-management decisions, interspersed and guided by comments and questions from participants. The third session involved the application of these risk-management concepts to an important case-study example, The Cook Inlet/Shelikof Strait Planning Area Oil and Gas Lease Sale 149. The content of Sessions 1 and 2 is summarized in Sections 4, 5, and 6 of this report: the results of Session 3 are summarized in Section 7.

The five-person workshop staff all have extensive experience in the use of risk management techniques and procedures in the context of resource allocation decisions. All faculty have previously taught courses and workshops in risk management, risk assessment and perception, or in decision analysis. They also are leading researchers in the fields of risk-management decision making —including decision analysis, risk perceptions, risk communication, and negotiation— and have extensive practical experience as consultants to resource-management agencies.

The workshop leader was **Robin Gregory**. Dr. Gregory's fields of specialization are risk management, natural resource policy, and decision making. He has taught courses and workshops in environmental risk management and decision making and he has frequently worked as a consultant to the U.S. government on risk regulation and decision policies. **Ralph Keeney** and **Detlof von Winterfeldt** are decision and risk analysts who have made important contributions to the theory and practice of both risk analysis and behavioral decision making. **Donald MacGregor** is a cognitive psychologist who has worked extensively on problems of risk communication and risk perceptions. **Robert Clemen** has a special interest in negotiation strategies and in decision making under uncertainty.

4. OVERVIEW OF THE RISK-MANAGEMENT PROCESS

The goal of the risk-management process is to aid in the selection of an action that will improve the overall welfare of society, including consideration of its human health, economic wealth, and environmental well-being. This requires two principal types of information. One type is concerned with the *content* of the risk assessment and evaluation: information about the values and perceptions of stakeholders, information about the alternative actions that might be undertaken, and information about the human and environmental consequences of these actions. The other type of information deals with the *process* by which decisions are made: who is to be involved and when, what are the agendas, to what extent is power shared, how will stakeholders interact, and how study results should be passed on to decision makers.

Risk assessment and evaluation do not make decisions but serve as aids to decision making and policy development. In this light, an effective process must not only be acceptable on social and technical grounds; it also should communicate clearly to decision makers and (when appropriate) facilitate implementation of the action or project that is selected by the agreed-upon decision process.

The risk-management process outlined during the workshop is composed of eleven principal tasks. These eleven tasks are closely related and their designation as separate entities is somewhat arbitrary (i.e., alternative lists of eight or fifteen tasks easily could be constructed). There is no magic to these eleven tasks: following through with them does not guarantee acceptance of a risk-management procedure. However, on the basis of both theory and experience, we believe that paying attention to these concerns will substantially increase the probability that the significant risk-management issues relating both to content and process will be clearly and explicitly addressed.

4.1. Structuring Facts and Values

There are four interdependent steps to structuring a resource allocation decision. The first is to *establish the decision context.* In most cases, the different parties concerned with the outcome of a decision will have different perspectives on setting an appropriate context. For example, a government agency may view the decision to develop a resource base in very specific economic or environmental terms whereas interest groups may view the decision more broadly, stressing its symbolic value and the precedent that will be set. Such disagreements are natural and typically cause problems only when the proponent explicitly or implicitly rules out aspects of the decision that others consider to be important. As a general rule, consensus is most likely if an agreement is made to accept the narrowest decision context that is acceptable to all parties.

The second step in structuring a decision is to *specify the objectives* to be achieved (Keeney 1988). This requires that all the interested parties probe their values to find out what matters to them about the decision. If someone cares about a possible consequence then it is important and merits consideration in the evaluation; if no one cares then the concern is irrelevant. The objectives of the stakeholders denote the basis for their values.

The third step in structuring is to *identify alternative projects or actions* that can satisfy the stated objectives. The alternatives are created in response to the stated values of stakeholders, which makes sense: the only reason why an alternative might be favored in the first place is because it is particularly successful at satisfying the objectives important to some person or to some group. A consensus listing of alternatives therefore would include all those actions or projects considered to be legitimate possibilities for satisfying expressed values.

The fourth step is to *identify and structure uncertainties*, such as the risks to human health from spills or the toxicity to coastal wetlands due to continuous, low-dose emissions.

4.2. Identifying Stakeholders

The objectives are held by stakeholders, defined as any party with an expressed interest in the process or outcome of a decision. Stakeholders can be large groups of people or they can be single individuals. It is important that the selected stakeholders include a diverse and representative range of views, including (for example) the proponent of the proposed action and a variety of public and governmental groups as well as critics who might oppose portions or all of the planned activity (Edwards and von Winterfeldt 1987).

Of course, this plea for comprehensiveness creates a problem because to some extent everyone's perspective is different and usually there are severe constraints of time and money placed on the risk management process. The practical solution is twofold. First, risk managers should attempt to incorporate a range of views, emphasizing (in terms of stakeholder selection) diversity of perspectives and credibility rather than depth. Second, the elicitation process should be regarded as iterative rather than one-time, thereby allowing the opportunity for groups or individuals whose views inadvertently have been omitted to voice their concerns as part of a second or third round of elicitations.

4.3. Eliciting Stakeholder Objectives

Objectives are elicited during scheduled, individual interviews with representatives from each of the stakeholder groups. These interviews help participants to articulate explicitly the values they feel should be used to assess project and action alternatives. Structuring objectives requires the definition of both an object of concern (e.g., disruption of lifestyles) and a direction of preference (e.g., less is better than more).

The objectives elicited from each stakeholder group are documented by the elicitor and later circulated to the participants for their comments. Several additional steps can be taken in order to make the results more useful to decision makers. For example, the individual values can be arranged hierarchically, so that specific values (e.g., losses of particular endangered species) are grouped as part of more general values (e.g., the potential loss of any endangered or threatened species). In addition, means objectives, which are important because of their effect on something else, can be distinguished from fundamental or ends objectives, which are of concern in and of themselves.

Because objectives denote the values of concern to participants, distinctions such as "objective" vs. "subjective" criteria are not useful. If people's perceptions regarding a value differ from those of the technically trained experts (e.g., a significant concern exists regarding a type of impact that experts believe to be unimportant or very unlikely), then decision makers should look at this difference as a source of information. The effect of such perceptions on utility, or welfare, is no less real than that of technically-supported beliefs. Numerous studies (e.g., Slovic 1987a) have shown that experts typically are concerned with attributes relating to the ultimate effects of a project (e.g., can it lead to human illnesses or losses in an animal population?) whereas public stakeholders typically are also concerned about impact pathways (e.g., is exposure voluntary or involuntary? Is it easy to control releases after an accident? Are effects experienced immediately or are they delayed?). Stakeholders also care about process values in addition to outcome considerations. These distinctions serve to broaden the range of objectives legitimately considered as part of environmental-risk assessment.

4.4. Developing Measures and Ranges for the Objectives

Each of the objectives expresses a concern; to be useful for purposes of the analysis the objectives must be defined in clear and operational terms. For example, one of the objectives that often is expressed in the context of a resource development option is to provide for the creation of additional jobs. Despite the apparent clarity of this objective (i.e., everyone knows what is meant by a job, and more jobs generally are considered better than fewer), two considerations must be addressed:

a. Exactly what is meant by a job? Is an 8-hour/day job the same as a 4-hour/day job? Is a seasonal job the same as a year-round job? Is a management-level job the same as a minimum-wage job? Is a job for locals the same as a job for in-migrants? Thus the attributes of the designated job must be carefully defined so that everyone shares a common understanding when evaluating alternatives.

b. What is the range of impacts on employment (a maximum of 2, 20, or 2000 8 hours/day, year-round, minimum-wage jobs for locals) that could result from the actions under review? This consideration is important in a later stage of the analysis, when tradeoffs are made across objectives. For example, consider a forestry project that requires a tradeoff between jobs and a key environmental indicator such as spotted owl habitat. Which is most important, jobs or owls? If the impacts of the project include a potential loss of 20,000 jobs in order to protect one-half acre of spotted-owl habitat, then most people would agree that the potential job loss is more important than the habitat loss and the project should not be undertaken. On the other hand, if the impacts include a potential loss of 2 jobs in order to protect one million acres of spotted-owl habitat, then most people would agree that preservation of the habitat is more important than the expected job loss and the project should go ahead. The example illustrates the point that tradeoffs, or assessments regarding the relative importance of different objectives, cannot be made in the absence of determinations of the range of possible impacts.

Measures and ranges for the objectives are elicited from stakeholders as part of scheduled discussions that can take anywhere from one to several hours. As part of these discussions the analyst typically will be required to question participants extensively in order to develop a final listing of objective measures that are clear, unambiguous, and can be measured to an acceptable degree of accuracy within the anticipated resource and time constraints of the project. This points out an important difference between the proposed risk-management approach and the usual scoping process. The output of a scoping session typically is an ill-defined set of concerns whose inclusion in formal project analyses remains problematic. In contrast, the output of a structured values-elicitation session is a clearly defined set of measures for the attributes of interest to stakeholders.

