United States Environmental Protection Agency | EPA Science Advisory Board (1400A) Washington DC | EPA-SAB-EC-COM-01-006 August 2001 *www.epa.gov/sab*

# IMPROVED SCIENCE-BASED ENVIRONMENTAL STAKEHOLDER PROCESSES

## A COMMENTARY BY THE EPA SCIENCE ADVISORY BOARD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

August 22, 2001

EPA-SAB-EC-COM-001-006

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

The Honorable Christine Todd Whitman
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

SUBJECT: Improved Science-Based Environmental Stakeholder Processes: An EPA Science Advisory Board Commentary

Dear Governor Whitman:

In October of 1999, the Executive Committee of the EPA Science Advisory Board sent a brief Commentary to Administrator Browner in which we "enthusiastically support(ed) the Agency's efforts to develop and promote new, more flexible, adaptive approaches to environmental regulations" but expressed concern about the extent to which group stakeholder decision processes are able to perform a "full and careful consideration of all available science." We indicated that we planned a series of workshops and deliberations with the objective of: a) better understanding the way in which scientific and technical knowledge is being developed and used in stakeholder processes; and b) identifying strategies that might allow such knowledge to be better developed and used in these processes in the future.

The enclosed Commentary, "Improved Science-Based Environmental Stakeholder Processes," reports the results of that effort. We found that the terms "stakeholder" and "stakeholder process" are remarkably elastic. Our recommendations are directed at processes in which participants such as non-expert and semi-expert citizens, representatives of environmental non-governmental organizations, corporations, and other private parties are asked to: define or frame a problem; obtain feedback in order to better inform decision-makers about proposed alternative courses of action; develop and elaborate a range of options and/or criteria for good decision-making that a decision-maker might employ; or either explicitly or implicitly, actually make environmental decisions. Properly conducted in those contexts, stakeholder processes can be valuable in supporting high-quality science-based environmental decisions.

To be effective, science-based environmental stakeholder processes require substantial financial resources and high-quality staff who are available to provide ongoing support to participants on an iterative basis. Thus, at least in the short run, good science-based stakeholder processes are typically *more* expensive than conventional environmental decision processes. They are *not* a low-cost alternative to conventional processes.

There are many problems for which stakeholder processes, of the kinds we have addressed, are not appropriate. Limitations in data, analytical capabilities, or Agency resources can result in pressures to expand inappropriately the use of these methods. Such pressures should be resisted since over-use and misuse hold the potential to yield decisions that are not well founded in relevant science, commit scarce resources unwisely, and sometimes lead to decisions that do not reflect a full consideration of the broad public interest. Over-use could give these techniques a bad name and undermine their use in those settings in which they can be most valuable.

Our Commentary makes seven specific findings listed in the attached table and then recommends that your office would be well advised to take two actions:

a) Develop brief guidance to the Agency on the appropriate use of stakeholder processes of the types we have addressed. When a unit within EPA proposes to use a group stakeholder process for such purposes, it should be asked to: 1) justify the decision in a fashion that addresses the seven findings of this report together with any other concerns the Agency considers appropriate; 2) base the proposed methods on a careful reading of available literature; 3) propose a specific strategy for evaluation, both during and after the completion of the process.

b) Direct the Office of Research and Development, in collaboration with the Program in Decision, Risk and Management Science at the National Science Foundation, to undertake an extramural program of experimental and field (case) studies designed to develop improved methods and tools for the use and evaluation of science-based environmental stakeholder processes.

We would be happy to meet with you or your staff to discuss this report and its implications, if that would be useful. We look forward to your response to this Commentary.

Sincerely;

***/ Signed /***

Dr. William Glaze, Chair
EPA Science Advisory Board

***/ Signed /***

Dr. Granger Morgan, Chair
New Approaches Working Group
EPA Science Advisory Board

## TABLE OF FINDINGS
## This Table lists the seven findings from the SAB Commentary "Improving Science-Based Environmental Stakeholder Processes."

| | |
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| **Finding 1** | An adequate treatment of science is possible in stakeholder processes, but typically only if substantial financial resources, adequate time, and high-quality staff are available from the outset to allow the necessary deliberation and provide the necessary support on an iterative basis through ongoing interaction with the stakeholders. Absent such resources, stakeholder decision processes, of the types considered in this commentary, frequently do not do an adequate job of addressing and dealing with relevant science. |
| **Finding 2** | While staffing arrangements should be tailored to the needs of specific stakeholder groups, it is often better to support a stakeholder process with a single balanced team of expert staff rather than give each stakeholder group a budget to go out and retain their own experts. |
| **Finding 3** | If group stakeholder processes, of the types considered in this Commentary, are to result in environmental decisions that are adequately informed by science, participants in those processes must share a commitment to explore the implications of *all* relevant science, and a willingness to reframe the problems they address when scientific evidence leads in unanticipated directions. |
| **Finding 4** | While stakeholder processes can appropriately be used as a vehicle for framing issues and clarifying and informing decisions to be made by EPA and other regulatory decision-makers in a wide variety of settings, they should be used judiciously and with sensitivity to the fact that they can impose substantial burdens on the very limited human and financial resources available to non-governmental organizations and local community groups. |
| **Finding 5** | Using stakeholder process, either explicitly or implicitly, to make regulatory decisions - as opposed to using them as a source of input to decisions made by regulators - should be undertaken with great care. If it is to be done at all, it can appropriately be applied to only a modest subset of environmental regulatory decisions in which:<br>a) adequate staff, generous financial resources, and sufficient time are available to provide expert support on an iterative basis;<br>b) parties are willing to adapt their thinking and the problem formulation to the scientific evidence as it becomes understood;<br>c) the problem being addressed involves a small number of well identified affected parties who can *all* be made party to the decision process;<br>d) a vehicle is provided for obtaining input from other interested but unaffected parties, including members of the general public, and<br>e) the legally authorized regulatory entity, such as EPA or a state or local agency, explicitly retains a right to review, and if necessary, modify or reject the decision. |
| **Finding 6** | If and when a stakeholder process is to be used *as the vehicle for decision-making*, great care must be taken to assure that all relevant interests are represented in a full and balanced manner. Only then can modest ambiguities involving fact-value tradeoffs be allowed to persist without risking serious errors in outcome. Most environmental decisions cannot properly be framed as a negotiation among a modest number of well-identified stakeholders. |
| **Finding 7** | The EPA should explore the development and appropriate use of randomly selected (i.e., disinterested jury-like) groups of members of the general public as a vehicle to obtain advice and insight about public views to assist the Agency in environmental decision-making in the public interest. |

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# 1. EXECUTIVE SUMMARY

This Commentary is based on a series of workshops and deliberations conducted by the Executive Committee on EPA's Science Advisory Board with the objective of addressing two questions. How well is scientific and technical knowledge being developed and used in group stakeholder processes? What strategies might allow such knowledge to be better developed and used in these processes in support of high-quality science-based environmental decisions? By the latter, we mean decisions that:

a) are based on a careful and complete review and critical evaluation of the available scientific evidence;

b) are based on an analysis of that evidence according to well-established methods and practice in decision and policy science; and

c) combine the resulting scientific understanding and insights with an appropriate set of value judgments that reflect public preferences and EPA's obligation to protect environmental health and welfare.

The definitions of the terms "stakeholder" and "stakeholder processes" have become highly elastic. Indeed, these words are sometimes used to refer to any interaction with groups outside the agency, or even to the involvement of experts or others within the agency. This commentary is concerned with group processes in which the participants include non-expert and semi-expert citizens, and/or representatives of environmental non-governmental organizations, corporations and other private parties. We focus on processes in which such groups are asked to: define or frame a problem; develop feedback in order to better inform decision-makers about proposed alternative courses of action; develop and elaborate a range of options and/or criteria for good decision-making which a decision-maker might employ; or, either explicitly or implicitly, actually make environmental decisions.

Over the past fourteen months, the Executive Committee has conducted four workshops and a small working group has reviewed a variety of literature and held extended deliberations. We find that properly conducted, stakeholder processes of the types we have considered can be valuable in supporting high-quality science-based decisions. They are most useful when they are employed to define or frame a problem; to obtain feedback in order to better inform decision-makers about proposed alternative courses of action; or to develop and elaborate a range of options and/or criteria for good decision-making that a decision-maker might employ.

To be effective, these kinds of science-based environmental stakeholder processes require substantial financial resources and high-quality staff who are available to provide ongoing support to participants on an iterative basis. Thus, at least in the short run, good science-based stakeholder processes are typically more expensive and time-demanding than conventional environmental decision processes. They are not a low-cost alternative to conventional processes. Participants in successful stakeholder decision processes must share a commitment to explore the implications of all relevant science, and a willingness to re-frame the problems they address when scientific evidence leads in unanticipated directions.

There are many problems for which stakeholder processes, of the kinds that we are addressing, are not appropriate. Limitations in data, analytical capabilities, or agency resources can result in pressures to expand inappropriately the use of these methods. Such pressures should be resisted since over-use and misuse hold the potential to yield decisions that are not well founded in relevant science, commit scarce resources unwisely, and sometime lead to decisions that do not reflect a full consideration of the broad public interest. Over-use could give these techniques a bad name and undermine their use in those settings in which they can be most valuable. Processes which, either explicitly or implicitly, are used to actually make, rather than inform, decisions can be potentially problematic and require particular attention. In addition to using processes that involve affected parties, the EPA should explore the development and use of processes that draw upon randomly selected (i.e., jury-like) groups of members of the general public as a vehicle to obtain advice on environmental decision-making in the public interest.

The report makes seven specific findings (listed in Table 1) and then recommends that the Administrator would be well advised to take the following two actions:

a) develop brief guidance to the Agency on the appropriate use of stakeholder processes in which groups are asked to work together to: define or frame a problem; develop feedback in order to better inform decision-makers about proposed alternative courses of action; develop and elaborate a range of options and/or criteria for good decision-making which a decision-maker might employ; or, either explicitly or implicitly, actually make environmental decisions. When a unit within EPA proposes to use a group stakeholder process for such purposes, it should be asked to: 1) justify the decision in a fashion that addresses the seven findings of this report together with any other concerns the Agency considers appropriate; 2) base the proposed methods on a careful reading of available literature; and 3) propose a specific strategy for evaluation, both during and after the completion of the process.

b) direct the Office of Research and Development, in collaboration with the Program in Decision, Risk and Management Science at the National Science Foundation, to undertake an extramural program of experimental and field (case) studies designed to develop improved methods and tools for the use and evaluation of science-based environmental stakeholder processes.

## TABLE I - TABLE OF FINDINGS

## This Table lists the seven findings from the SAB Commentary "Improving Science-Based Environmental Stakeholder Processes."

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| **Finding 2** | While staffing arrangements should be tailored to the needs of specific stakeholder groups, it is often better to support a stakeholder process with a single balanced team of expert staff rather than give each stakeholder group a budget to go out and retain their own experts. |
| **Finding 3** | If group stakeholder processes, of the types considered in this Commentary, are to result in environmental decisions that are adequately informed by science, participants in those processes must share a commitment to explore the implications of *all* relevant science, and a willingness to reframe the problems they address when scientific evidence leads in unanticipated directions. |
| **Finding 4** | While stakeholder processes can appropriately be used as a vehicle for framing issues and clarifying and informing decisions to be made by EPA and other regulatory decision-makers in a wide variety of settings, they should be used judiciously and with sensitivity to the fact that they can impose substantial burdens on the very limited human and financial resources available to non-governmental organizations and local community groups. |
| **Finding 5** | Using stakeholder process, either explicitly or implicitly, to make regulatory decisions - as opposed to using them as a source of input to decisions made by regulators - should be undertaken with great care. If it is to be done at all, it can appropriately be applied to only a modest subset of environmental regulatory decisions in which:<br>a) adequate staff, generous financial resources, and sufficient time are available to provide expert support on an iterative basis;<br>b) parties are willing to adapt their thinking and the problem formulation to the scientific evidence as it becomes understood;<br>c) the problem being addressed involves a small number of well identified affected parties who can *all* be made party to the decision process;<br>d) a vehicle is provided for obtaining input from other interested but unaffected parties, including members of the general public, and<br>e) the legally authorized regulatory entity, such as EPA or a state or local agency, explicitly retains a right to review, and if necessary, modify or reject the decision. |
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# 2. INTRODUCTION

## 2.1 Introduction

In November of 1997 the Executive Committee of the EPA Science Advisory Board held a planning retreat in Washington, D.C. At that retreat the Board decided to expand the set of self-initiated studies it undertakes in order to provide more strategic advice to the agency. As a result, standing committees of the SAB were encouraged to begin to identify and address issues that needed their special attention beyond their usual work of reviewing major agency reports. In addition, the Executive Committee of the SAB identified a number of such issues. The use of science in stakeholder processes quickly emerged as a topic warranting early attention.[1] In October of 1999, the Executive Committee sent a Commentary on this subject to the Administrator[2], in which we noted that:

a) the SAB "enthusiastically support[s] the Agency's efforts to develop and promote new, more flexible, adaptive approaches to environmental regulations."

b) involving representatives of specific interested or affected parties in environmental decision-making is clearly important;

c) the Agency has a responsibility to represent the broad public interest;

d) it is in the broad public interest to base environmental decisions on a "full and careful consideration of all available science."

e) in "newer decision environments, which involve a greater focus on consultation and negotiation among directly involved stakeholders," there is a risk that this broad public interest could be frustrated and full consideration of all available science may receive too little attention in the interest of accommodating conflicting interests and perspectives.