Measures of the objectives are defined in terms that make sense to stakeholders (Keeney 1988). For some concerns, such as fatalities to shorebirds that might result from a chemical spill, *natural scales* exist that provide easily understood measures of the value: 300 shorebirds killed is worse than the loss of 25 birds. For other concerns, such as the boom-bust cycle that sometimes accompanies resource-development projects, *constructed scales* will provide indices of the value: significant disruption of lifestyles and the influx of 1,000 workers for six months is worse than a moderate disruption and the influx of 100 workers for five years. The use of constructed scales is a major advantage of the decision-analysis approach because it provides a mechanism for making tradeoffs directly among objectives and subobjectives in terms that come from the stakeholders themselves.

Formally, consideration of the relative desirability of different attribute levels requires the development of single attribute utility functions, which scale the attributes of values to permit their detailed consideration. For example, assessment of the environmental attribute "percent reduction of elk population in range X" would require a stakeholder representative to express both a direction (e.g., smaller percentages are preferred) and the relative desirability among scale levels for this attribute (e.g., is the step from 0% to 25% more or less undesirable than the step from 25% to 50%?). However, such detailed consideration of the form of the utility function is not required in many cases; instead, the insights provided by developing a clear structure of stakeholder values may provide sufficient insight into the nature of a preferred solution that decision makers are able to move forward without needing a formal, complete analysis.

4.5. Building a Common Value Tree

Objectives elicited from individual groups can be combined with those of other groups to create a common value tree. This listing recognizes similarities across the expressed values but includes all of the values expressed by all of the participants.

This task, as with other aspects of the elicitation process, requires careful documentation of the judgments made by the analyst. For example, the analyst might consider that impacts on village lifestyles and impacts on rural communities can be combined into a single social or cultural indicator, thus eliminating overlapping or redundant impact categories. Alternatively, the analyst might consider that equity concerns regarding Alaska's economic position *vis a vis* "the lower 48" is a natural subobjective to be included as part of concerns regarding Alaska's socioeconomic position *vis a vis* the world. These actions may be helpful, in that they increase the clarity of the final common value tree, or they might result in an unintended disservice to the exact meaning of the value expressed by a stakeholder; in either case, the ultimate authority should remain the stakeholders themselves.

The resulting value models can be very informative concerning the sources and importance of differences among stakeholder groups. For example, experience suggests that stakeholders will agree on the main value categories but differ in the level of detail to which they develop particular categories and the importance they assign to values at upper levels of the common value tree (Gregory, Keeney, and von Winterfeldt 1992). Disagreements among stakeholder groups about the appropriate value trade-offs then will serve as a clue to where sensitivity analyses might lead to different rankings of the project alternatives under consideration.

4.6. Creating Alternatives

In a typical evaluation, the alternative favored by the proponent will receive detailed consideration in terms of those impacts considered to be most relevant to its review. Other alternatives usually will be considered as well but their review often is less complete. The chronology of the typical environmental-assessment process thus proceeds from the impacts of a proposed action (the preferred project) to its alternatives (demonstrating slightly more or less of this or that) to values, which are used to assess the proposal and favored alternatives.

An alternative approach, which we believe works far better as a risk-management process, is to start with the elicitation of stakeholder values and to use these values to create, rather than to defend, alternatives. Ralph Keeney (1992) refers to this as a distinction between *value-focused* and *alternative-focused* thinking. Value-focused thinking works better because it starts with the considerations of importance to a stakeholder and defines a preferred alternative in terms of its ability to satisfy those values. One implication of value-focused thinking is that the participation of stakeholders should begin very early in the assessment process, so that their expressed concerns and interests can guide the development of the risk-management process.

Creating alternatives is neither easy nor straightforward. It is difficult because the human mind tends to anchor new thoughts on those that have come before; as a result, it often is difficult to think creatively about new alternatives that may do a better job of satisfying expressed objectives (Bazerman 1986). A number of techniques exist for helping individuals to create alternatives, including brainstorming methods, developing wish lists, and incorporating simple mental games such as removing perceived constraints (not enough time, not enough support) that may unduly limit the generation of new ideas.

4.7. Identifying Experts

Once alternatives and value-relevant measures have been delineated in a comprehensive and unambiguous manner, the task remains to develop credible estimates of the impacts that could be associated with each of the project or action alternatives. This is a facts-based task rather than a values-based task; whereas everyone is an expert in their own values, it is not true that everyone is an expert in the estimation of impacts. Stated differently, if a factory is proposed for a town, then the set of impacts that should be considered in the evaluation of design alternatives should come from the values of all stakeholders but the actual calculation of the impacts (e.g., using dispersion models or an analysis of chemical processes) should come from the best experts in the various steps of impact identification and measurement.

The question naturally arises: who is an expert? In many risk analyses the initiating government agency or the proponent (perhaps in association with government representatives) selects the relevant experts. From a technical standpoint this procedure may be fine, but it is flawed from a process standpoint because such experts often lack credibility with the concerned stakeholders and communities. As a result, it is essential that experts be involved who are nominated by, and have the trust of, the stakeholders. This might well make for a messier process because no experts may be found who are trusted by all stakeholders; instead, several different experts may be involved who might disagree with each other or argue about their relative qualifications (e.g., Expert A might possess more training but Expert B might possess more in-field experience). However, the involvement of experts viewed as credible by stakeholders is generally a prerequisite for the development of a defensible and acceptable assessment of the anticipated impacts.

4.8. Assessing Impacts and Probabilities

Where do estimates of impacts and probabilities come from? In some cases, databases already may exist for the variables of concern or for closely analogous processes. Sometimes engineering (e.g., fault trees), economic (e.g., cost-benefit), or ecological (e.g., habitat mitigation) studies may be commissioned to provide the required information. In other cases, the absence of reasonable data will encourage the adaption of an expert judgment process (Spetzler and von Holstein 1975), which typically requires extensive interviews with several experts in which they are asked a series of structured questions designed to elicit their understanding of the uncertainty associated with the events of concern.

In many analyses, impact estimates are stated in precise terms: if some action is taken the population will decline by 37%, or if nothing is done the remaining resource supplies will last for 18 months. In most cases, the apparent precision in these terms is misleading, for two reasons. First, the impact estimates may mask substantial uncertainty and could be more accurately depicted in terms of a probability distribution over the effects of concern. If this distribution is considered too broad—for example, if the resource supplies noted above could last from 3 to 38 months, and anything less than another 12 months would result in catastrophic results—then further studies might

be commissioned to refine the estimates and (perhaps) narrow the distribution. A number of inexpensive computer programs are available to handle probabilistic concepts and information (Morgan and Henrion 1990).

A second reason to mistrust precision in impact estimates is that important conditionalizing assumptions may be omitted from the analysis (von Winterfeldt and Edwards 1986). These assumptions may be crucial to the assessment of probabilities because they determine the scope and decomposition of the problem. Without knowledge of the underlying assumptions and definitions, it is easy to misinterpret the meaning of a probability assessment. Workshop participants were provided with several examples to illustrate the potential pitfalls of probability estimation for problems whose decomposition remains ambiguous.

4.9. Evaluating Alternatives

Stakeholder values determine what matters and assign the dimensions of value; impact estimates assess the score of a given project on each of these dimensions. If the criteria and the alternatives are viewed (respectively) as the rows and columns of a matrix, then the evaluation of alternatives requires two further steps (Gregory and Keeney 1992). First, the cells of the matrix need to be filled in with the scores; that is, each alternative is evaluated on each objective (or subobjective) of concern in terms of the operative measure. Second, the criteria need to be weighted in terms of their relative importance to the various stakeholders (Stillwell, von Winterfeldt, and John 1987). Once this is done, the individual impact scores may be multiplied by their respective weights and added across objectives (assuming an additive utility function) to develop an aggregated comparison across project alternatives (keeping in mind that, when impacts are uncertain, expected utilities can be calculated over the probability distributions characterizing the impact of each alternative).

However, several caveats need to be kept in mind. First, the outputs of this process are intended to serve only as an aid to decision making. In most cases a number of further considerations, often having to do with the historical or political context within which decisions are made, will also influence the ultimate decision. To the extent possible, these other considerations also should be defined and brought within the explicit framework of the analysis.

Second, some people may question the fundamental basis of this procedure, because they question the assumptions of decision analysis or because they question the relevance of an explicit value function to their preferences (Lichtenstein et al. 1990). Others may question the subjectivity of the values and measures, believing that the analysis is too highly influenced by the analyst. Others may question the honesty of any explicit evaluation framework, believing that an analytical process is not to be trusted to the extent that it employs a linear, quantitative, or piecemeal thinking and evaluation process (Keeney 1984; MacGregor and Slovic 1986).

These concerns are not irrational, particularly in light of the frequent misuse of analyses to defend, rather than to examine, proposed actions. A general suggestion is to start, here as with any other concern, by recognizing the legitimacy of the value and attempting to understand its source and attributes. Modifications in the risk-management process to take account of concerns about trust or fairness, such as spending time in communities getting to understand first-hand some of the stakeholder concerns or involving stakeholder representatives in thorough reviews of the evolving project, can help to improve the acceptability of the overall risk-management procedure and its credibility with stakeholders.

4.10. Sensitivity Analysis and Communication

Sensitivity analysis is useful to test the effects of changes in key elements of the analysis, including differences in the value weights and in the probability distributions assigned by technical experts. Sensitivity analyses also are useful to identify discrepancies between people's intuitive preferences and the models developed to represent stakeholder values.

Communication about the process and results of the analysis is essential, both as a means to inform participants or decision makers and as a mechanism for eliciting their comments, as a prelude to revising the existing analysis or acknowledging the need to initiate further analyses. Communication about project risks, benefits, and costs is a two-way process, facilitating an exchange of information (Desvousges and Smith 1988). Risk communication strategies therefore need to address both the process and the results of the analysis, including the underlying perceived attributes of the risk source: whether it is voluntary or involuntary, whether catastrophic impacts are feared, or whether stakeholders trust the project proponents. Strategies for communication also need to recognize differences among stakeholder groups, both in terms of their fundamental concerns and in terms of the language they might typically use to address these concerns. As a result, separate risk communication strategies might be developed for each of the key stakeholder groups.

The results of sensitivity analysis and communication provide the basis for iteration and consequent changes in the decision process which may lead to changes in the outcomes of the analysis (Johnson and Fisher 1989). For example, a sensitivity analysis may lead to the realization that more data is needed for a significant variable or that the probability distribution for an impact has not been fully described. Communication may demonstrate that a key stakeholder group has been ignored or slighted; making changes in the process and analysis to reflect this omission may appear expensive or time consuming, but it is essential for the building of a defensible and credible study.

4.11. Negotiated Decision Making

Some time ago, decisions by resource-management agencies could be based on the results of formal analyses conducted largely by in-house experts. Those days are gone. Resource management in the 1990s must be conducted on the basis of a negotiated decision-making process based on the values and concerns of stakeholders.

Negotiation in this sense is broadly defined as communication designed to reach an agreement between two or more parties, in which some interests are shared and others are opposed (Fisher, Ury, and Patton 1991). The topic of negotiation has received a great deal of attention in recent years, and as a result of this work techniques for successful negotiation have become much better understood.

The work of the Harvard-MIT Negotiation Project served as the basis for the formal presentations on negotiation in the workshop and is particularly useful in the context of resource and risk-management disputes. Three messages were emphasized as central to an improved negotiation framework:

1. *Separate the issues from the participants*, realizing that any participant has multiple interests and that attention should be paid to the underlying concerns and values rather than to positions or personalities (Fisher, Ury, and Patton 1991).

2. *Generate a wide range of options*, which requires that participants be creative and avoid placing unnecessary limits on alternative actions (Susskind and Cruikshank 1987).

3. *Develop objective criteria for evaluating alternatives*, because the creation of agreed-upon principles can set the basis for identifying shared interests and moving toward agreements that provide for mutual gains and a win-win situation (Raiffa 1982).

Workshop participants also were presented with several short case-study examples which provided for hands-on use of the negotiation tools and emphasized the linkages between negotiation methods (e.g., structuring multidimensional values, developing criteria, or generating alternatives) and tools from decision analysis and risk-perception research.

5. KEY DISTINCTIONS FOR MMS RISK MANAGERS

5.1. Factual vs. Values Input

The assessment of risks requires two principle types of input: judgments about facts and judgments about values. Judgments about facts come from experts whose training and experience enables them to assess the likely range of effects on those values and measures of concern to stakeholders. For the purposes of a negotiated risk-management decision, it is essential that experts hold the confidence and trust of identified stakeholders.

Judgments about values should come from a representative group of stakeholders who share an interest in the proposed action. These people may agree on the highest-level objectives (e.g., economic, environmental, and social concerns) that should be used to evaluate the consequences of a management action. In the typical case, however, stakeholders are likely to differ with regard to three key tasks: (a) the definition of the objectives useful for understanding the decision problem, (b) the value tradeoffs between these objectives, and (c) the degree to which project alternatives satisfy the objectives. Knowledge of these agreements and disagreements among stakeholder groups should form the basis for the environmental risk and impact analysis.

5.2. Technical vs. Perceived Risks

Experts and laypersons often disagree about the meaning of risk: the qualities of a hazard can matter as much as the quantity of risk faced by the public. Risk-perception studies have been particularly influential in making this point, demonstrating that laypersons think of risk as a multidimensional concept that includes psychological responses to such concerns as the voluntariness of exposure, the potential for catastrophe, and the newness of a technology. Studies of risk perception are widely cited by risk managers and play an active role in debates concerning risk policies.

The increased attention given to risk-perception studies in part reflects recent shifts in the decision-making locus of society, with individuals and interest groups today participating in many aspects of public policy development (Fischhoff 1985). But it means more: the influence of risk perceptions also derives from a normative position, taken by many risk regulators, that the views of the public should play a large role in defining risk-management priorities.

Most current approaches to studying risk perceptions employ psychometric techniques to produce quantitative representations or "cognitive maps" of risk attitudes and perceptions (Slovic 1987a). In the usual case, people are asked to make judgments about the riskiness of a diverse set of hazards using a numbered (seven- or nine-point) scale. Ratings are typically made regarding the characteristics hypothesized to account for risk perceptions and attitudes, the perceived social benefits, and the number of deaths caused by the hazard. In general, the higher a hazard's score, the higher its perceived risk, the more people want to see its current risks reduced, and the more likely they are to seek strict regulations designed to reduce the risk.

Investigation of these relations through psychophysical scaling and multivariate analysis techniques (e.g., statistical procedures such as factor analysis) has shown that the intercorrelations among a broad domain of risk characteristics can be used to identify underlying, higher-order risk perception factors. Two factors often emerge as the most important. One factor, termed *dread risk*,

includes such characteristics of a hazard as dread, perceived lack of control, catastrophic potential, fatalities, and the distribution of risks and benefits. Power generation technologies and waste storage often score highest on the dread factor scale. A second factor, termed *unknown risk*, includes such characteristics of a hazard as the extent to which it is observable, known, new, and delayed in its manifestation of harm. Chemical technologies often receive high scores on this factor. The number of people exposed to a risk also may be important, and in some studies this concern has emerged as a third principal factor.

The results of risk-perception studies conducted over the past ten years (see Slovic, Fischhoff and Lichtenstein 1985; or Kates, Hohenemser, and Kasperson 1985) indicate that people's attitudes about technologies are basically consistent, that perceived characteristics of risks can often be quantified, and that people's expressed opinions are not random or particularly labile. Furthermore, they emphasize that significant differences often exist in how experts and members of the public view the nature of a technological risk and that differences in risk perceptions among experts or different stakeholder groups may be large. Differences in experts' and laypersons' risk characterizations arise in part because the public's conception of risks often is broader than that of technical experts. Thus, it is not that laypeople ignore quantitative calculations (e.g., those based on the expected value of damages) but that they often place less weight on them as part of an overall risk-evaluation framework.

Risk sources often create social and economic impacts that are far greater than would be predicted on the basis of any reasonable estimates of direct harm. As a result, the adverse impacts of these technologies may be amplified over and above any direct effects of facility construction or operation (Kasperson et al. 1988); and occur in advance of, or even in the absence of, any identifiable accidents or events. The first phenomenon is significant because it suggests that events may be important as signals (Slovic 1987b). The second phenomenon is significant because it suggests that the geographic area around any hazardous activity may become stigmatized (Edelstein 1988); that is, adverse sociological or economic consequences may accompany even the possibility of hazardous materials production, storage, or use, and this adverse image may seriously taint public perceptions of an activity or locale.

Both amplification and stigmatization can lead to psychological, sociological, and economic effects that may not be anticipated in the absence of risk-perception studies. Media coverage is often a key contributing factor to the amplification of risks. Other considerations also appear to play a role in risk amplification: for example, the appearance of incompetence or callousness on the park of risk managers is likely to foster a split between the perpetrators and victims of an accident (e.g., public anger at the perceived delayed response of Exxon to the March, 1989 Alaska oil spill).

However, the increasing reliance placed by decision makers on information about the public's perception of risks does not necessarily mean that a risk manager should go along with everything stakeholders say that they want (Zeckhauser and Viscusi 1990). For example, What if stakeholder values reflect opinions prohibited by law, such as a distrust of government-sponsored projects because the government hires minorities, or are based on incorrect information, such as a belief that certain physical processes can occur in cases where they cannot? Another reason for caution is that attitudes concerning the risks of an activity or technology may confuse economic, political, and health considerations (Gregory 1989). For example, experimental evidence supports a view that people's attitudes about risk levels may be strongly influenced by their perceived personal benefits from an item, which implies that stated risk attitudes provide a net rather than gross measure, of harm (Dyer and Sarin 1986). Other considerations, such as how people feel about the influence on government, may also affect assessments of perceived riskiness, as could prejudice or misinformation. Variations in the source and legitimacy of these different sources of risk attitudes merit further study in specific policy domains as a basis for understanding risk perceptions.

5.3. Statistical vs. Identifiable Impacts

Most risk-management decisions are made on the basis of anticipated statistical impacts, which refers to the likelihood of a specified consequence of an action. For example, the decision to permit oil tankers to pass through an area may reflect the information that an accident of a specified magnitude is expected to occur once every 250 years, based on anticipated traffic volumes, weather conditions, and the like. An identifiable impact refers to the consequence associated with the occurrence of the actual accident, at which time the name of the boat, its owner, and the preceding events all become identifiable. Such identifiable impacts form the basis for much of the public's perception of risk-management effectiveness and contribute significantly to regulatory and legislative initiatives.