Having stated both its support and this concern, the SAB went on to explain that it would run a series of workshops with the objective of better understanding the way in which scientific and technical knowledge is being developed and used in stakeholder processes, and to identify strategies that might allow such knowledge to be better developed and used in such processes in the future.

In the subsequent 14 months, in conjunction with their regular meetings, the SAB Executive Committee held four half-day workshops on this topic. Appendix 2 summarizes the agendas and speakers. At the first of these workshops, a group of Senior Agency staff was invited to offer suggestions and advice on the questions that should be addressed and on how we should proceed.

We have been greatly facilitated in our work by the fact that several groups have recently conducted extensive summary analyses of stakeholder processes that have included an examination of how scientific knowledge has been summarized and used. Thus, in each of the three workshops that followed, we were able to adopt the following format:

a) a briefing on a summary analyses which had reviewed and assessed a large number of stakeholder processes.

b) a series of "reports from the field" from a variety of people who had been participants in, or close observers of, specific stakeholder processes.

The presentations inevitably sparked extensive discussion that allowed Executive Committee members to explore a wide range of relevant questions.

In writing this report, we have chosen to focus on the bottom line, placing most supporting references and examples in endnotes so as to keep the report brief and easy to read. Additional supporting detail can also be found in the Appendices.

## 2.2 Environmental Decision-making

Before we turn to a summary of our findings, we provide some context with a few observations on the nature of environmental decision-making. Good environmental decision-making is a complex process which requires *both* a careful review and assessment of relevant science *and* a thoughtful application of social values.

When the US Environmental Protection Agency (EPA) was created in 1970, environmental problems were pretty obvious. Anyone who traveled around the country could see them, smell them and taste them. The things that needed to be done were also pretty obvious: set standards to reduce emissions and then push hard to get them enforced. Over the years, the nature of environmental problems in the United States has evolved. Most of the more obvious problems have been brought under control. Today's problems are more subtle. They involve complex and uncertain scientific evidence and involve difficult societal value judgments and tradeoffs.[3] To address such problems, environmental decision-makers must have access to substantial technical and scientific resources, and the support of strong decision-science and policy analytic skills informed by social and natural science as well as engineering.

It has become popular to talk of "science-based" environmental decision-making. While all good environmental decisions must be based in a careful consideration of the relevant science, science alone is not sufficient. Equally important are value judgments. Science rarely provides answers that are as precise as decision-makers would like. Even in an ideal world, where science could precisely describe all health and environmental damages in detail and accurately predict the costs and consequences of all proposed control actions, important value judgments would be required to choose the best level and pattern of environmental protection. In the real world, scientific understanding about important environmental issues is almost always incomplete. Thus, environmental decision-makers must also decide how to make decisions in the face of uncertainty. There is typically uncertainty about both the nature and extent of the damages and the costs and consequences of proposed control actions. Again, deciding how to proceed, in the face of uncertainty, requires a value judgment.

The fundamental appeal of stakeholder-based decision processes lies in this necessity to make value judgments, informed by available scientific evidence. When and if representatives of the all relevant and interested parties, including the general public, can be brought together to clarify collectively and openly areas of agreement and disagreement, understand and apply the relevant science, and perhaps even reach consensus on how best to deal with an environmental problem, the result should be a decision that is both scientifically and socially sound.[4]

## 2.3 What is a "High-quality Science-Based Environmental Decision?"

What are the properties of a "high-quality science-based environmental decision?" As noted above, it is rare that science is as complete as environmental decision-makers would like. Nor is complete scientific understanding either necessary or sufficient for high-quality decision-making. As the agency charged with protecting the nation's environmental health and welfare, EPA cannot afford to wait for complete understanding before acting. When there is a plausible prospect that damage is occurring, or could occur, it is appropriate for EPA to take protective action.

Thus, by "high-quality science-based environmental decisions" we mean decisions that:

a) are based on a careful and complete review and critical evaluation[5] of the available scientific evidence;

b) are based on an analysis of that evidence according to well-established methods and practice in decision and policy science; and

c) combine the resulting scientific understanding and insights with an appropriate set of value judgments that reflect public preferences and EPA's obligation to protect environmental health and welfare.

## 2.4 What Is a "Stakeholder?"

In conducting this study, the SAB found that the term "stakeholder" has now been stretched to include almost any group imaginable. However, most dictionaries contain just a single definition for the term "stakeholder," a definition that does not include contemporary usage. A stakeholder is defined as:

> ***n.*** one who holds money, etc. bet by others and pays it to the winner.

While this definition does not capture contemporary usage, it is subtly symbolic. Clearly, the stakeholder of the traditional dictionary definition should hold the interests of others in trust and be counted on to serve those interests in a fair and expeditious manner, on the basis of an objective assessment of the state of the world. By this definition, *the EPA is US society's stakeholder for environmental protection!*

The National Research Council (NRC) report *Understanding Risk*[6] views stakeholders as including both "interested" as well as "affected" parties. In contrast, the EPA Agency-wide 2000 Public Involvement Policy[7] adopts a narrower definition of stakeholder. It differentiates between "the public," by which it means any member of the general public; "stakeholders," by which it means that sub-set of people and groups "who have a strong interest in the Agency's work and policies;" and "affected parties," by which it means "individuals and groups who will be impacted by EPA policies or decisions."

We prefer the NRC's broader definition and will use it in this report because it is our belief that members of the general public – who may not be directly affected by, but as citizens certainly have, or with time and attention could develop, an interest in environmental decisions – should be included in any general consideration of stakeholder processes.

Stakeholder processes can be classified and used in several ways. At our March 2000 workshop, presenter Dr. Juliana Birkhoff, of the environmental dispute resolution firm RESOLVE Inc., noted that stakeholder processes may be used to:

a) define or frame a problem;

b) provide feedback to better inform decision-makers about proposed alternative courses of action;

c) develop a range of options and/or criteria for good decision-making; or

d) actually make decisions.[8]

While this Commentary uses a broader definition of "stakeholder" than the EPA draft Public Involvement Policy, we use a narrower definition of "stakeholder processes." We include as stakeholders non-expert and semi-expert citizens and citizen groups, independent of their initial degree of interest in the issues or the magnitude of the impacts they will experience, as well as representatives of environmental non-governmental organizations, corporations, and other private parties with economic or other interests in the decisions being made. However, we limit "stakeholder processes" to situations in which such groups *work together* to perform the four kinds of tasks listed in the paragraph above.

It turned out to be rather difficult to find examples of processes that involved representatives of the general public.[9] This fact may reflect a problem with the design of many current processes.[10] The participants in many of the cases that were first suggested as examples of stakeholder decision processes involve representatives from various insider and expert communities or people with material interest in the outcome. However, with some effort a wide range of examples was found, including a number which involved significant participation by members of the general public.

# 3. FINDINGS AND RECOMMENDATIONS

In our workshops, and our reading of the literature, we examined stakeholder processes that encompassed both our broad definition, of "interested and affected parties" as well as the narrower definition of "affected parties." Except where noted, the findings and recommendations that follow apply to both. As previously noted, our recommendations are directed at group processes in which the participants include non-expert and semi-expert citizens, and/or representatives of environmental non-governmental organizations, corporations and other private parties in which the group is asked to work together to: define or frame a problem; develop feedback in order to better inform decision-makers about proposed alternative courses of action; develop and elaborate a range of options and/or criteria for good decision-making which a decision-maker might employ; or, either explicitly or implicitly, actually make environmental decisions.

## 3.1 An Adequate Treatment of Science is Possible

Among the specific cases we examined, we saw a number of examples of stakeholder processes that effectively reviewed and used relevant science in their deliberations.[11] All of these examples had three things in common:

a) high-quality staff available to summarize and interpret the science;[12]

b) a process that gave stakeholders the time and support needed iteratively to refine and reshape the scientific questions that staff were asked to address[13] and develop new questions as participants' understanding of the issues evolved;[14] and

c) substantial resources to support the review of relevant scientific evidence and the development of summary scientific materials in a form that was intelligible to the stakeholders.

Unfortunately, these three conditions were not present in many of the stakeholder processes we reviewed.[15]

> **Finding 1:** An adequate treatment of science is possible in stakeholder processes, but typically only if substantial financial resources, adequate time, and high-quality staff are available from the outset to allow the necessary deliberation and provide the necessary support on an iterative basis through ongoing interaction with the stakeholders. Absent such resources, stakeholder decision processes, of the types considered in this Commentary, frequently do not do an adequate job of addressing and dealing with relevant science.

Adequate time is important both to allow stakeholders to understand fully the science and its implications, and to engage in a meaningful deliberative process with other participants.

By "high-quality staff" we mean staff who combine good technical understanding and analytical skills with an understanding of the broader decision context, good communication skills, and an ability to respond flexibly to, and support, the needs of the stakeholders. In a number of the successful examples that we examined, staff support also included one or more trained facilitators who could work constructively to support the progress of the group deliberations.

In fairness, we should note that more traditional decision processes also sometimes fail to do an adequate job of addressing and dealing with relevant science. In this context, Beierle[16] appropriately asks: with what standard of decision-making should we be comparing stakeholder processes? He notes that studies of agency decision-making suggest that the status quo to which stakeholder processes are an alternative often also falls well short of the ideal of "expert-led scientific decision-making." While this observation has a "second-best" appeal, we take little comfort from it because the SAB is charged with "making a positive difference in the production and use of science in the Agency," independent of the decision process employed.[17]

### 3.2 Mechanisms for Technical Support

Careful thought must be given to designing the form that technical staff support should take for a particular stakeholder process. As discussed in paragraphs below, different arrangements are likely to best serve different circumstances. In a number of the most successful examples we reviewed, the set of stakeholders shared a common pool of supporting staff, as opposed to each being given resources to go off and commission their own separate experts. This approach appeared to have three advantages: it minimized the risk that deliberations would deteriorate into dueling experts; it built a sense of shared problem understanding; and it tended to focus the group on the necessary value choices, making it harder to hide behind the science.

> **Finding 2:** While staffing arrangements should be tailored to the needs of specific stakeholder groups, it is often better to support a stakeholder process with a single balanced team of expert staff rather than give each stakeholder group a budget to go out and retain their own experts.

The issue of control is obviously important when the same staff is to be used by all participants, particularly because different participants often come to the proceedings with vastly different resources. In the best examples we saw, the group was able to agree collectively on what questions they wanted staff to address. Often those questions changed as the process proceeded and participants' understanding evolved. When the Agency is providing technical support, it is important to avoid the temptation to shape the proceedings by controlling the content of the technical support.

While there is good evidence that a shared staff and shared resources can be very beneficial in many stakeholder settings, the literature is not sufficiently clear to support the conclusion that this is always the best procedure. For example, there may be situations in which a topic has become so highly polarized that stakeholders cannot collaborate effectively. The Agency might still find it useful to arrange separate technical support for different stakeholders, and then seek input from each.