The distinction between statistical and identifiable impacts poses a dilemma for risk managers. This is because many of the benefits of the risk-management actions taken by MMS are in the form of statistical savings of lives or money: by permitting this type of activity rather than that, populations of coastal mammals or birds and the livelihoods of fishers who otherwise could have been adversely impacted will be maintained. Thus the benefit of the action is in terms of lives and dollars not foregone. However, the costs of risk-management actions often are identifiable, in the sense that a burst pipeline or an oiled seabird constitutes a specific incident and the costs are both real and visible. Hence the dilemma: statistical benefits easily are ignored whereas identifiable costs are highly salient. Because good decisions guarantee neither good nor visible outcomes, the prudent risk manager thus may be heavily criticized for the results of a decision process which in fact merits applause. The only answer (and it is not fully reassuring) is to establish a solid basis for communication with the public and media and to work over time to develop an improved appreciation of the decision and risk management implications of this distinction.

5.4. Zero Risk vs. Acceptable Risk

Risk-free activities do not exist. Any action, whether taken by an individual or by society, involves either the creation or the transfer of risks (Whipple 1985). The illusion of zero risk sometimes arises in the context of eliminating an alternative, in the sense that if some risky option is not pursued then risks are assumed to drop to zero. However, elimination of one risk merely transfers risk to some other source: selling a car increases the probability that we will die in a bicycle accident; voting against a hydroelectric plant means that the risks are higher from other power sources or from conservation (Keeney 1992).

A zero-risk level is not required for an activity to be acceptable. Instead, assessments of the acceptability of a given risk level are dependent on the problem context and on the relevant tradeoffs among objectives. A risk that is not acceptable in one circumstance (e.g., driving at night when your headlights don't work) may be entirely acceptable in another (e.g., driving at night without headlights to take a family member to the emergency room of the hospital). The recommendation for MMS risk managers is therefore to participate in the construction of the problem context, helping to provide a mental picture of the relevant alternatives and objectives that will encourage a comprehensive assessment of a proposed activity in light of its anticipated benefits, costs, and risks.

5.5. Process vs. Outcome Concerns

The typical MMS risk-management process has focused on providing a credible output, for example in the form of an environmental impact assessment that addresses the principal identified sources of concern. The experience of risk managers in the 1980s and early 1990s suggest that such

outcome concerns address only a part of the risk-management puzzle, because process considerations—not *what* is done, but *how* it is done—are at least equally important (Gregory and Kunreuther 1990). As a result, it is essential that MMS risk managers open up decisions regarding the process by which lease sales are developed to meaningful participation from stakeholders.

This argument is based on the distinction, first proposed by Herbert Simon (1978), between substantive and procedural rationality. Substantive rationality refers to the outcomes of a decision process; procedural rationality refers to the processes by which an outcome is determined and takes into account the effectiveness of actions in light of prior conditions and human cognitive limitations. The analysis of outcomes therefore is assessed in the light of process considerations. If the assessment process is viewed as flawed or biased, then no agreement is likely to be reached.

Trust is one of the most important procedural concerns. The concept connotes a level of comfort within a community about its own role in the risk-management process as well as a sharing of power between experts and laypersons. Thus community trust contains, at minimum, two operative factors: the belief that a sound decision process selected this option as the best and the belief that risk-management decisions made in the future will be influenced by community choices. Fairness and a belief in the legitimacy of risk-management activities are among the other process concerns that are key to the acceptance of a proposed project or activity.

5.6. Communication vs. Announcement

Risk communication describes both a message and a process (Covello, von Winterfeldt, and Slovic 1986). The message of risk communication typically involves information about the impacts of an event (which may be routine or surprise) to human health or to the environment. The process of risk communication typically has to do with the institutional setting in which an event occurs and the medium (e.g., on-site experience, newspaper or television accounts) by which information about it is communicated. However, these two elements clearly are linked: content must address process (e.g., how more information can be obtained, when meetings will be held) and process must acknowledge content (e.g., more extensive public involvement may be required when the level of hazard is high).

Communication about physical impacts is needed to address the concerns raised by stakeholders or by technical studies of impact likelihoods and consequences. Communication about perceptual impacts is needed to address what the public believes might, or could, happen and may not reflect the technical judgments of experts. Thus, perceptions may be related (for example) to the institutional setting within which project alternatives are created or to the anticipated equity impacts of an action on future generations. These concerns may be based in physical impacts but they also can exist independently of the physical models of exposure to environmental contaminants. Such perceptual impacts may directly influence people's behavior or they may affect people's sense of well-being, thus influencing their psychic welfare in ways that may not have a direct behavioral component. For example, people may experience an increased sense of anxiety or worry because of living close to a chemical storage site or because they live close to a principal transportation corridor used for shipping hazardous materials.

Risk communication must address both sets of considerations, and workshop participants were provided with an overview of many of the methods (e.g., appropriate means for using risk comparisons and graphical tools) developed to aid managers in communicating about the risks, benefits, and costs of proposed actions (e.g., Slovic 1986; Roth et al. 1990). One message of the workshop is that effective risk communication requires managers to listen closely to people's

concerns; the risk literature is replete with examples of failed projects whose proponents neglected the multiattribute nature of people's concerns and instead attempted to convince them to follow a prescribed course of action and perspective. Yet this simple maxim—address everything, because who knows what might be important—is obviously too simple: risk communicators face limits of time and resources, experts face limits of information, and lay persons face limits of attention (i.e., limited mental budgets) and cognitive-processing abilities. In addition, the process of impact definition and communication is itself highly dynamic. This dynamic nature of risk decisions requires flexibility and open-mindedness in the risk-communication process as well as sensitivity to the interactive nature of the two-way dialogue by which (it is hoped) both public and experts will become better informed.

6. ILLUSTRATIVE CASE STUDY: LEASE SALE 149

As part of the third session of the workshop, an illustrative case study was utilized to demonstrate and apply the proposed risk-management techniques. Following extensive consultation with representatives of the MMS, Alaska, it was decided to use the proposed Oil and Gas Lease Sale 149 in the Cook Inlet/Shelikof Strait planning area as the case study. Both workshop participants and managers within MMS were informed that the use of Lease Sale 149 was for illustrative purposes only, so that no policies would be determined on the basis of the workshop discussion and no specific recommendations would be made regarding planned offers for the lease of whole or partial blocks within the designated area.

6.1. Description of the Problem

The proposed Lease Sale 149 Scoping Report defines seven alternative lease-sale areas. The Alternative 1 area consists of 761 whole and partial blocks encompassing approximately 3.7 million acres, located between 3 and 24 miles offshore in water depths of 1 to 1,300 feet. Alternative 2 (the No-Sale Alternative) removes the entire area from consideration: Alternatives 3 through 7 involve either delays of the sale or reductions in the leasing area.

6.2. Organization of the Case-Study Session

Representatives of the five stakeholder groups were invited to participate in the case-study session: local and national environmental groups, community and fishing interests, MMS staff and other federal regulators, native interests, and the oil/gas industry. At least three representatives from each of these five groups attended the workshop. Altogether, there were approximately 25 participants. Participants were instructed to address this question from their own individual perspective.

The case study introduction began with a presentation of the Lease Sale 149 status and alternatives by an MMS representative. This was followed by a brief overview of the proposed risk-management approach for the benefit of those participants who had not been present for all of Sessions 1 and 2.

The first afternoon and second morning of Session 3 were designed to obtain the objectives of the five stakeholder groups. Objectives were elicited from each group on an individual basis, although (for teaching purposes) observers were permitted. At the beginning of each group meeting, we reminded participants that the purpose of the session was to develop a comprehensive list of their objectives; anything important to the participants was considered to be a legitimate objective. Then we asked each participant to take five to ten minutes to write down everything they believed to be important for consideration as part of the Environmental Impact Statement (EIS). This insured that each participant recorded their individual thoughts to bring to the subsequent group discussion and avoided biases due to inadvertent anchoring on the thoughts of others.

The group discussion recorded each individual's objectives and formed the basis for a combined listing of objectives. The session included a probing discussion of the reasons why an objective appeared on someone's list. The participants' responses helped to recognize means-ends relationships between objectives and to identify the set of fundamental objectives.

Six general categories of impacts—environmental, economic, social, cultural, equity, and process—appeared on most individual lists and in all five groups. These lists of fundamental and process objectives are shown in Tables 1-5, along with the means objectives noted by each of the groups. Important differences also were found in the objectives stated by the five groups. As a general comment, stakeholders spent considerably more time and developed more detailed lists of objectives when discussing the topic areas in which they possessed special expertise. For example, the Environmental group noted a large number of specific species of animals and plants when discussing the objective reflecting species value.

The participants reconvened as a single group during the second afternoon to develop a combined list of fundamental objectives for the EIS, shown in Table 6, and to identify and discuss further the process objectives, shown in Table 7. The difference between fundamental objectives and means objectives was introduced in terms of a distinction between those things that participants fundamentally care about, such as environmental quality, and those that matter only through their effect on these fundamental concerns, such as land-use conflicts. It was noted that this does not imply that means objectives are any less important than are fundamental objectives. As a simple example, participants were told that if one means objective accounted for one-half the impact on each of five equally weighted fundamental objectives, then the ***de facto*** weight on that means objective would be 50% whereas each fundamental objective would count only 20%.