Respondents in an Environmental Law Institute interview-based study expressed mixed views on this topic.[18] Many were probably most familiar with adversarial processes. It is not clear whether those who strongly supported expanded use of technical assistance grants to individual organizations had experience with processes which provide common technical assistance to all participating stakeholders. Similarly mixed views are reported in interview results in a study by Suzanton Associates.[19] In both these cases, what is reported are opinions, not actual experimental findings, that compare different procedures for providing technical support.

### 3.3 The Need for Participant "Buy-In"

Our workshops identified examples in which difficulties arose because some of the participants came to the process with strong preconceptions about the nature of the problem. When a review of the science began to suggest that the problem should be reframed, difficulties arose, and in at least one case, key stakeholders walked out. Whether the problem being addressed is simple or complex, achieving "buy-in" by all participants is critically important.[20] If stakeholder decision processes are to be based in science, that "buy-in" must include a commitment by all participants to explore all relevant evidence and a willingness to reframe the problem if the science leads in unanticipated directions.

Situations can also arise in which it is to the advantage of some (or all) stakeholders to ignore selectively parts of the science, or to withhold information germane to the problem. The Agency itself is not immune to these impulses. In such situations, it is important that the process include some party with a strong commitment to honoring the full range of scientific evidence.[21]

> **Finding 3**: If group stakeholder processes, of the types considered in this Commentary, are to result in environmental decisions that are adequately informed by science, participants in those processes must share a commitment to explore the implications of *all* relevant science, and a willingness to reframe the problems they address when scientific evidence leads in unanticipated directions.

### 3.4 Stakeholder Processes Are Not a Solution to all Environmental Problems

As we noted in our discussion of definitions, stakeholder processes can be used to achieve a number of objectives: a) to define or frame a problem; b) to obtain feedback in order to better inform decision-makers about proposed alternative courses of action; c) to develop and elaborate a range of options and/or criteria for good decision-making; or d) to actually make decisions.

The use of stakeholder processes to serve the first three of these objectives poses relatively few problems, since all parties understand that legally authorized regulatory decision-makers retain full responsibility for all decisions, and will use the results of the stakeholder involvement as just one of a number of inputs to inform their decisions.

However, many stakeholders, such as national environmental non-governmental organizations and local community groups, have very limited personnel available to participate in stakeholder processes. They simply do not possess enough personnel or other resources to support serious participation in more than a modest number of stakeholder processes at any one time.[22]

> **Finding 4**: While stakeholder processes can appropriately be used as a vehicle for framing issues and clarifying and informing decisions to be made by EPA and other regulatory decision-makers in a wide variety of settings, they should be used judiciously and with sensitivity to the fact that they can impose substantial burdens on the very limited human and financial resources available to non-governmental organizations and local community groups.

Studies of public participation have emphasized the importance of developing a climate of cooperation among participants, so that they are willing to consider alternative values and viewpoints and the possibility of surrendering a portion of their individual autonomy for the collective good. Trained facilitators can often be effective in helping to create such a climate. In their comparative evaluation of eight models for environmental discourse drawn from experience in Europe and the United States, Renn, Webler, and Wiedemann[23] propose that efforts to increase participation be coupled with structural incentives to foster and promote communitarian values. Such approaches, they argue, are likely to be seen as more legitimate when problems are largely technical, impacts uncertain and complex, and values in competition. Similarly, the National Research Council Report, *Understanding Risk*, in arguing for public participation as a form of broadly-based deliberation, saw a potential for enhanced decision-making by improving problem formulation, increasing shared knowledge, clarifying views, and increasing acceptability of decisions.

State agencies and the EPA often face many more mandates than they have resources to address adequately. In such situations it can be tempting to deal with the problem by handing it to a stakeholder group without providing significant resources. However, at least in the short run, good stakeholder decision-making is typically *more* not less resource intensive than conventional methods. When agencies face more mandates than they have resources to cover, they should discuss the problem publicly and frankly, and seek redress, either in the form of more resources, or in the form of more realistic mandates. Handing such problems off to stakeholders will not in general lead to decisions based on a full and careful consideration of all relevant science, and actually can compromise principles of democratic procedure.

When environmental decisions require tough and unpopular choices, regulatory agencies may be tempted to turn the problem over to a stakeholder process. Of course, strictly speaking the Agency or other regulatory authority usually retains ultimate legal responsibility. However, when the output of a stakeholder process is implemented as a decision with little or no modification, the stakeholder process is being used, at least implicitly, to actually make decisions. Such cases require great care.[24]

**Finding 5:** Using stakeholder process, either explicitly or implicitly, to make regulatory decisions - as opposed to using them as a source of input to decisions made by regulators - should be undertaken with great care. If it is to be done at all, it can appropriately be applied to only a modest subset of environmental regulatory decisions in which:

a) adequate staff, generous financial resources, and sufficient time are available to provide expert support on an iterative basis;

b) parties are willing to adapt their thinking and the problem formulation to the scientific evidence as it becomes understood;

c) the problem being addressed involves a small number of well identified affected parties who can *all* be made party to the decision process;

d) a vehicle is provided for obtaining input from other interested but unaffected parties, including members of the general public, and

e) the legally authorized regulatory entity, such as EPA or a state or local agency, explicitly retains a right to review, and if necessary, modify or reject the decision.

There is one further issue that requires clarification, if and when stakeholder processes are to be used for decision-making. It is clear, both from the literature, and from the personal experience of many SAB members, that environmental conflicts often masquerade as arguments about science (i.e., about facts) when they are in actuality arguments about values.[25] This is not surprising, given the relatively privileged position that we give to science in environmental decision-making and the difficulty that many have in negotiating issues of value. As scientists, the initial instinct of most SAB members is to call for a sharp distinction between issues of fact and issues of value, as suggested in the so-called "Red Book" on risk.[26] However, while it is important that environmental decision-makers be clear about this distinction, we understand that practical political reality sometimes dictates a bit of public ambiguity and that assessing risks always involve value choices.

How explicit decision-makers can be is partly a function of evolving public understanding and accepted practice. For example, thirty years ago, most regulatory decision-makers were extremely reluctant to talk publicly about the fact that their decisions implied an implicit investment rate for life saving.[27] Today many agencies, such as National Highway Traffic Safety Administration and Federal Aviation Administration publish a target number and require that proposed regulations be evaluated against this target.

It can sometimes also be awkward, or even counterproductive, for parties in a negotiation to be too explicit about their values and objectives. While they should be clear in their own mind about fact/value distinctions, there is evidence in the literature on negotiation[28] that when different parties to a conflict have different, and multi-dimensional, objectives, progress toward a negotiated compromise may sometimes best be served by *not* being overly explicit about who is gaining, or giving up, what.

These observations impose an additional limitation on when stakeholder processes can appropriately be used for environmental decision-making:

> **Finding 6:** If and when a stakeholder process is to be used *as the vehicle for decision-making*, great care must be taken to assure that all relevant interests are represented in a full and balanced manner. Only then can modest ambiguities involving fact-value tradeoffs be allowed to persist without risking serious errors in outcome. Most environmental decisions cannot properly be framed as a negotiation among a modest number of well-identified stakeholders.

In summary, then, pressures to expand inappropriately the use of stakeholder methods, in the ways outlined above, should be resisted since overuse holds the potential to yield decisions that are not well founded in relevant science and to place great burdens on non-governmental (NGO) and community groups. Over-use could give the technique a bad name and undermine its use in those settings in which it can be very valuable.[29]

### 3.5 Involving the General Public

During the course of our review, we found relatively few examples of stakeholder processes that involved members of the general public, as opposed to stakeholders with well-developed specific interests. However, in as much as EPA's mission is to serve the broad public interest, and the greatest value of stakeholder processes is as a source of advice to decisions made by regulators, we believe that Agency decision-makers could find it very useful if they developed and used processes in which "jury-like" groups of representative members of the general public were asked to become knowledgeable about, and provide advice to the Agency on important environmental decisions. We use the phrase "jury-like" as a short hand to refer to representative groups of citizens chosen through some appropriate random process (which excludes interested parties), who are given the time and resources to understand and offer informed advice on an important regulatory issue. There has been considerable experience in both the United States and Europe with the development and use of such methods. This experience has demonstrated that, given adequate time and resources, lay groups can perform extremely well in such advisory capacities.[30]

> **Finding 7:** The EPA should explore the development and appropriate use of randomly selected (i.e., disinterested jury-like) groups of members of the general public as a vehicle to obtain advice and insight about public views to assist the Agency in environmental decision-making in the public interest.

# 4. AGENCY ACTIONS

On the basis of the preceding, we believe that the Administrator would be well advised to take two actions:

> **Recommendation 1:** Develop brief guidance to the Agency on the appropriate use of stakeholder processes in which groups are asked to work together to: define or frame a problem; develop feedback in order to better inform decision-makers about proposed alternative courses of action; develop and elaborate a range of options and/or criteria for good decision-making which a decision-maker might employ; or, either explicitly or implicitly, actually make environmental decisions. When a unit within EPA proposes to use a group stakeholder process for such purposes, it should be asked to: a) justify the decision in a fashion that addresses the seven findings of this report together with any other concerns the Agency considers appropriate; b) base the proposed methods on a careful reading of available literature; c) propose a specific strategy for evaluation, beginning early in the process so as to capture baseline data and using evaluation to identify and improve participation programs during their implementation.[31]

The recent literature contains a number of very useful anecdotal guidelines and strategies to develop and use scientific knowledge effectively in stakeholder processes. In the short term, persons running stakeholder processes would be well advised to read these insights and draw upon them carefully in designing and conducting their process. In order to facilitate this, Appendix C, D, and E reproduce three recent studies, which, taken together, do an excellent job of summarizing the current state of knowledge.

However, while intuition and skill will certainly always be part of the operation of an effective stakeholder process, many important issues can be framed as researchable questions. This leads to our second recommendation:

> **Recommendation 2:** Direct the Office of Research and Development, in collaboration with the Program in Decision, Risk and Management Science at the National Science Foundation, to undertake an extramural program of experimental studies, at a level of $3 to $5-million over the next five years, that is designed to build upon existing literature and systematically address the following questions:
>
> a) What are good strategies for developing and summarizing available scientific knowledge for use by non-technical and semi-technical participants in stakeholder processes?
>
> b) What are good strategies for introducing available scientific knowledge and assuring that it is adequately used in stakeholder processes involving non-technical and semi-technical participants?

c) How can "representative" members of the general public (as opposed to those with special interests and expertise) be selected? When they are used in processes that also include interested parties, how can they be helped to retain their "representative" status as the process proceeds?

d) How can stakeholder groups be assisted in understanding and dealing with the limits to scientific knowledge and with scientific uncertainty?

e) What methods can best be used to evaluate the performance of stakeholder processes both during and after their operation?

We proposed that the research be done collaboratively with National Science Foundation Decision Risk and Management Science program because EPA lacks the necessary social science research skills to develop and perform such work on its own. We recommend an extramural program because there are a number of excellent applied social science research groups across the country and elsewhere which are well qualified to undertake such work. We recommend a funding level of $3 to $5-million over five years because it will require a minimum of $1 to $1.5-million for any one group to develop and perform the necessary experimental studies, and it will be important to have more than one group addressing several of these questions in order to have the benefits of multiple perspectives and approaches.

# 5. ACKNOWLEDGMENTS

We thank the many people who participated in the four workshops and provided us with extensive advice and comments. Most of their names are listed in Appendix 2. We extend particular thanks to Mr. Thomas C. Beierle, Dr. Juliana E. Birkhoff, and Dr. Gail Charnley for their briefings on studies they have conducted reviewing large numbers of stakeholder processes, and for their permission to reprint their reports in Appendices C, D, and E.

## NOTES

1. For discussions of "new approaches" considered by the Board prior to its Commentary in 1999, see:

Pritzker, David M. and Deborah S. Dalton (eds.), 1995, *Negotiated Rulemaking Source Book*, Administrative Conference of the United States.

Davies, Terry and Jan Mazurek, 1996, *Industry Incentives for Environmental Improvement*, Resources for the Future, Washington, D.C.