The third and final day of Session 3 was devoted to a discussion of techniques for evaluating tradeoffs and their implications for generating alternatives, shown in Table 8. Although there was not sufficient time to systematically develop tradeoffs for all objectives, several scenarios were discussed that allowed participants to apply and to ask questions about the required tradeoff assessment methods. For example, detailed value tradeoffs were elicited between changes in state revenues (impact range: $0 to $10 million) and changes in sea otter populations (impact range: 0 to 1,000 individuals). Two additional objectives, the anticipated change in the number of permanent local jobs (impact range: 0 to 200) and the expected level of disruption of native communities (a constructed scale, showing a range of low to high impacts), also were included to illustrate how tradeoffs could be made across these objectives using a swing weighting procedure (von Winterfeldt and Edwards, 1986). The basis for this method is to identify worst and best impact levels for each objective and then to ask participants, in the context of a hypothetical proposed action, to designate that objective which they would most like to change (or swing) from the worst to best level. The designated objective thus receives the highest weight, with the relative weights of other objectives assigned on a ratio basis.

6.3. Stakeholder Objectives

Stakeholder objectives for each of the groups are shown in Tables 1-5. In each case, the values include the fundamental objectives, means objectives, and process objectives expressed by group members.

6.4. Common Fundamental Objectives

The common fundamental objectives expressed by participants in the five groups are shown in Table 6. There are six major categories, denoting environmental, economic, health and safety, social, cultural, and equity considerations.

6.5. Common Process Objectives

The common process objectives expressed by participants are shown in Table 7. This listing of process objectives is one of the most important products of the workshop, for several reasons. The list is quite comprehensive and provides a useful guide to beneficial changes in the EIS and risk-management processes currently in use. For example, assessments are is asked to consider the future transportation implications of a lease sale, to place proposed sales in the context of a national energy strategy, and to clearly indicate how stakeholder comments were addressed as part of the least-sale risk decision process. The list of process concerns also includes several specific comments addressing communication aspects of the study, such as the need to arrange community meetings at compatible times.

As workshop leaders, we were struck by the intensity with which many of the process concerns were voiced by participants from both outside and within the MMS. It was clear from the discussions that many outside participants are frustrated by the current risk-management procedures followed by MMS and that they question the credibility of the organization. The urgency of this message was supported by the reports from MMS staff regarding their inability to respond to many of the stakeholder concerns because of constraints placed on their actions. In this sense, the list of process concerns shown as part of Table 3 provides an accessible basis for further discussions among MMS staff regarding steps that could be taken to improve the effectiveness and credibility of MMS risk management activities.

Detailed prescriptions for how process issues can be addressed should not be made without additional input and clarification from the stakeholders, including participants both within and outside the MMS. Indeed, several of the process concerns back up this point: to take the initial information collected as part of the workshop and begin to suggest changes on this basis would simply repeat old patterns that have frustrated both MMS staff personnel and some of the key stakeholders in Alaska. Process issues require serious attention; if MMS decides to address these concerns meaningfully, then a procedure should be put in place to identify and clarify the key issues, to determine differences in process concerns among stakeholder groups, and to develop methods for mitigating those concerns that are legitimately within the bounds of MMS activities.

6.6. Creation of Alternatives

The discussion of fundamental, means, and process objectives was used as the basis for considering alternatives to the proposed Lease Sale 149. For the illustrative purposes of the case study, this discussion regarded Alternative 1 as the preferred alternative and focused on generating options that recognized process as well as area requirements. Implications for the EIS were presented using the visual tool of a matrix, whose rows were the individual lease-sale alternatives and whose columns were the fundamental objectives and subobjectives expressed by participants in the combined values tree.

The list of alternatives developed by workshop participants is presented in Table 8. If additional resources had been available, these alternatives could have been more closely defined and then scored in terms of the measures developed for each of the objectives. Several of the workshop participants expressed a desire to continue in this direction; for example, to explicitly link values to alternatives and to determine the extent to which the suggested alternatives satisfied the key values expressed by workshop participants. In our experience, this process would have helped to generate a larger and more complete listing of alternatives and, after extensive discussion, could provide the basis for a well-defined set of preferred program and project alternatives. These next steps were not possible, however, due to the time constraints placed on the workshop process and the partial information available to participants regarding the illustrative case-study example.

Table 1. Objectives Expressed by Environmental Group Interests

FUNDAMENTAL OBJECTIVES:

- Minimize Environmental Impacts
  Respect symbolic/sacred basis of ecosystems—the "religious value" of the natural environment
  Minimize impacts on migratory birds
  Minimize impacts on marine animals
  Minimize impacts on endangered and threatened species
  Minimize impacts on fisheries
  Minimize impacts on spectacled eider
  Minimize impacts on peregrine falcons
  Minimize impacts on whales
  Minimize impacts on Steller's sea lion
  Minimize impacts on Harbor seal
  Minimize impacts on other trust species
  Minimize food chain degradation

- Maximize Economic Benefits
  Minimize external economic costs

- Minimize Detrimental Health and Safety Impacts
  Minimize muds and cuttings from drill operations
  Minimize toxic releases to environment
  Ensure integrity of engineering (e.g., in response to high waves, currents)

- Minimize Detrimental Social Impacts
  Minimize adverse impacts on small communities
  Minimize adverse impacts on Native villages

- Minimize Cultural Disruptions
  Minimize effects on subsistence resources (lifestyle concerns)
  Promote recognition of sovereign rights of Indian nations

- Promote Equity
  Provide for balance between national and local interests
  Promote equity: Alaska vs. lower 48

Table 1, continued: Objectives Expressed by Environmental Group Interests

MEANS OBJECTIVES:

- Means to Several Fundamental Objectives:
  Improve understanding of oil spills: probabilities, consequences, duration of effects
  Prevent sea-level rise due to effects on mobilization of stored toxic substances
  Analyze regional geographic concerns (e.g., west coast)
  Understand links to future developments (e.g., lease sale leads to transportation)
  Create environmental trust fund ($)
  Improved understanding of the technical and regulatory requirements and constraints that are in place

- Means to Economic Impacts:
  Account for economic impacts from ecotourism
  Examine effects on consumptive uses of fish and wildlife
  Anticipate cumulative economic impacts
  Recognize subsidies to oil industry (to establish "level playing field")

- Means to Health and Safety Impacts:
  Provide for disposal of hazardous wastes

- Means to Environmental Impacts:
  Encourage habitat preservation
  Examine biodiversity impacts of project
  Minimize adverse impacts on wilderness environment
  Minimize cumulative impacts on the environment
  Minimize global warming impacts of oil and gas developments
  Minimize cumulative environmental impacts in reference to other lease sales
  Monitor environmental effects over time

Table 1, continued: Objectives Expressed by Environmental Group Interests

PROCESS OBJECTIVES:

- Promote Legitimacy of Process: Visibility of Input
- Maximize Openness of Process, Avoid "Statutory Bias"
- Encourage Separation of Powers Within MMS: Promotion of Development vs. Review of Alternatives
- Ensure Use of Appropriate/Accurate Expertise
- Promote Ongoing Communication with Stakeholders
- Pay Attention to Quality of Information
- Require Identification of All Responsible Project Alternatives
- Utilize Appropriate Timing in the Process (e.g., conduct EIS prior to plan approval)
- Provide Description of Reclamation Plans (post-production)
- Account for Impacts on International Operations of Oil Industry
- Provide Comprehensive Analysis of Wildlife, Species, and Habitat
- Incorporate Public Concerns
- Understand Relationship to National Energy Planning
- Establish Central Clearinghouse for Information, To Ensure Availability and Avoid Redundancy
- Promote Informed Process To Increase Knowledge and Reduce Uncertainty
- Be Consistent with NEPA/EIS Process and Democratic Ideals
- Evaluate Alternative Energy Scenarios
- Promote Recognition of the Majority Will
- Examine International Record and History of Potential Oil Industry Lessees, Requiring a "Clean Slate" as Precondition of Sale

Table 2. Objectives Expressed By Local Group Interests

FUNDAMENTAL OBJECTIVES:

- Minimize Environmental Impacts
  Minimize habitat losses
- Minimize Tainting of Fishery Resources
- Minimize Disruption of Land Resources
- Minimize Impacts on Rare, Threatened, and Endangered Species
  Steller's sea lion
  Spectacled eider
- Maximize Economic Benefits (and Minimize Economic Costs)
  Maximize economic benefits to Alaska
  Maximize economic benefits to communities in Alaska
  Maximize economic benefits to local businesses
  Enhance opportunities to earn a livelihood
- Minimize detrimental health and safety impacts
  Maximize safety opportunities (e.g., rescue operations)
  Maximize health (e.g., due to food supply)
- Minimize Detrimental Social Impacts
  Minimize impacts on communities
  Minimize disruption of recreation
  Minimize inconvenience
  Minimize stress on family services in communities
  Respect existing social balance
  Minimize loss of family traditions
  Minimize impact on subsistence activities
- Minimize Cultural Disruption
  Minimize disruption and archaeological sites
  Minimize impacts on local villages and towns
  Minimize impacts on native subsistence
- Promote Equity
  Promote equity between beneficiaries and assumers of risk

Table 2, continued: Objectives Expressed by Local Group Interests

MEANS OBJECTIVES:

- Means to Several Fundamental Objectives:
  Minimize oil spills
  Maximize timing and effectiveness of spill response
  Minimize disruptions due to exploration technique
  Minimize hazardous material discharge
  Minimize tainting of fishery resources*
  *Note that this is a means to economic effects for the reason described, a means to health effects because of poor food supply or lack of food supply, and a means to subsistence effects on natives within the cultural impacts. In addition, it is a fundamental environmental objective as indicated in Table 1.