National Academy of Public Administration, 1997, *Resolving the Paradox of Environmental Protection: An Agenda for Congress, EPA and the States*, Washington, DC.

United States General Accounting Office, 1997, *Regulatory Reinvention: EPA's Common Sense Initiative Needs an Improved Operating Framework and Progress Measures*, GAO/RCED-97-164.

United States General Accounting Office, 1997 *Environmental Protection: Challenges facing EPA's efforts to reinvent environmental regulation*, GAO/RCED-97-164.

Steinzor, Rena I., 1998, *Reinventing Environmental Regulation: The Dangerous Journey from Command to Self-control*, Harvard Environmental Law Review, v22, pp. 103-202.

US Environmental Protection Agency, 1998, *Reinventing Environmental Protection*, EPA100-R-99-002.

US Environmental Protection Agency, 1999, *The Common Sense Initiative: Lessons Learned*," EPA100-R-98-001.

2. Science Advisory Board, 1999, Science Advisory Board Commentary on the Role of Science in 'New Approaches' to Environmental Decisionmaking that Focuses on Stakeholder Involvement, EPA-SAB-EC-COM-00-002. This commentary is reproduced in Appendix 1.

3. See: U.S. Environmental Protection Agency, 1987, *Unfinished Business: A Comparative Assessment of Environmental Problems*, Washington DC; Science Advisory Board, 1990, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection*, EPA-SAB-EC-90-021, 1990; and Science Advisory Board, 2000, *Toward Integrated Environmental Decision-Making*, EPA-SAB-EC-00-001.

4. Stern, Paul C. and Harvey V. Fineberg, Editors, 1996, *Understanding Risk: Informing Decisions in a Democratic Society*, Committee on Risk Characterization, National Research Council, Washington, D.C.

5. Critical evaluation is essential. While it is not correct to characterize most incomplete science as "junk", it is also the case that scientific findings can vary substantially in quality, and the amount of weight they are given in decision-making should be weighted by their quality.

6. See Stern and Fineberg, *Understanding Risk: Informing Decisions in a Democratic Society.*

7. U.S. Environmental Protection Agency, 28 December 2000, *Draft Public Involvement Policy*, FRL-6923-9, 82335-82345.

8. Note that these objectives for stakeholder processes are quite different from those for the peer review of scientific or analytical products. The latter requires the considered critical judgment of experts.

9. Thomas Beierle (Appendix 3, page 16) notes that "there is a tendency to assume that the citizens participating in environmental policy decisions are laypeople rather than experts. Yet the capacity that participants bring to the table can often be quite impressive..." In the 239 case studies he reviewed, he observes that "…in roughly 40% of the cases for which data …[were] available, there was a significant level of technical capacity among most of the participants. In another roughly 45%, there were at least some participants with significant technical capacity who could act as internal technical resources for the rest of the group. In the remaining cases, participants had little overt technical or issue-related expertise. It is only to this last 15% that the label 'lay public' most appropriately applies."

10. Kasperson, Roger K., 1986, *Six propositions on public participation and their relevance for risk communication,* Risk Analysis, 6 (No.3), 275-281.

11. The Microbial/Disinfectant By-product Federal Advisory Committee convened by the Office of Ground Water and Drinking Water was illustrative of an activity in which adequate resources and dedicated staff were committed to the support of a deliberative process. Despite the fact that the issue was complex and there were several vested interests, the process was brought to a successful conclusion. An equally important factor was that the groups represented on the committee appeared to recognized that it was in their own interest to come to a resolution. The uncertainties on the scientific basis available for decision-making were such that any one of these groups could have staked out an unreasonable position.

In contrast, the Snake River TMDL activity never came to clear resolution. In part, the failure of the process appeared to be due to the failure of the Agency to commit sufficient resources early in the process. The discussion of the project raised the issue of whether most of the parties with an interest were committed to coming to a common agreement or were simply to defending their own interests. More up-front investment of resources may have lead to a better definition of the problem to be resolved and drawn in stakeholders. Alternatively, a conclusion could have been reached that this was not a problem that could be dealt with by a stakeholder process.

12. In their report, "Building Capacity to Participate in Environmental Protection Agency Activities: A needs assessment and analysis" (1999) the Environmental Law Institute notes that some of the groups and individuals they interviewed in their study "strongly emphasized the need for more technical assistance, because of the technical nature of EPA decisions. They thought that EPA should not shift the burden to perform technical analysis to citizens and communities – the agency should translate citizen concerns into technical terms rather than require citizens to assume that responsibility…"

13. Sequential processes in which staff summarize the science without subsequent iteration have frequently not been very successful. While staff needs to get stakeholders familiarized with the broad range of relevant science, stakeholders need to be able to frame questions and ask staff for analysis which is responsive to their specific questions and concerns.

14. In place-based processes, it is also important to note that participants can sometimes bring in local knowledge which might otherwise be overlooked.

15. See two useful reviews of different types of public participation: Fiorino, Daniel, 1990, *Citizen Participation and Environmental Risk: A Survey of Institutional Mechanisms*, Science, Technology, and Human Values, 15 (No.2), 226-243 and Creighton, James L, Jerome Delli Priscoli, and C. Mark Dunning, 1998, *Public Involvement Techniques: A Reader of Ten Years Experience at the Institute for Water Resources*, IWR Research Report 82-R1, Alexandria Virginia: The Institute.

16. See page 29 of Appendix 3.

17. This discussion raises the broader question of how one should measure the "quality" of the decisions made by either conventional or stakeholder decision processes. While Beierly developed and used a measure in his study, this topic deserves considerable additional attention. Accordingly, it is included as one of the research objectives in our Recommendation 2.

18. Environmental Law Institute, 1999, *Building Capacity to Participate in Environmental Protection Agency Activities: A Needs Assessment and Analysis*.

19. Suzanton Associates, 1991, *Attitudes Toward Regulatory Negotiation*, National Institute for Dispute Resolution and the Environmental Protection Agency.

20. This conclusion is echoed in "Best Practices for Government Agencies: Guidelines for using collaborative agreement-seeking processes," Society of Professionals in Dispute Resolution, Washington, DC, 1997.

21. Because they have been appointed to represent the broad public interest, state or federal regulators should play this role, although sometimes they too may find it convenient to use the science selectively. In some circumstance, it may be possible to arrange for academic or other expert participants to play this role.

22. A good example of both appropriate and inappropriate uses of stakeholder groups is provided by the need to develop 40,000 TMDLs. While it is sometimes appropriate to involve stakeholders in addressing the problem of how to allocate allowed pollution loads, it is not appropriate to ask stakeholder groups, acting on their own, to assess the data and models used in establishing those loads, nor is it reasonable to expect that environmental NGOs will be able to produce participants for more than a modest set of the most important decisions.

23. Renn, Ortwin, Thomas Webler, and Peter Wiedemann, 1995 *Fairness and Competence in Citizen Participation; Evaluating Models for Environmental Discourse*, Dordrecht: Kluwer.

24. For a somewhat different discussion of the settings in which non-expert stakeholder processes should and should not be applied see: Chess, Caron , Thomas Dietz and Margaret Shannon, Who Should Deliberate When?" Human Ecology Review, 5, 45-48, 1998; Terry F. Yosie and Timothy D. Herbst, 1998, *Using Stakeholder Processes in Environmental Decision Making: An Evaluation of Lessons Learned, Key Issues, and Future Challenges*," Ruder Finn Inc., Washington, DC; and Society of Professionals in Dispute Resolution, 1997, *Best Practices for Government Agencies: Guidelines for Using Collaborative Agreement-seeking Processes*, Society of Professionals in Dispute Resolution, Washington, D.C.

25. See Stern and Fineberg, *Understanding Risk: Informing Decisions in a Democratic Society*, 49, and Renn et al.

26. National Research Council, 1983, *Risk Assessment in the Federal Government: Managing the Process*, National Academy Press.

27. See for example: Tengs, Tammy O., et. al., 1995, *Five-hundred Life-saving Interventions and Their Cost Effectiveness*, Risk Analysis, 15, 369-390.

28. Raiffa, Howard, 1982, *The Art and Science of Negotiation*, Belknap Press of Harvard University Press.

29. For an overview, see: Lynn, Francis M., and George J. Busenberg, 1995, *Citizen Environmental Committees and Environmental Policy: What We Know, What's Left to Discover*, Risk Analysis, 15, 147-162; and Stern and Fineberg, *Understanding Risk: Informing Decisions in a Democratic Society*, Appendix B. Also see the useful discussion of the "complications" of public participation, particularly limits and problems relevant to this point in Renn et al., 1995, . 28-29.

30. For an overview, see: Crosby, Ned , 1995, *Citizen Juries: One Solution for Difficult Environmental Questions*, in Renn et. al (1995), 157-174 and Armour, Audrey, 1995, *The Citizen's Jury Model of Public Participation: A Critical Evaluation*, in Renn et al., 1995, . 175-188. For a discussion of how such groups might be selected see: Morgan, M. Granger, Baruch Fischhoff, Lester Lave, and Paul Fischbeck, 1996, *A Proposal for Ranking Risk within Federal Agencies*, in Comparing Environmental Risks: Tools for setting government priorities, J. Clarence Davies (ed.), 111-148, Resources for the Future, Washington, D.C.

31. For a discussion of evaluation criteria and process, see Roger E. Kasperson, *Evaluating Risk Communication*, in Effective Risk Communication: The Role and Responsibility of Government, ed., V. Covello, D. McCallum, and M. Pavolva, NY: Plenum, 143-160.

Appendix A--"Science Advisory Board Commentary on the Role of Science in 'New Approaches' to Environmental Decisionmaking that Focuses on Stakeholder Involvement," EPA-SAB-EC-COM-00-002, October 7, 1999

October 7, 1999

EPA-SAB-EC-COM-00-002

Honorable Carol Browner
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington DC 20460

Subject: Science Advisory Board Commentary on the Role of Science in "New Approaches" to Environmental Decisionmaking that Focus on Stakeholder Involvement.

Dear Ms. Browner:

In recent years the Agency has devoted considerable attention to developing and promoting new, more flexible, and adaptive approaches to environmental regulation. Many of these address the problems of specific places, specific economic sectors, or especially vulnerable populations such as children or the disadvantaged. In all of these efforts, the Agency has worked hard to develop and use new strategies for enlisting the active advice and participation of relevant stakeholders. Of course, EPA has always sought and encouraged public input, but this new focus on stakeholder involvement is a welcome effort to make environmental regulation more democratically responsive. As a recent review by Yosie and Herbst[1] has shown, learning how to most effectively involve stakeholders is an ongoing process which deserves continuing attention.

Involving representatives of specific concerned or affected parties in environmental decision making is clearly important. However, the Agency also has a responsibility to represent the broad "public interest" in environmental decision-making. Cynics may argue that there is no such thing as "the public," only interest groups. But the concept of the general public interest lies at the heart of many of our most cherished democratic institutions. For example, we don't appoint a committee of the family of the accused and the family of the victim to try criminal

[1]Terry F. Yosie and Timothy D. Herbst, "Using Stakeholder Processes in Environmental Decisionmaking: An Evaluation of Lessons Learned, Key Issues, and Future Challenges," Ruder Finn, Washington, September 1998.

cases.  We appoint an unbiased jury and give them the mandate to determine the facts on the principle that in the long run justice based on factual truth serves the best interests of the public at large.

In a similar way, the interests of the general public are best served when, in addition to addressing the interests and needs of stakeholders, environmental decisions are also based on a full and careful consideration of all available science.  Sometimes, such a full and careful consideration also serves the immediate interests of specific stakeholders.  But often it does not. Polluters may be influenced by compelling short-term economic interests.  Environmental activists may be motivated by their specific political agendas.  Affected citizens may be motivated by perceptions, concerns, and political agendas that are only partially informed by available science.  In short, involving stakeholders in the decision making process does not guarantee that decisions will be based on a secure scientific foundation and, therefore, does not assure that the broader public interest will be fully served.

Basing decisions on a careful consideration of all available science is a basic part of the EPA's mission.  However, in the press of day-to-day operation even the Agency may be diverted from this mission.  For obvious and legitimate political reasons, the Agency is interested in minimizing controversy.  Especially in newer decision environments, which involve a greater focus on consultation and negotiation among directly involved stakeholders, there is a risk that the broad public interest in assuring that decisions are based on a full consideration of all available science may receive too little attention.

One way to minimize this risk is to work on evolving better mechanisms to assure that available science gets adequately reviewed for, and considered in, such decision settings. Equally important is the need to identify gaps in knowledge uncovered in such decision settings, so that research agendas can be responsive to these needs.

We enthusiastically support the Agency's efforts to develop and promote new, more flexible, adaptive approaches to environmental regulation.  They are responding to an important need.  As these new approaches evolve and mature, we urge you to lead the Agency in a more systematic consideration of how science can most effectively be reviewed for, and considered and used in, these new decision processes.

For our part, to assist in this effort, representatives from the Science Advisory Board (SAB) have been participating in a series of internal workshops on “New Directions in EPA Science: Workshops on Innovations in Environmental Protection” being run by the Office of Research and Development.  When these are complete, the SAB Executive Committee plans a series of its own workshops, to which selected Agency, SAB and outside parties will be invited to discuss how science is being reviewed and used, and how it might better be reviewed and used, in each of a number of new programs and offices.  In advance of these workshops, we plan to invite a number of senior Agency officials to give us feedback on this commentary.  Are we inappropriately concerned?  Are there mechanisms already in place that adequately mitigate the risks we have discussed?  Are there important aspects of the issue that we have perhaps overlooked and need to consider?

We hope you will support and join us in advancing this important agenda.

Sincerely,

/s/
Dr. Joan Daisey, Chair
EPA Science Advisory Board

/s/
Dr. Granger Morgan, Chair
New Approaches Subcommittee
EPA Science Advisory Board

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# Appendix B--Summary of the Four Workshops Conducted by the SAB Executive Committee on the Role of Science in Stakeholder-based Environmental Decision Processes

**B.1. Meeting with Agency Official: Science and Stakeholder Involvement in the Agency's New Approaches**

**Date and Time**: November 30, 1999, 1:00-3:00 p.m., during the SAB Executive Committee Meeting

**Purpose:** To discuss with agency leaders' the Board's Commentary EPA-SAB-EC-COM-00-002, "Commentary on the Role of Science in "New Approaches" to Environmental Decisionmaking that Focus on Stakeholder Involvement"

Welcome and Introductions - Dr. Granger Morgan welcomed participants and asked them to introduce themselves and give a brief description of their organization. He then summarized the Commentary letter, described the SAB's plan for a series of workshops on the topic, and then invited Agency representatives to give advice and guidance to the Board.

Discussion. Mr. David Davis (Office of Water) began the discussion with the caveat that "nothing is broken" with Agency stakeholder processes. He stated, however, that it was appropriate to examine how to address technical issues that arise at different scales of decision making, such as at the local level or the ecosystem level. He identified the National Estuary Program (NEP) as a well-established program that has significant resources and a process for creating Community Advisory Councils. He characterized the NEP approach as "workable."

Dr. Norine Noonan (Office of Research and Development) stated that the Agency was faced with "tough problems" that pose major challenges in time and scale. The Agency is faced with assessing and addressing ecosystem impacts, long-term effects of pollutants, cumulative risks, and inter-generational impacts. Scientific tools are not available for addressing these complex issues, yet communities want to know impacts. There is a need to establish a framework for dealing with stakeholders, before specific tools are available.

Ms. Elizabeth Cotsworth [Office of Solid Waste and Emergency Response (OSWER)] introduced her office as one that does not specialize in science, as does the Office of Research and Development. Her office uses multiple processes to identify the different kinds of science related to an issue and then uses Agency science as a catalyst to get more scientific information from stakeholders. As a result, work on issues generates a mixture of science and stakeholder involvement. OSWER uses a variety of peer review processes to tease out the science.

OSWER has also developed Technical Assistance Grants that enable community groups to enlist independent consultants who help them address science issues.

Ms. Cotsworth described a mechanism her office used to involve stakeholders in the scientific issue of removing silver as a toxicity characteristic. Stakeholders were asked to nominate a pool of peer reviewers. Peer review proceeded to evaluate available science.

Mr. Davis then suggested the Board make a distinction in its thinking on stakeholder processes between activities that involve stakeholders in EPA decisions and activities where EPA is providing information and science to help stakeholders make decisions.

Mr. James Hanlon (Office of Water) pointed out that most environmental programs are delivered by state and local governments through well-established processes. Some new approaches, such as community-based environmental protection and Project XL are examples of where EPA has set up new processes. He suggested that it was a legitimate question of how to ensure science in those efforts.

Dr. Carl Mazza [Office of Air and Radiation (OAR)] stated that the Air Office generally focuses on national policy, not site-specific decision making. He suggested that the variety of stakeholder processes at EPA varies greatly, and no one approach was appropriate for all.

Dr. Mazza explained that at the national level, his office works with the Clean Air Advisory Committee, where technical papers are presented that generally do not have peer review. Once the Agency decides to take and act on the advice of the Committee, however, the science component of the advice is scrutinized and peer reviewed.

At the national level, EPA's Indoor Air Program brings together stakeholders from industry, the building trades and other groups for developing guidance documents. The program has developed a facility for peer reviewing their guidance.

OAR has developed negotiated rules within the Maximum Achievable Control Technology Program. The science has involved establishing a baseline that describes practice that the Agency can set as a baseline. These negotiations are followed by a formal proposal, where technical documents are scrutinized.

OAR is embarking on a national-level effort to address air pollution related to airports. Stakeholders will be involved in developing emissions inventories and a variety of analyses. The Agency has yet to determine whether and how review of technical documents will happen.

Dr. Terry Young asked about the relationship between the Agency's technical work and stakeholder consensus. What happens if the technical work indicates a different direction than the stakeholder process?

Ms. Cynthia Dougherty (Office of Water) explained that regulatory negotiations require an initial agreement among parties about the scope and purpose of negotiation. In that process, EPA must be careful not to cede authority to make certain decisions to the negotiation processes. In some cases, stakeholders identify issues or evaluate what can be accomplished by a technology. Then EPA will provide this information to its personnel who will conduct a risk assessment.

In the Microbial Disinfectant Byproduct (MDB) Rule in Phase Two, the not-for-profit group, RESOLVE, is working with stakeholders to identify an array of scientists to make presentations to the stakeholder group. Through that process the group will learn about EPA's science and industry's science. Once that process is concluded, EPA will conduct its risk assessment.

Dr. Noonan interjected that the "best science is in the eye of the beholder." She commented that it is difficult to give stakeholders an understanding that science is dynamic, that it has areas of disagreement and uncertainty, but that rulemaking and decision-making still have to happen. Ms. Dougherty commented that the MDB process will benefit from stakeholders' broader understanding of scientific uncertainty.

Dr. Robert Ward (Office of the Administrator) pointed out the important role that "neutrals" (e.g., facilitators, negotiators, fact-finders) play in stakeholder processes. He commented that neutrals, as well as Agency participants, may vary in the experience and knowledge they bring to environmental issues. As a result, stakeholder processes may have varying effectiveness.

Mr. Jeff Morris (ORD) focused his remarks on the SAB question "Are there mechanisms in place to ensure that stakeholder involvement does no harm to the science?" He suggested that for regulatory development, mechanisms were in place theoretically, if ORD were engaged early in the peer review process. For non-regulatory processes, however, he suggested that the Agency did not know if mechanisms were in place.

Dr. Noonan followed his comments with several observations. When a specific site is at issue, a community often wants scientific information it doesn't have. How does a community obtain that information? Or work with whatever information is available? She suggested that local issues, like those at Tom's River, indicate that communities have questions and may use information that is not always validated. EPA doesn't always understand what's happening at these sites.

In response to a question from the Chair about how to integrate science in the process and whether there might be a need for applied social science research on this issue, Dr. Noonan responded that ORD has been working with the National Environmental Justice Advisory Committee to develop a research agenda.

Dr. Peter Grevatt (OSWER) then described activities in the Superfund program. He commented that on some of the site-specific projects, there are Superfund Community Working Groups, where a broad range of stakeholders has been participating in working groups at the community level. These working groups, convened by EPA, have also included the Agency for Toxic Substances and Disease Registry. There are opportunities to identify information needed by stakeholders (e.g., bioavailability studies) and provide that information. The general purpose of the Working Groups is to help people understand and contribute to the process.

Dr. Gerald Filbin (Office of Policy, Economics, and Information) suggested that despite the Agency's negotiated processes and new social profiling tools, the Agency must still find ways of taking stakeholder input seriously.

Ms. Claudia Walters (Office of Research and Development) discussed a major transition underway for ORD. Her office in the past has primarily dealt with national scientific issues. Community-based science projects have raised novel issues: how to translate and deliver science to specific locations, and how to address the resource needs associated with a community science program. She informed the group that ORD has developed a Community Science Team. It has also held two Agency workshops in a series of five overall on the topic of community assessment. To date, the workshops have focused on community-level questions and the information available to answer them. The workshop planned for February will focus on how to address information gaps. Future workshops will deal with the issues of building community capacity and communicating science to communities. She also stated that ORD has completed an inventory of its own community assessment tools.

Dr. Linda Greer (SAB Executive Committee) noted that there is an important distinction to be made between situations when the science on an issue is not certain and situations where science has something clearly to offer the process. She emphasized an important difference between providing information and data to community groups, as opposed to providing science to them

The Chair then invited comment from all in the room on the topic of science and stakeholder involvement. Dr. Thomas Beierley (Resources for the Future) commented that his research has shown cases where stakeholders have taken action to seek out and create the science they need (e.g., stream monitoring) and that stakeholders' agreement on strategies to find the facts have helped to address and resolve disputes.

Mr. Dave Clarke (Chemical Manufacturers Association) encouraged the SAB to address the topic of science and uncertainty. Dr. Gail Charnley (Healthrisk) pointed out the need for research on science and stakeholders. She is working on a project for the American Industrial Health Council which will be an integrated study of science, decision-making and stakeholder involvement. It will rely primarily on case studies. Dr. Eugene Rosa (Washington State University) asked whether there is an assurance that the selection of stakeholders truly represent the diversity of public interest in an issue.

Ms. Kathleen Bailey (Office of Policy, Economics and Information) encouraged the Board to involve regional offices in future discussions and suggested a videoconference mechanism. She also identified two professional associations of "neutrals" that might be a resource to the Board: the International Association for Public Participation and the Society of Professionals for Environmental Dispute Resolution.

Mr. Dave Davis suggested that the Board pick a subset of stakeholder involvement activities for a focus. He suggested that the Board look at community-based efforts, estuary activities, or watersheds, where EPA is providing information and tools to communities and the communities are combining intuition and analysis to reach their decisions. Mr. James Hanley suggested that the Board focus on watershed efforts to develop Total Maximum Daily Loads, since that program is a major current initiative. Mr. Thomas Carrato (Monsanto, liaison with the Children's Health Protection Advisory Committee) suggested that the Board focus on issues where the science is least certain and decisions are most emotional and intuitive.

Action item(s):

1. The SAB Executive Committee will hold a second workshop on Science and Stakeholder Involvement on March 7, 2000, where there will be presentations of research and analyses on this issue.

2. The DFO for the Executive Committee Workgroup on New Approaches, Angela Nugent, will contact participants, as needed by the workgroup, for additional information on their stakeholder involvement activities.

**B.2. Workshop on the Role of Science in Stakeholder Processes**

**Date and Time:** March 7, 2000, 2:00-5:00 p.m., during the SAB Executive Committee Meeting

Introduction

Dr. Morgan opened the discussion with an introduction that provided background on the SAB Commentary (October 7, 1999) that stated the Board's support for new, more flexible and adaptive approaches to environmental decision making. The Commentary also stated the Board's concern that the broad public interest in assuring that decisions are based on a full consideration of all available science may not always receive as much attention as it should in new approaches that increase emphasis on consultation and negotiation among directly involved stakeholders.