- Means to Environmental Impacts:
  Minimize land-use conflicts
  Maximize the feasibility of operating safely in the areas of the leases
  Minimize disruption of commercial fishing activities

- Means to Economic Impacts:
  Minimize gear conflicts between commercial fishers and the oil and gas industry
  Minimize preemption of fishing grounds
  Minimize disruption of recreation
  Minimize disruption of tourism
  Minimize liability resulting from detrimental economic impacts

- Means to health impacts:
  Minimize family stress

PROCESS OBJECTIVES:

Several process objectives were stated, including:

- Provide for Constructive Public Input
- Enhance Cooperation Among Stakeholders
- Promote Trust in the Government and the Oil Industry
- Provide an Unbiased Environmental Impact Statement (EIS)
- Provide a Meaningful Response to Comments on the EIS Process
- Clarify the Process of Decision Making
- Provide a Clear Indication About the Details of How the Decision Was Made
- Be Clear About How Comments of Stakeholders Were Included in the Decision-Making Process

Table 3. Objectives Expressed by MMS/Federal Regulators Group Interests

FUNDAMENTAL OBJECTIVES:

- Minimize Environmental Impacts
  Minimize adverse coastal land uses

- Maximize Economic Benefits (and Minimize Economic Costs)
  Maximize fishing income
  Maximize long-term economic viability of lease-sale area

- Minimize Detrimental Health and Safety Impacts
  Protect health and well-being of children
  Protect health and well-being of elderly

- Minimize Detrimental Social Impacts
  Minimize adverse community mental health problems (e.g., alcoholism)
  Minimize adverse effects on community cohesion
  Minimize perceived/real displacement of current users (e.g., fishers)

- Minimize Cultural Disruption
  Minimize adverse impacts of activities on subsistence lifestyle

- Promote Equity
  Promote equity with respect to regional vs. national concerns
  Promote self-determination (i.e., stakeholder values count)

MEANS OBJECTIVES:

- Means to Several Fundamental Objectives:
  Prevent oil spills
  Monitor potential tanker traffic and safety—oil spill implications
  Establish and fund area-specific biological studies (e.g., portions of Cook Inlet)

- Means to Economic Impacts:
  Consider interaction between discrete economic categories
  Provide financial assistance to communities
  Ensure a fair monetary return to public (e.g., S-T vs. L-T resource-base users)
  Promote understanding of economic effects of development in Alaska on other countries

- Means to Health and Safety Impacts:
  Maximize assistance to communities in event of an accident

- Means to Environmental Objectives
  Minimize cumulative environmental effects
  Maximize protection of biological resources
  Evaluate key environmental interrelationships
  Incorporate latest environmental information (e.g., from Exxon studies)

Table 3, continued. Objectives Expressed by MMS/Federal Regulators Group Interests

PROCESS OBJECTIVES:

- Encourage Use of Civilized Discourse in EIS Process
- Address Regulatory Loopholes that Might Permit Environmental Damages
- Promote Understanding of Biological/Cultural Interactions
- Establish Broader Base of Expertise Within MMS for Writing EIS
- Ensure that EIS Summary Communicates Clearly with Stakeholders (e.g., policy implications, time constraints, funding constraints, legal requirements)
- Establish a Responsible Process that Will Follow Through
- Establish a Credible Process that Will Include Public Input from All Sides
- Incorporate Latest Information (e.g., Exxon data, federal and state data)
- Facilitate Staff-to-Staff Communication (federal, state, local)
- Guarantee Quality of Information in Light of Tradeoffs Between Deadlines (time crunch) vs. Good Science (ignore reduction)
- Provide Guidance Regarding Quality of Information for Decision Makers
- Ensure Public Accountability of Results
- Consider All Alternatives To Be "Real" Alternatives
- Include Comprehensive Review of Alternative Energy Resources
- Investigate Global Implications of Non-development in Alaska
- Employ Up-to-Date Information Whenever Possible

Table 4. Objectives Expressed by Native Group Interests

FUNDAMENTAL OBJECTIVES:

- Minimize Environmental Impacts
  Minimize loss of habitat
  Protect the natural environment
    Air resources
    Water resources
    Food-chain effects

- Maximize Economic Benefits (and Minimize Economic Costs)
  Maximize the income provided to Alaska and local communities
  Create local jobs
  Provide for income for local citizens

- Minimize Detrimental Health and Safety Impacts
  Minimize health impacts

- Minimize Detrimental Social Impacts
  Minimize disruption of communities
  Minimize disruption of social harmony among local groups
  Minimize disruption of local services

- Minimize Cultural Disruption
  Minimize disruption of subsistence activities:
    On hunting
    On fishing
    On gathering
  Minimize disruption to native lifestyles
    Minimize disruption of language
    Minimize disruption of arts
    Minimize violations of traditional knowledge and wisdom
    Minimize induced incompatibilities of the environment and lifestyle
    Minimize archaeological and historical impacts
    Respect ancestrally important locales
  Minimize social disruption
    Minimize disruption to the family (e.g., due to alcohol use)
    Show respect for local citizens and elders
    Preserve dignity
    Provide for convenient interaction
  Preserve options for the future generations

- Promote Equity
  Promote equity regarding risks to the local community and benefits to the outside

Table 4, continued. Objectives Expressed by Native Group Interests

MEANS OBJECTIVES:

- Means to Several Fundamental Objectives:
  Maximize the ability to respond to oil crises

- Means to Environmental Impacts:
  Minimize pollution due to development and operations

- Means to Economic Impacts:
  Maximize the tax base for communities
  Minimize the disruption to commercial fishing

- Means to Health and Safety Impacts:
  Avoid any detrimental impact on nutritional value of products consumed by those on subsistence

- Means to Cultural Impacts:
  Provide for local control of local life
  Provide local control of the processes of change
  Address the diversity and non-homogeneity in different native villages
  Recognize that native cultures cannot easily be parcelled into bits and pieces. Their culture is built on the integrative whole and this is not equal to the sum of a number of parts

PROCESS OBJECTIVES:

The means objectives to cultural impacts also are process objectives. In addition, it is important to provide a useful manner for input from native communities that includes:

- Be Compatible with the Time Schedule of Native Communities

- Be Compatible with the Traditions in Native Communities

Table 5. Objectives Expressed by Oil Industry Group Interests

FUNDAMENTAL OBJECTIVES:

- Minimize Environmental Impacts
  Minimize adverse environmental impacts on wildlife
  Minimize adverse environmental impacts on fisheries
  Minimize adverse environmental impacts on habitat

- Maximize Economic Benefits
  Minimize cost to not develop oil/gas resources
  Maximize income-earning potential of Alaska residents
  Maximize future employment opportunities
  Minimize cost to develop oil/gas resources
  Maximize number of jobs for local people
  Maximize revenues to state of Alaska
  Maximize local government revenues

- Minimize Detrimental Health and Safety Impacts
  Minimize health and safety impacts on local residents

- Minimize Detrimental Social Impacts
  Minimize negative effects on lifestyles of current residents
  Minimize project-related community conflict (e.g., factionalism)
  Minimize adverse psychological impacts of development, such as fear and anxiety
  Improve quality of local services—women's resource center, substance abuse programs

- Minimize Cultural Disruption
  Maximize availability of transition jobs for Natives
  Maximize sharing of opportunities among cultural groups
  Minimize impacts of development on subsistence values: native and non-native
  Minimize negative impacts of development on Native cultures (e.g., pride)
  Respect cultural preservation concerns of Native cultures

- Promote Equity
  Promote equity, in terms of citizen/industry split of profits and costs

Table 5, continued. Objectives Expressed by Oil Industry Group Interests

MEANS OBJECTIVES:

- Means to Several Fundamental Objectives:
  Maximize opportunities for education among local residents
  Account for inmigration when considering project alternatives
  Establish clear oil-spill response plans
  Account for energy strategies at national and regional levels
  Incorporate local perceptions of development scenarios
  Monitor ability of development process to stick to rules/regulations
  Evaluate influence of future energy alternatives
  Avoid boom/bust syndrome of development

- Means to Economic Impacts:
  Facilitate economic growth at local/state/national levels
  Establish job-training opportunities for local populations
  Maximize economic opportunities for Alaskans (e.g., owning a house)
  Promote local spending of inmigrants

- Means to Health and Safety Impacts:
  Maximize safety opportunities (e.g., accident prevention)

- Means to Environmental Impacts:
  Minimize conflicts over alternative uses of marine environment

PROCESS OBJECTIVES:

- Conduct Detailed Studies at Appropriate Level of Analysis
- Recognize and Address NIMBY Syndrome—Opposition to/Fear of Unknown
- Ensure Consistency with State Regulations
- Ensure that Development Is Consistent with Industry Standards and Expectations
- Promote Comprehensive Economic Cost/Benefit Calculations