He introduced the goals of the session: (1) to hear reports from others who are studying the issue have learned about how science has been reviewed and used in stakeholder processes, and (2) to examine a number of specific case examples of how science has been or is being reviewed and used.

He identified two objectives for the workshops undertaken by the Board: (1) to suggest a set of best available practices that the Agency might promote and (2) to identify applied social science research that could significantly strengthen the review and use of relevant science in stakeholder decision processes.

Presentations and Discussions

The first presenter was Dr. Juliana Birkhoff, Director, Center for Research and Education, at RESOLVE, Inc. She summarized the results of a study just completed in collaboration with the United States Institute for Environmental Conflict Resolution in Tucson, Arizona, and the Western Justice Center Foundation in Pasadena, California, entitled *Managing Scientific and Technical Information in Environmental Cases; Principles and Practices for Mediators and Facilitators*. She described: (1) several categories useful for understanding different kinds of stakeholder processes (e.g., by branch of government they relate to and by intended goal or outcome); (2) the focus group process she used to gather information; (3) barriers that mediators and stakeholders encounter in addressing scientific and technology issues; (4) successful strategies that they have used; and (5) suggestions for further research and applications of her findings.

Action: Dr. Morgan asked SAB Staff to provide a copy of Dr. Birkhoff's slides and draft paper to Executive Committee Members.

The second presenter was Mr. Jeffrey Morris, Office of Research and Development, Office of Science Policy. He spoke on "Stakeholders and EPA Science: An ORD Perspective." He described four different cases where ORD has engaged stakeholders in its work: (1) Science Planning 2000 (SP2K); (2) Border 21; (3) EMAP/MAIA; and (4) the Eastern Columbia Plateau Aquifer. In his view, these efforts helped ORD meet its goal of sound science in support of the Agency's mission.

The next part of the workshop addressed science and stakeholder issues in selected National Estuary Programs (NEP). Ms. Holly Greening, Senior Scientist, Tampa Bay Estuary Program, presented an overview of how modeling and other science activities have influenced the work of her Program. She emphasized the importance of modeling in building understanding of the importance of reducing nitrogen loadings. Mr. Jake Stowers, Assistant Administrator for Pinellas County and Mr. Greg Williams, Environmental Manager for IMC-Agrico, both participants in the Tampa Bay Nitrogen workgroup, participated by phone. They emphasized the importance of the goal set by the Tampa Bay NEP, to increase sea grass production, and the importance of the Nitrogen model in helping participants understand how to address the goal.

The second speaker to describe science and stakeholder activities in an NEP was Dr. Joseph Costa, Executive Director, Buzzards Bay Project National Estuary Program. He described the development of a citizen-based water quality monitoring program that had major impacts: (1) it increased citizen awareness of environmental conditions; (2) local citizens used the information to influence local authorities to make decisions regarding land use and pollution run-off; and (3) it also helped the NEP refine its Nitrogen loading strategy and goals so that it was able to set standards for more sensitive areas.

The final NEP speaker was Ms. Nancy McKay, Chair, Puget Sound Water Quality Action Team. She emphasized how her NEP, like all NEPs has a Citizens Advisory Committee, developed with broad stakeholder involvement, which works with a Science Advisory Committee. She listed numerous accomplishments of these two groups working together, including: (1) opening of shellfish beds previously closed despite rapid growth in the Pugot Sound area; (2) establishment on standards for contaminated sediment; (3) a monitoring program that publishes an annual report; (4) development of performance measures, Puget Sound Health 2000, distributed to over 400,000 households; (5) research conferences held every two years to bring decision makers, students, citizens and scientists together; and (6) education efforts including a program designed to helping sector groups (e.g., dry cleaners) take research on the Sound and apply it to educating members of their sector to take voluntary action.

She identified several issues for attention: (1) how to reach beyond people immediately involved in NEP activities to influence and involve broader stakeholder groups; (2) how to obtain reliable data on issues of concern, such as long-term monitoring and conditions of near-term habitat; and (3) how to ensure that new environmental activities, such as new investments in EMAP, can supplement and complement NEP activities.

The Executive Committee then engaged in a general discussion of science and stakeholder involvement. Members identified a need to clearly define the term "stakeholder." They also identified a range of possible stakeholder involvement efforts to explore in future workshops, including:

1. Food Quality Protection Act and Pesticide Tolerance activities
2. Industrial Combustion Council rulemaking
3. Pollution Prevention Activity with Dow Chemical
4. Cal Fed
5. Some case study that directly addresses the stakeholder identification issue
6. Stakeholder programs run by World Bank (e.g., world commission on dams)

Action: Dr. Morgan asked SAB Staff to schedule a follow-up discussion of next steps for the New Directions Workgroup of the Executive Committee.

## B.3 Workshop on the Role of Science in Stakeholder Processes

**Date and time:** July 12, 2000 from 2:30-5:30 p.m. during the SAB Executive Committee Meeting

### Introduction

Dr. Granger Morgan introduced the session, the third of four planned workshops at the Executive Committee meetings to focus on science and stakeholder involvement. He mentioned that the Executive Committee intended to include the following topics in the fourth workshop: an overview of science and stakeholder issues presented by Gail Charnley and additional case studies involving lay participants and controversial and interesting science. These case studies may address the CALFED process, the Dow Pollution Prevention Experience, the Microbial Disinfection By-Products Rulemaking, and science and the implementation of requirements for Total Maximum Daily Loads.

Presentations and Discussions

Three presentations followed. Mr. Thomas Beierly (Resources for the Future) reported on preliminary results and preliminary conclusions from research funded by the National Science Foundation on 225 cases involving stakeholder involvement. His final analysis will address many issues, including several involving science in stakeholder processes. His presentation to the Executive Committee addressed the following questions: (1) are stakeholder processes leading to better or worse science? (2) are there checks and balances on the road to implementation?; and (3) how to benchmark the effectiveness of science in stakeholder process.

He summarized briefly his model for analyzing individual cases and coding information to be analyzed quantitatively. His methodology included capturing information in each case about: (1) the wider public; (2) the problem being addressed; (3) the participants directly involved; (4) the Agency involved; (5) aspects of the process; (6) process outcomes; and (7) substantive outcomes.

Early analysis shows that the cases fall into the following categories: (1) slightly more than half were risk-related; (2) more than half-involved state and local government and addressed site- or region-specific issues (27 cases identify EPA as the lead Agency); and (3) the cases were fairly evenly divided by type of process (information exchange, advisory without consensus, advisory with consensus unclear, advisory with consensus, and negotiation/mediation). Processes for identifying stakeholders varied across cases. In some cases, organizers of the processes actively identified all groups involved and tried to find representatives of each; in other cases, "whoever walked in the door" participated. Generally, stakeholders tended to be professional representatives of interest groups that had a stake in the issue being discussed.

One major early conclusion presented indicated that stakeholder involvement generally led to better decisions than would have been made otherwise. Quality of decisions was assessed in three ways: (1) direct measures (cost-effectiveness, pareto-optimality; opinions expressed); (2) indirect measures (added information, technical analysis, innovative ideas, holistic approach); and (3) process measures (improved access to technical information, improved technical capacity). Evidence of greater substantive quality primarily was indirect and/or procedural.

Mr. Beierly then discussed two cases in detail. The Fernald Citizens Task Force involved a 15-person consensus-based advisory committee addressing a complex clean-up decision for a weapons site. The committee participated in a 2-year process. It was noteworthy for its use of a tool-box provided by the Agency and its technical consultant ( the toolbox distilled technical information on main topics into 2-page synopses) and the use of "Future Site," a board game to look at different scenarios for cleanup that helped the committee work with multiple complex factors and options. The process resulted in a decision that recommended a mix of on-site/off-site disposal options that minimized soil disruption and protected the aquifer. He characterized the result as a faster, cheaper, more holistic solution than would have otherwise been reached.

The next case involved the Buffalo River Citizens Committee, an Advisory Committee, where consensus was not required. The goal was to reach a decision on a restoration plan, where there was limited information. The process involved "high capacity" stakeholders, use of outside science, emphasis on information gathering. The stakeholders developed a dataset used for the decision.

Mr Beierly's presentation then addressed the relationship between political and technical issues in the cases studied. He suggested that they were intertwined. Sometimes scientific uncertainty appears as a source of conflict. There are themes of mistrust of information and expertise. Technical evaluation criteria are challenged and a source of dispute. He contended, however, that solving technical problems can also lead to resolution of political problems, that the "science and technical can work together." He came to this conclusion because he saw the following themes appearing in cases: (1) sometimes conflict is resolved by resolving scientific disputes (especially through joint fact-finding); and (2) trust is formed through equal access to expertise and technical information. He suggested that his preliminary results showed a relationship between consensus-based processes and cases associated with higher quality factors, although he gave the caveat that consensus-based decisions may also involve more time, resources, and are typically more intense processes that in themselves might lead to higher levels of quality.

On the topic of checks and balances, he informed the audience that stakeholder processes appear to have a direct influence on decisions in 65% of cases and some influence in 90%, but that their impact on implementation was still an open question. Many of his case studies show little relation between decisions made and actual implementation achieved, and published literature also bears out this conclusion. Many intervening forces may explain this disconnect: bureaucratic agenda and funding; politics; pressure from a wider public and the media.

The last major topic discussed involved the baseline for assessing stakeholder processes. Mr. Beierly suggested that if the baseline was "managerialism," this "traditional" decision-making process was also subject to political, non-technical influence. He also suggested that in American society there is no consensus on whether such influence is a bad or good thing. If Americans are indeed worried about politics or political influence, he suggested that at least stakeholder processes are open and would make the decision-making process transparent.

He concluded that the case study record was generally reassuring. More cases lead to high quality decisions than not; there are many "bumps in the road to implementation," and "decision-making as usual" is a low hurdle when one is measuring the quality of cases involving stakeholder processes.

General discussion then followed. Executive Committee members asked about how the study controlled for publication bias. Mr. Beierly answered that the data was coded for obvious preselection (e.g., it indicated whether people writing up the case studies were involved vs. whether it was written up by an academic, whether it was begun early in the process before the outcome was determined). He also suggested that authors differed in their definitions of success from each other and from the definitions used by the study.

Dr. Morgan and others asked whether the data could be analyzed to address several issues of particular interest to the SAB: (1) were cases involving negotiation and mediation distinctive?; (2) are cases involving EPA distinctive?; (3) are there different patterns if the case involves local, state, regional or national issues?; and (4) are there any conclusions to be reached about cases where third-party neutrals were involved in the process. Mr. Beierly indicated that he would be willing to investigate these questions and provide the Executive Committee with information, along with an early version of his final report.

The second presentation took place by teleconference. Dr. John Toll from Parametrix presented the experience of stakeholder processes in environmental decision-making in the Duwamish

Estuary in Washington State. He had prepared the briefing in collaboration with Ms. Sydney Munger, Senior Water Quality Manager for the King County Department of Natural Resources. In his presentation he described the purpose of the project [which engaged stakeholders to advise the County executive on whether the risks associated with combined sewer overflows (CSOs) worth the $300,000,000 it will cost to control CSOs to the Washington State Standard and the next steps for the King County CSO control program]. He described how the project identified stakeholders and engaged them intensively in a two-year process of identifying values to protect in the estuary and agreement on findings of risk. He described that the process resulted in stakeholders' high satisfaction with the work of the committee and increased level of trust. He also indicated that the process for identifying alternative options for spending the $300,000,000 was not made clear to the stakeholder committee, and the "County should have addressed how redirected $$ might be used to achieve community values." He concluded the presentation with some recommendations for research: (1) how to manage conflicting time lines; (2) values to be protected vs. measurement endpoints; and (3) rules of evidence for data admissibility, boundary issues, and stopping rules.

The Committee then engaged in a short discussion. They observed that problem definition was key and wondered whether there was freedom to identify water quality problems "bigger than CSOs." They also noted that the process was expensive for the agency and the stakeholders involved and noted that the process designed only to allow stakeholders a limited range of options for their work and potential conclusions.

The final presentation, made by Dr. Henry Topper (US EPA, Office of Pollution Prevention and Toxics) addressed the topic "Science in the Community: Lessons from the Work of the Baltimore Air Committee." He described how his office in EPA entered into the Baltimore Community Environmental Partnership formed in 1995 to address neighborhood problems and then committed staff to three years of working on issues identified by the partnership, especially through its Air Committee. His particular efforts focused on community air concerns and resulted in a publication, "Baltimore Community Environmental Partnership Air Committee Technical Report; Community Risk-based Air Screening: A Case Study in Baltimore, MD," (April 1990). He suggested that the committee's work resulted in the following outcomes: (1) the assessment, drawn on available national, state and local data, indicated that the sources of air pollution were different than those originally feared by the Partnership and the assessment provided important information; (2) consensus in the Baltimore community was not sufficient for clear action; and the (3) partnership organization was not sustained after the completion of the assessment.

He identified several lessons learned regarding the role of science: (1) science carried out with community participation can help overcome divisions; (2) science must be focused on action; (3) local partnerships can mobilize new resources for local assessments; (4) environmental concerns must be put in broader community context; (5) EPA capacity to apply science at the community level needs further development (e.g., methods, tools and information; more resources and better coordination for community science efforts; and training for EPA scientists to understand and value community input and to participate in local partnerships) and (6) building local capacity is also key to success.

The Executive Committee then began a brief discussion on next steps for developing advice for the Agency on science and stakeholder involvement. Dr. Morgan suggested that the Executive

Committee subcommittee will be drafting a letter which would comment on the strengths and limitations of the approaches known by the Board, either through briefings received during the workshops during the Executive Committee quarterly meetings or through individual members' experience. The letter would identify good practices and advice regarding needed research (e.g., research on the iterative process for providing technical information to stakeholders.). He asked for preliminary suggestions from members for topics to be addressed in the letter.

Dr. Roger Kasperson suggested that the Board consider how to define success for the use of science in stakeholder process. Mr. Beierly's presentation focused on the impact on the quality of decisions. Dr. Topper's presentation introduced the element of capacity of capacity building at the community level to improve public health from the bottom up. Dr. Kasperson also suggested that community assessments incorporate the notion of differential community vulnerability (e.g., the question of integrating environmental hazard with social and economic vulnerability that would include indicators for public health, poverty, access to a variety of services). He also suggested that any discussion of costs of stakeholder processes consider this investment as a new one that needs a benchmark of comparison. He suggested that the apparent large size of investments in meaningful stakeholder involvement may be low in cost as compared to environmental benefits from averting or reducing risks or to the cost of a regulatory process.

Dr. Ken Cummings suggested that the subcommittee also consider whether scientists are the key players to be involved in a stakeholder process. He suggested that other professional groups, such as educators, might have the skills needed to help a group reach a decision. He suggested that problems be examined for the "evidence that science is needed."

Dr. Andy Anderson commented that community-based stakeholder processes, like Baltimore, need to involve the local infrastructure, such as the local health department. Dr. Mark Utell agreed that environmental issues at the local level involve many other health determinants.

Dr. Morgan adjourned the session at 5:30 p.m. with thanks to presenters and participants.

## B.4 Workshop on the Role of Science and Stakeholder Involvement

**Date and Time:** November 1, 2000 from 1:15-4:45 p.m. during the SAB Executive Committee Meeting

Introduction

Dr. Granger Morgan introduced the session, the fourth of four planned workshops at SAB Executive Committee meetings to focus on science and stakeholder involvement. He discussed a process for drafting a report, based on information received at the workshop: (1) Dr. Morgan, with the assistance of the Designated Federal Official, Dr. Angela Nugent, will draft a report to be circulated for review by the Executive Committee in January; (2) the SAB Executive Committee will discuss the revised draft at the planned retreat of the Executive Committee in the spring of 2001. Dr. Nugent added that there will also be a public teleconference to discuss the SAB workgroup's initial findings for the Commentary.

Dr. Morgan identified the current members of the SAB workgroup: Dr. Terry Young, Dr. Richard Bull, who would continue as a consultant to the SAB Executive Committee for fiscal year 2001 for this project, Dr. Henry Anderson, Dr. Roger Kasperson, and potentially Dr. Rhodes Trussell, who will be invited to join the group. Dr. Morgan asked other members of the Executive Committee to let him know if they would like to join the group developing the report.

The Workshop generally followed the agenda with two exceptions. Dr. Linda Greer, SAB Executive Committee Member, did not discuss the Michigan Source Reduction Initiative and Dr. Jeffrey Griffiths, Tufts University, did not participate by phone in the panel discussion of Microbial Disinfection By-Products.

Presentations and Discussions

The first topic discussed was a case study involving national and regional perspectives on science and stakeholder involvement in the Total Maximum Daily Load (TMDL) program. Mr. James Pendergast from EPA's Office of Wetlands, Oceans and Watersheds began his presentation by addressing the relationship of science to policy in the TMDL program. By statute, TMDLs set the maximum amount of pollutant that can exist in a water body that meets Water Quality Standards. In addition, TMDLs assign responsibility for exceeding maximum limits to different sources, so that the sum of source contributions do not exceed the total maximum limit permitted. Thus, TMDLs are a combination of science and policy.

Mr. Pendergast provided historical background on the program. States have reported that 20,000 waterbodies do not meet Water Quality Standards. As a result, states are required to complete more than 41,000 "pollutant-waterbody" TMDLs. The most frequent causes of failure to meet standards are: (1) excessive erosion and soil deposition; (2) nutrients; and (3) pathogens. These causes are related to non-point sources: agriculture, septic tanks, air deposition, and legacy pollutants. He estimated those point sources are responsible for only 10% of the problems.

Mr. Pendergast stated that in setting TMDLs, states take three steps: (1) assessing the problem (this step is called "listing"); (2) identifying causes of the problem (step usually involves modeling); and (3) allocating responsibility. Science is involved in the assessment process through collection of information and judgements about whether that information is sufficient to assess water quality. Science is also involved in the second step, which focuses on cause and effect relationships. In the third step, allocation of responsibility, there is no science or limited science involved. States make decisions about allocating TMDLs to sources based on criteria such as equity. Some states, however, are beginning to consider trading-based solutions; these efforts may involve science in the future.

Mr. Pendergast then discussed how the public gets involved in the TMDL process. At the national level, there is a requirement to review Water Quality Standards every three years. Science is used to set standards and the public may comment on those standards through a notice and comment process. Then states follow listing procedures comparing data on their waterbodies against the national standards. Procedures differ across states; not all states have public review. EPA' s TMDL rule of July 13, 2000 called for more systematic public involvement at this stage; this rule was made subject to a Congressional rider and cannot be made effective before October 30, 2001.

In the second stage, identifying "cause and effect," the process generally happens in a "black box" and the public has a hard time understanding the science. EPA is developing a clearer process for updating the models through the Agency's Committee on Regulatory Environmental Models.

Mr. Pendergast stated that the Agency is also engaged in a Consolidated Assessment and Listing Methodology (CALM) Project to improve the use of science and information in determining impaired waters. To develop CALM, the Agency is using a stakeholder process involving industrial trade groups, agriculture groups, waterwork treatment agencies, environmental groups and local governments. These groups were identified through the Agency's process of developing the TMDL rule; they represent major groups with an interest in the TMDL program. The goal of the stakeholder process is to identify major elements for draft guidance on the collection and analysis of data to be used in the determination of impaired waters.

SAB members enquired whether there had been an effort to involve the general lay public, as opposed to organized groups affected by the rule. Mr. Pendergast stated that the public involvement process had principally focused on interest groups. These groups have strong interest in how states use data to make listing decisions and how they might make better use of existing data. He stated that the general public could comment on the document, once developed, through a formal notice and comment process.

Dr. Patricia Cirone, from EPA's Region X, spoke to the Executive Committee by phone about her experience in developing TMDLs for the Mid-Snake River and the Columbia River. She described how the State of Idaho and an affected County came to EPA because they were looking for expertise in Watershed Assessment for developing a TMDL for the Mid-Snake. She believed that these "publics" wanted EPA science because they were seeking solutions to their "clogged eutrophic system" and wanted science to force some solutions.

In response to this request, EPA made available an expert modeler who tailored a model to the specifics of the Mid-Snake (e.g., added system dynamics, the multiple driving sources, benthic community dynamics, data collected). This formed the basis of a watershed-level Ecological Risk Assessment.

Dr. Cirone described how the Agency worked with the involved public. The Agency requested and received peer review from the community and from local universities. Agency representatives worked with the Watershed Council. EPA invited participants to contribute what they knew and observed to the Agency's model. They gave introductory briefings on risk assessment and the mathematics and logic behind the model. They attended many meetings, sometimes with PCs and maps, to demonstrate the models used. The participants at the meetings included people who lived in the area, commissioners of affected counties, members of environmental organizations, state and county agencies involved, and owners of the hatcheries and Dams.

As the process developed, attitudes toward the science changed. The interested public came to feel the model was too complicated and wanted to provide the regulated community with information and assessments more similar to assessments used in the past. A court decision also called for a quick decision on the TMDL. In the end, the state used a simple, quick way of deciding the TMDL.

Dr. Cirone suggested that different people or institutions became involved with the science in different ways. State and local agency staff contributed technically to the Agency's risk assessment. The general public related to the conceptual models used, e.g., to the question "what do you think is causing the problem?"

Dr. Terry Young raised the question of whether the stakeholder process prevented the Agency and the TMDL decision makers from focusing on a major cause of water quality issues in the mid-Snake, upstream dams. Dr. Cirone agreed that indeed flow restriction was the major single factor changing the system. She pointed out, however, that the TMDL program is a pollutant-by-pollutant program. The critical role of impoundments dropped out as decisions were made, even though people had initially identified impoundments as a key part of the conceptual model. She suggested that even though the TMDL decisions did not focus on the dams, the risk assessment process educated decision makers and local citizens in the roles dams played.

Dr. Morgan posed questions about resource investment in the Snake, including staff time to develop a model in a custom model for the Snake River and in its public involvement efforts for the case. He asked if it was too expensive (resource intensive) to do such work for all impaired waterbodies. Dr. Cirone answered yes, with the qualification that the model developed was generally applicable and that it was being used on the Columbia River. She believed also that there was long-term value associated with several aspects of the effort: (1) education and capacity building associated with the Mid-Snake project; (2) documentation of the damage done by impoundments, evident in the ecological risk assessment completed; and (3) ongoing use of the model. She suggested that the stakeholder group learned several things from their exposure to the model-building and risk assessment process. She believed they came to appreciate the uncertainties involved in measurement as well as modeling. Through the process they came to understand that the hatcheries weren't the only cause of the problem in the Mid-Snake; instead there were multiple stressors including dams, irrigation returns, and irrigation withdrawals. They also came to understand that water quality problems did not only exist in the tributaries, but also in the main stem as well.

Dr. Cirone then responded to a question about the contributions of public participation to the science and to the quality of the decision. Dr. Cirone said that the Agency developed a more "realistic understanding" of how the system developed and how it may develop in the future. Agency staff learned about information and literature useful for the model and ecological risk assessment.

The second topic at the workshop was a presentation by Dr. Gail Charnley, from HealthRisk Strategies, who spoke on her recent study, *Democratic Science; Enhancing the Role of Science in Stakeholder-Based Risk Management Decision-Making*. The report was commissioned by the American Chemistry Council and the American Industrial Health Council. In the report she examined case studies that demonstrated that effective stakeholder processes are central to risk assessment and risk management because stakeholders can contribute important information and because stakeholders are critical to problem formulation. From the case studies she examined, she concluded that "scientific integrity is maintained and its credibility is assured when stakeholders are involved in deciding how science is used to answer their questions and in obtaining the scientific information needed to answer their questions." She argued that the case studies demonstrated the value of implementing the "analytic-deliberative process," as described in the National Academy of Science report, *Understanding Risk.* Science was used less successfully, she found, when there were teams of dueling scientists and parties were only interested in science when it backed their own point of view.

She summarized research needs identified in her report: (1) research evaluating how science has been included in stakeholder-based decision-making and how its role has had an impact on process outcomes; (2) analysis of the social factors that contribute to differing interpretations of scientific information and the role science plays, weighed against many other factors that contribute to managing risks; and (3) analysis of the relative roles that science, stakeholder collaboration, and political expediency play in risk management decisions.