Table 6. Fundamental Objectives Expressed by Stakeholder Interests

ENVIRONMENTAL

- Minimize loss of aquatic habitat
- Protect the natural environment
  - Air resources
  - Water resources
- Minimize disruption of land resources
- Minimize impacts on rare, threatened, and endangered species
  - Steller's sea lion
  - Spectacled eider
- Respect symbolic/sacred basis of ecosystems—the "religious value" of the natural environment
- Minimize impacts on animal resources
  - migratory birds
  - marine animals
  - fisheries
  - peregrine falcons
  - whales
  - Harbor seals
  - other trust species
- Minimize food chain degradation
- Minimize adverse coastal land uses
- Minimize muds and cuttings from drill operations

ECONOMIC

- Create local jobs
- Minimize tainting of fishery resources
- Maximize economic benefits (and minimize economic costs)
  - Maximize economic benefits to Alaska
  - Maximize economic benefits to communities in Alaska
  - Maximize economic benefits to local businesses and citizens
  - Enhance opportunities to earn a livelihood
- Minimize external economic costs
- Maximize fishing income
- Maximize long-term economic viability of lease-sale area
- Minimize cost to not develop oil/gas resources
- Maximize income-earning potential of Alaska residents
- Maximize future employment opportunities
- Minimize cost to develop oil/gas resources
- Maximize number of jobs for local people
- Maximize revenues to state of Alaska
- Maximize local government revenues

Table 6, continued. Fundamental Objectives Expressed by Stakeholder Interests

HEALTH AND SAFETY

Minimize adverse health impacts
Maximize safety opportunities (e.g., rescue operations)
Maximize health effects (e.g., due to improvements in food supply)
Minimize toxic releases to environment
Ensure integrity of engineering (e.g., in response to high waves, currents)
Protect health and well-being of children
Protect health and well-being of elderly

SOCIAL

Minimize disruption of communities
Minimize disruption of social harmony among local groups
Minimize disruption of local and family services
Minimize disruption of recreation
Minimize inconvenience
Respect existing social balance
Minimize loss of family traditions
Minimize adverse impacts on small communities
Minimize adverse impacts on Native villages
Minimize perceived/real displacement of current users (e.g., fishers)
Minimize negative effects on lifestyles of current residents
Minimize project-related community conflict (e.g., factionalism)
Minimize adverse psychological impacts of development (fear, anxiety)
Improve quality of local services—women's resources center, substance abuse programs

CULTURAL

Minimize disruption of subsistence activities
  On hunting
  On fishing
  On gathering
Minimize disruption to native lifestyles
  Minimize disruption of language
  Minimize disruption of arts
  Minimize violations of traditional knowledge and wisdom
  Minimize induced incompatibilities of the environment and lifestyle
  Minimize disruption to archaeological and historical sites
  Respect ancestrally important locales

Table 6, continued. Fundamental Objectives Expressed by Stakeholder Interests

CULTURAL, continued

- Minimize social disruption
  - Minimize disruption to the family (e.g., due to alcohol use)
  - Show respect for local citizens and elders
  - Preserve dignity
  - Provide for convenient interaction
- Preserve options for the future generations
- Minimize adverse impacts on villages and towns
- Promote recognition of sovereign rights of Indian nations
- Maximize availability of transition jobs for Natives
- Maximize sharing of opportunities among cultural groups
- Minimize negative impacts of development on Native cultures (e.g., pride)
- Respect cultural preservation concerns of Native cultures

EQUITY

- Promote equity between economic benefits to the local community and benefits to the outside
- Promote equity between beneficiaries and assumers of risk
- Provide for balance between national and local interests
- Promote self-determination (i.e., stakeholder values count)
- Promote equitable citizen/industry split of profits and concerns

Table 7. Process Objectives Expressed by Stakeholder Interests

- Maximize the Quality of the Overall EIS Process (E,M)
  - Follow a credible and legitimate process (E,M)
  - Be open for review (E)
  - Be politically accountable (M)
  - Separate promotion and review functions of MMS (E)
  - Have a responsible process regarding time, money, and effort (M)
    - Avoid regulatory loopholes (M)
    - Meet deadlines (M)
    - Monitor project over time (E)

- Maximize Quality of the Inputs to the EIS (All)
  - Incorporate input from all stakeholders (M)
    - Villages (M)
    - Local communities (L,N,O)
    - General public (E,L)
  - Address the process that occurs after a lease sale
    - Include transportation and necessary future development (E)
    - Include reclamation plans (E)
    - Address the ability to communicate in crisis situations (N)
    - Consider liability issues (L)
  - Comprehensively address context in which lease sales occur (M)
    - Address cumulative impacts (E,M)
    - Address alternative energy futures (E,O)
    - Place lease sales in context of national energy strategy (M,O)
  - Use high-quality information (E,M)
    - Consider a broad range of alternatives (E)
    - View possible impacts broadly (All)
      - Address diversity and nonhomogeneity of native communities (M)
      - Recognize sovereign rights of natives (E)
      - Recognize international record of and subsidies to the oil industry (E)
      - Acknowledge public perceptions (O)
        - Psychological impacts (O)
        - Fear of unknown and anxiety (O)
      - Use good science (M)
        - Use up-to-date information (M)
        - Use appropriate expertise (E)

- Maximize Quality of the Analysis (All)
  - Conduct analysis in an unbiased fashion (L)
  - Consider all alternatives as real alternatives (M)
  - Conduct analysis with natives in a compatible way with their lifestyle (N)
    - Arrange meetings at a compatible time (L,N)
    - Listen to and respect judgments offered (N)
    - Do not assume no response implies no interest (N)
    - Preserve dignity and respect in interactions (N)

Table 7, continued. Process Objectives Expressed by Stakeholder Interests

Conduct the analysis consistent with all existing regulations (O)
Consistent with NEPA regulations (E)
Consistent with state regulations (O)
Consistent with industry standards and expectations (O)

Select the appropriate level for analysis (O)
Internalize external costs (E)
Balance national versus local interests (E)
Balance economic costs and benefits (O)
Establish broad base of expertise within MMS (M)

- Maximize the Quality of Decision Making (All)
  Recognize the majority desires and values (E)
  Provide thorough and meaningful response to issues raised by stakeholders (L,N)
  Clearly indicate how stakeholder comments affected the decision process (E,L)

- Communicate Clearly and Accurately (All)
  Communicate with all interested parties (M)
  With all stakeholders (All)
  Among staff and various agencies (M)
  Communicate using civilized discourse (M)
  Have ongoing communication with stakeholders (E)
  Establish a clearinghouse for relevant information (E)

- Enhance Contributions of the EIS
  Increase knowledge (E)
  Facilitate community cohesion and cooperation (L,M)
  Improve trust of government and the oil industry (L)

Note: We have placed a letter after each objective to indicate which interest group or groups brought up the issue. The designations are the following: L = local group interests, N = Native group interests, E = environmental group interests, O = oil industry group interests, and M = Minerals Management Service/federal regulator group interests. Because some comments concerned broad issues and others narrow issues, it is sometimes difficult to indicate precisely all of the groups that made specific process comments. No priorities are meant to be implied by the order of the issues or by the order of the groups indicated as having suggested the issues.

Table 8. Alternatives for Consideration* as Part of Proposed Lease Sale 149, Cook Inlet/Shelihof Strait

1. Seasonal drilling restrictions, to minimize gear conflict
2. Seasonal operating restrictions, due to ocean turbulence
3. Constraints on future development and transportation decision processes tied to current lease sales
4. Increased local consultation on, and control over, exploration and spill containment plans
5. Improved communication with communities and better coordination of the timing of meetings
6. Established engineering and performance standards, set prior to lease sale
7. Required compliance by industry with ITL (Information to Lessees) advisories
8. Improved mitigation of possible subsistence impacts
9. Consideration in EIS of alternatives to fossil fuel development

* Order of alternatives does not denote priorities.

7. CONCLUSION: RISK-MANAGEMENT OPPORTUNITIES FOR MMS

The Minerals Management Service, Alaska is a significant federal resource development and management agency. It is an important contributor to revenue generation activities and it plays an important role in the management and character of Alaska's offshore and coastal-zone resources. Indirectly, through the economic and environmental impacts of its activities, risk management recommendations made by Alaska's MMS hold national and international scope and significance.

This importance implies that the risk-management methods used by MMS should be state-of-the-art. Unfortunately, our conclusion based on the background documents provided to us by MMS staff as well as what we have heard from workshop participants is that current MMS risk-management practices and the potential of what could be done is a major contributor to many of the problems now confronting the agency: a decline in public confidence and trust, a decline in oil and gas industry confidence, and a decline in morale among MMS employees.

The risk-management approach we outline in this report comes with no guarantees of success. We believe it is likely to lead to improvements in both the procedures by which MMS makes risk-management decisions and in the outcomes which result from those decisions. At its core are beliefs in the participation of multiple stakeholders and in the existence of multidimensional values for the economic, environmental, social, and cultural concerns at risk. These beliefs reflect a literature developed over the past thirty years, the results of hundreds of applied projects, and the experience of the consultants in Alaska during the three-week tenure of the workshop.

The *participation of multiple stakeholders* in all phases of the risk-management process is a critical element in the proposed approach. Each of the different stakeholders concerned about the impacts of a proposed management action will be interested in a slightly different set of concerns. For a risk-management process to be credible and to have the support of the stakeholders, it must address these concerns in terms that speak to the potential impact as it is thought about by the stakeholder.

The participation of stakeholders must begin early in the process and it must be meaningful, involving selection and refinement of the risk-management procedures as well as the identification of experts and the communication of study results to the public and decision makers. This involves an empowerment of stakeholders-whether from public, native, environmental, or other government groups-that is often conceptually difficult for managers within government agencies but that is consistent with the intent of legislative and judicial practice in the 1990s.

The proposed approach rests on a specific analytic framework, derived from work in *decision analysis* and *risk perceptions*, but it is recognized that the analysis cannot and should not make decisions. Instead, the products of the analysis form part of a *negotiated basis for decision making* that requires MMS to search for actions and projects that will take account of the interests and concerns of all the potentially affected stakeholders.

This is a fundamentally different forum for decision making, because the agenda for the evaluation of alternatives explicitly reflects the *values of all stakeholders* rather than only those of technically-trained experts. The payoff from the approach is that projects or activities which survive the review process have been agreed-to in terms of those concerns most relevant to the needs and interests of each of the stakeholders. If a proposed action can satisfy the expressed objectives of the stakeholders, then in their own terms it is considered, at least on balance, to be a beneficial action.

The *resource needs* of the revised risk-management process are substantial but, in our opinion, no greater and perhaps less than those required by current procedures. Staff will need to be trained to work with stakeholder groups, but many individuals already working for MMS have extensive experience with the various communities: native interests, environmental groups, local communities, fishers, and the oil and gas industry. New and perhaps unfamiliar elements of the proposed risk-management process, such as probability assessments or communication regarding risk perceptions, will require additional training by off-site personnel or the hiring of new staff. More precise requirements of an improved risk-management process could be defined in consultation with MMS risk managers, but only following additional clarification of the revised objectives of the MMS risk-management program. However, it is important to remember that offsetting savings will occur in terms of both time and legal costs. In our opinion, the current process by which environmental risks are assessed is both overly lengthy, because of the lack of a clear link between data-collection efforts and their importance to the decision-making process, and overly expensive, because of the amount of time taken by court appeals. By involving stakeholders at the start of the process and by using explicit stakeholder values and perceptions as the basis for the analysis, our expectation is that the overall resource needs of the proposed risk-management process will be considerably decreased.

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APPENDIX A

Workshop Schedule: "Managing Environmental Risks"
Sponsored by: Alaska OCS Region, Minerals Management Service

Session 1: March 2-4, 1992
Robin Gregory, Ralph Keeney, and Donald MacGregor

Monday, March 2

8:30 a.m. Introduction to Managing Environmental Risks Workshop: Structure and Objectives. R. Gregory.

10:15 a.m. Introduction to Risk Management. R. Gregory.
Thinking About Risks. R. Keeney.

1:30 p.m. Structuring Objectives for Public Risk Issues. R. Keeney, R. Gregory.

3:15 p.m. Public Values Case Study: Tradeoffs Among Objectives. R. Keeney.

Tuesday, March 3

8:30 a.m. Risk Perceptions: Insights into Public Response. R. Gregory.

10:15 a.m. Using Decision Analysis to Learn About Risks. R. Keeney.

1:30 p.m. Models of Risk Perception and Trust. R. Gregory.

3:15 p.m. Using Surveys to Learn About Risk Perceptions: Data Collection, Analysis, and Interpretation. D. MacGregor.

Wednesday, March 4

8:30 a.m. Risk Perception Case Studies: Transportation of Hazardous Materials, Water Pollution, Facility Siting, EMF. D. MacGregor, R. Gregory.

10:15 a.m. Using Risk Comparisons in Risk Communication. D. MacGregor.

1:30 p.m. Communicating Technical Risk Issues: Information, Attitudes, and Behavior. D. MacGregor.

3:15 p.m. Focus Groups: Risk Amplification, Establishing Two-Way Communication, and Stigmatization. R. Gregory.

Session 2: March 16-18, 1992
Robin Gregory, Bob Clemen, and Detlof von Winterfeldt

Monday, March 16

8:30 a.m. Introduction to Environmental Preferences and Value Models: Values, Ambiguity, Sources of Uncertainty. R. Gregory.

10:15 a.m. Using Decision Analysis: Options, Uncertainty, and Quantification of Expert Judgments. D. von Winterfeldt.

1:30 p.m. Decision Analysis Case Study: Hazardous Facility Siting, Emissions. D. von Winterfeldt.

3:15 p.m. Judgmental Heuristics: Choice, Bias, Constructed Values. R. Gregory.

Tuesday, March 17

8:30 a.m. Using Decision Analysis To Make Risk Decisions: Value of Information, Sensitivity Analysis. R. Gregory, D. von Winterfeldt.

10:15 a.m. Values Structuring Case Study: Offshore Oil Development. D. von Winterfeldt.

1:30 p.m. Tools for Structuring Risk Negotiations: Decision Trees, Influence Diagrams. B. Clemen.

3:15 p.m. Using Decision and Value Trees in Negotiation: Case Study Examples. R. Gregory, B. Clemen.

Wednesday, March 18

8:30 a.m. Strategies for Negotiations: Getting to Yes: Processes and Outcomes. R. Gregory. Environmental Issues Case Study: EPA NESHAPs. R. Gregory.

10:15 a.m. Environmental Issues Case Study: Riverside DEC. B. Clemen.

1:30 p.m. Mitigation/Compensation Processes and Outcomes: Overcoming NIMBY. R. Gregory.

3:15 p.m. Case Study Example: Bargaining Strategies and Prisoner's Dilemma. B. Clemen.

Session 3: June 1-3, 1992
Robin Gregory and Ralph Keeney

Monday, June 1

8:30 a.m.	Judgment and Psychological Traps: Evaluation and Negotiation Illusions. R. Gregory.
10:15 a.m.	Prescriptive Risk Communication. R. Gregory, R. Keeney.
1:30 p.m.	Group Case Study 1: Stakeholder Fundamental Objectives for Lease Sale 149. R. Gregory, R. Keeney.
3:15 p.m.	Case Study 1, continued.

Tuesday, June 2

8:30 a.m.	Case Study 1, continued.
10:15 a.m.	Case Study 1, continued.
1:30 p.m.	Case Study 2: Attributes, Weights, and Tradeoffs. R. Gregory, R. Keeney.
3:15 p.m.	Case Study 2, continued.

Wednesday, June 3

8:30 a.m.	Case Study 3: Lease-Sale Alternatives.
10:15 a.m.	Case Study 3, continued.
1:30 p.m.	Discussion: Risk-Management Policy for Least Sale 149. R. Gregory, R. Keeney.
3:15 p.m.	Discussion, continued.

APPENDIX B

Workshop Participants

From Outside MMS:

Dan Benfield, U.S. Fish and Wildlife Service
Tasha Chmielewski, North Pacific Rim
Linda Freed, Kodiak Island Borough
Jim Haynes, Alaska Division of Oil and Gas
Chris Herlugson, BP Exploration
Paul Jackson, North Pacific Rim
Carol Jorgensen, Arctic Marine Resource Commission
Christine Klein, Prince William Sound Reg. Citizen's Adv. Cou.
Tom Lohman, North Slope Borough
George Matz, Anchorage Audubon Society
Pam Miller, Greenpeace
Jesse Mohrbacher, ENSR Consulting
Gail Phillips, Alaska State Representative (Homer)
Brad Smith, National Marine Fisheries Service
Dorothy Smith, Greenpeace
Kathryn Thomas, Arctech Services
Robert Wolfe, United Cook Inlet Drift Association (UCIDA)

From Inside MMS:

Tracy Andrews	Steve Landino
Michael Baffrey	Maureen McCrea
Don Callaway	Kyle Monkelien
Paul Dubsky	Ruth Poff
Ray Emerson	John Schindler
Karen Gibson	Jerry Shearer
Judy Gottlieb	Jeff Walker

APPENDIX C

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APPENDIX D

Annotated Bibliography

Allman, W. F. 1985. Staying alive in the 20th century. *Science 85*, October. 31-41.

Provides an overview of some of the management and decision-making issues currently being investigated by risk researchers, and a casual introduction to why public and expert views of risk may differ and what these different perceptions might mean for risk-communication initiatives.

Bazerman, M. 1986. *Judgment in managerial decision making.* New York: Wiley.

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This text uses influence diagrams and decision trees to model decision situations that are applied to real-life problems. Considerable discussion is given to the role of personal computer programs in the construction and analysis of decision models and to how creativity in problem solving relates to decision making.

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Discusses the origin of focus groups in market surveys and summarizes the role of focus groups in improving managers' understanding of how people respond to environmental risks.4

Edwards, W. , and von Winterfeldt, D. 1987. Public values in risk debates. *Risk Analysis*, **7**, 141-158.

Demonstrates how techniques based on decision analysis can be used to clarify public values in risk debates and as a basis for negotiation.

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Discusses the importance of cognitive aspects of choice for people's ability to function as decision makers and as intuitive statisticians.

Fisher, R., Ury, W., and Patton, B. 1991. *Getting to yes: Negotiating agreement without giving in* (2nd ed.) New York: Penguin.

Provides a straightforward approach to the development of mutually acceptable agreements in a variety of conflict situations.

Gregory, R., Keeney, R., and von Winterfeldt, D. 1992. Adapting the environmental impact statement process to inform decision makers. *Journal of Policy Analysis and Management*, **1**, 58-75.

Draws from work in decision analysis, judgment, and probability assessment to propose an approach for making the environmental impact assessment process more useful to resource managers.

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