Dr. Joe Mauderly asked whether it is possible to manage a process to engage stakeholders in the science involved in an environmental issue when the problem is not a one-time effort, but instead a continuing process, like the development of National Ambient Air Quality Standards. Dr. Charnley agreed that it may be difficult to coalesce and sustain such intense ongoing efforts. She questioned the scope of the term "stakeholder involvement" and called for more attention to the definition and whether it included activities covered by the Administrative Procedures Act and democratic processes more generally.

Dr. Roger Kasperson then enquired about whether the controversies in several of the cases involved the issue of who should have control over decisions and the consent required for decisions. Dr. Charnley responded that scientists generally are more effective when they listen to and understand the social and policy context for their work.

The discussion then turned to the question of problem formulation. Dr. Richard Bull expressed concern over Dr. Charnley's conclusion that successful use of science involved stakeholders' helping to formulate problems and identify what science is needed. He cautioned that in the Mid-Snake TMDL case, stakeholders "defined out" some important aspects of the science for decision making. Dr. Hilary Inyang raised a similar view, especially for science issues that are not place-based and instead are national in scope. He asked about the relationship of stakeholders to democratic processes and asked about mechanisms to protect members of the public whose economic interests are not immediately affected by the decisions at stake in a major way.

Dr. Janet Johnson asked about the resources needed to invest in resource-intensive stakeholder processes. Dr. Charnley responded that her experience with the Risk Assessment and Risk Management Commission suggested that federal agencies such as the Department of Energy and Department of Defense think they have saved billions of dollars through well-managed stakeholder processes.

The third topic at the workshop was the stakeholder process involved in the Microbial Disinfection Byproduct (MDB/P) Negotiation. Ephraim King from EPA's Office of Wetlands, Oceans and Watersheds began the discussion by describing the intensive 18-month Federal Advisory Committee Act (FACA) process that resulted in the agreement. The agreement resulted in further regulation for cryptosporidium than in 1998 and agreement on a running annual average as a standard for MDP/Bs. In terms of resources, the process cost EPA $3-5 million per year, plus $1 million for the stakeholder process. Over 100 people worked full time inside and outside EPA on this agreement.

The FACA was composed of representatives of major interests. To represent the general public, a mayor, tribal representative and a public health official were involved. There was not an effort to identify "typical jury pool members." There was also a technical work group that preceded the FACA and provided ongoing assistance to the FACA. The technical work group took the initiative to prepare the science they believe would be required by the FACA. The FACA also gave the technical workgroup instructions on the science to be developed. A representative from the technical work group, Michael McGuire, attended all FACA meetings and served as a link between the work group.

The FACA also held two workshops on scientific and technical issues. There was a massive emphasis on costs, technology, impacts and modeling. Much detail on geographic differences was presented.

Mr. King reported that the process resulted in identifying significant areas of uncertainty: in occurrence of microbes of concern, in infectivity of different strains of cryptosporidium, and in the understanding of the potential reproductive and developmental effects of MDB/Ps. The process helped participants deal with risk management questions in the face of inconclusive science and significant uncertainties on both sides of a complex question involving "risk/risk tradeoffs." They were able to assess information on tools, technologies and costs and information on parts of the country with high rates of cryptosporidium and high rates of MDB/Ps. The result was a change in policy involving running annual averages.

Executive Committee members then asked several questions that broadened the discussion to the larger panel discussing the MCB/P issue. Dr. Granger Morgan asked how the stakeholder process added value to the decision. Mr. Brian Ramalay, from Newport News Water Works and a participant in the MDB/P FACA, replied that a purely scientific evaluation conducted by the Agency alone might have led to a "no action" decision. Without stakeholder involvement, the Agency might have interpreted important uncertainties differently. He expressed the view that Dr. Jeffrey Griffiths and representatives from the National Association of People with AIDs heightened the importance of the uncertainties for the whole FACA. He asserted that the approach resulted in a superior decision. It was implementable and had the best chance of balancing benefits with practical implementation. Mr. Ramalay underscored that EPA was one of the stakeholders at the table and could "pull away" from the decision if it believed that public health was not adequately protected.

Mr. King echoed similar views. He agreed that the decision making process benefitted from public involvement. It found the middle ground. He believed that without stakeholder involvement, the Agency would not have come to the same decision and that the decision would have had less credibility. The next step is for EPA to propose a rule as negotiated by the stakeholders. Stakeholders have agreed to support the proposed regulation through the notice and comment process. Mr. King characterized the process as time-consuming, expensive, and successful.

Dr. Morgan asked whether stakeholders had any problems remaining as representatives of their groups as they participated in the FACA process. Mr. King, Ms. Abby Arnold, mediator for the process, and Mr. Ramalay all replied that participants consciously worked hard to keep their constituencies informed. Mr. Ramalay stated that he participated as a representative of the American Metropolitan Waterworks Association (AMWA), an organization of the nations's largest water agencies. He saw his role as communicating the progress of the FACA deliberations to AMWA and negotiating on behalf of AMWA.

The panel concluded with comments from Ms. Abby Arnold from RESOLVE Inc. She began with the reflection that the MDB/P negotiation process was the most comprehensive integration of science into multiparty decision making that RESOLVE has seen at EPA over the past 20 years. She described four "process elements" that brought science to the FACA in a structured way: (1) three technical workshops, including one on statistics; (2) a technical work group, focusing on engineering issues; (3) an expert to review and synthesize disinfection by-products health effects literature for the FACA; and (4) an expert to review microbial statistical literature for the FACA. She described the relationship between the stakeholder group and the technical people assisting them as "interactive." The stakeholder group, which included EPA, defined the science questions to be addressed and technical people reframed the questions. She gave the example of a toxicologist reframing issues associated with developmental and reproductive effects.

Ms. Arnold stated that she believed the intensive process educated members of the FACA and helped them make decisions. They were able to hear and understand, for example, very detailed explanations of why a particular monitoring approach wouldn't work. They were able to refine the question of where and how to monitor for disinfection by-products. They were able to understand the limitations of the health effects risk analysis and make decisions, even though the process did not meet industry's expectation, established prior to the just-completed FACA process, for a conclusive risk assessment. Environmental groups also were able to participate, even in the absence of such a risk assessment. She noted that the FACA never summarized its conclusions about health effects research in its final decision. It decided to move ahead to focus on a risk management solution without a health summary and instead focused on the risk management solution. Members of the FACA were able to decide technical issues by working from a decision-making matrix that offered tradeoffs between various options for controlling for disinfection by-products as well as technical approaches to address cryptosporidium.

Dr. Richard Bull asked about the question of surrogates used in risk analysis. Mr. Ramalay replied that surrogates were consciously discussed in the FACA. Members of the FACA became comfortable with using that concept to address questions involving families of compounds.

The panel discussion concluded with a comment from the audience, from Ms. Marisa Bueno, from Inside Washington. She remarked that she attended most meetings of the FACA and liked the process. It "worked for laymen." It applied the precautionary principle and focused on practical implementable approaches.

At the close of the workshop, Dr. Morgan invited Dr. Thomas Dietz, Chair of the National Resource Council (NRC) Committee on Human Dimensions of Global Change, to comment on the work of his Committee. He stated that the interplay of science and democracy is of major interest to his committee. He finds that many federal Agencies are working in this area; there is expertise in many individuals' hands, science in the area is not generally being shared. He described an NRC workshop conducted 18 months ago, where a variety of Agencies presented on the issues. As a follow-up to that workshop, his committee has begun a consensus study on the deliberative process and public participation. The study is being funded by several federal agencies, including the Environmental Protection Agency. In the spring of 2001, there will be a panel focusing on the "dimensionality" of the issue: identifying programs, processes, outcomes, and definitions of success. The NRC will then identify 6 or 8 cases where there have been replications of processes around a theme and conduct case studies. Possible candidates are forest planning, global change, and watersheds. A resulting report will provide recommendations to federal agencies on process and needed research.

Actions:

In concluding the workshop, Dr. Morgan asked members of the Executive Committee to send him and Dr. Nugent an email within the week. He asked each member to identify the key points to be made in the SAB's report resulting from the workshops.

Dr. Morgan adjourned the session at 4:45 p.m. with thanks to presenters and participants.

Appendix C--Thomas C. Beierle, ***The Quality of Stakeholder-Based Decisions: Lessons from the Case Study Record***

**November 2000--Resources for the Future Discussion Paper 00-50**

# The Quality of Stakeholder-Based Decisions: Lessons from the Case Study Record

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November 2000 • Discussion Paper 00–56

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# The Quality of Stakeholder-Based Decisions: Lessons from the Case Study Record

Thomas C. Beierle

## Abstract

The increased use of stakeholder processes in environmental decisionmaking has raised concerns that the inherently "political" nature of such processes may sacrifice substantive quality for political expediency. In particular, there is concern that good science will not be used adequately in stakeholder processes nor be reflected in their decision outcomes. This paper looks to the case study record to examine the quality of the outcomes of stakeholder efforts and the scientific and technical resources stakeholders use.

The data for the analysis come from a "case survey," in which researchers coded information on over 100 attributes of 239 published case studies of stakeholder involvement in environmental decisionmaking. These cases reflect a diversity of planning, management, and implementation activities carried out by environmental and natural resource agencies at many levels of government.

Overall, the case study record suggests that there should be little concern that stakeholder processes are resulting in low quality decisions. The majority of cases contained evidence of stakeholders improving decisions over the status quo; adding new information, ideas, and analysis; and having adequate access to technical and scientific resources. Processes that stressed consensus scored higher on substantive quality measures than those that did not. Indeed, the data suggested interesting relationships between the more "political" aspects of stakeholder decisionmaking, such as consensus building, and the quality of decisions.

**Key Words:** public participation, stakeholder, science, alternative dispute resolution, consensus building

## Contents

# The Quality of Stakeholder-Based Decisions: Lessons from the Case Study Record

Thomas C. Beierle*

## 1. Introduction

Stakeholder participation in environmental decisionmaking has increased at all levels of government in the last decade. Among federal agencies, the Environmental Protection Agency (EPA), Department of Energy (DOE), and Department of Defense have initiated over 200 citizen advisory groups at contaminated sites around the country (FFERDC, 1996). State environmental agencies conducting comparative risk projects have convened interest group representatives and the general public to help make decisions about environmental priorities (Perhac, 1998; WCED, 1997). Local governments have increasingly engaged citizens in watershed management activities, sustainability projects, and a myriad of other planning and management activities.

Underlying much of the move toward greater stakeholder involvement is a recognition that environmental decisions are “political” as well as scientific. That is, resolving environmental problems requires addressing the interests and values of the public in ways that cannot be resolved with science alone. A focus on “consensus building” and “alternative dispute resolution” in many stakeholder processes is an explicit effort to accommodate the political aspects of environmental decisionmaking.

Some analysts have raised the question, however, of whether stakeholder processes are shifting the emphasis of environmental decisionmaking too far in the political direction. They are concerned that stakeholder processes may sacrifice the quality of decisions—and scientific and technical quality in particular—in pursuit of political expediency. In a recent examination of stakeholder processes, Yosie and Herbst (1998) stated that scientists and scientific information are typically not well-integrated into stakeholder decisionmaking. Gregory (2000) recently

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suggested the need to de-emphasize consensus in stakeholder processes in favor of competent problem-solving aimed at producing high quality, but perhaps not universally accepted, decisions. EPA's Science Advisory Board (SAB) recently expressed its concern about the quality of stakeholder decisions in a letter to EPA Administrator Carol Browner (Daisey and Morgan, 1999). In the letter, the SAB queried whether stakeholder processes at EPA were moving the agency away from the use of good science, perhaps leading it to abrogate its responsibility to pursue the public interest.

Concerns about the role of science in stakeholder-based decisions are a subset of a larger set of issues about the substantive quality of decisions made by stakeholders. Although there is much in the public participation literature about the quality of stakeholder processes, there is very little about the quality of decisions that stakeholders actually make. In fact, in their review of stakeholder processes, Yosie and Herbst (1998, 49) noted that there was broad disagreement in the environmental policy community over whether stakeholder involvement improved decisions or not.

To settle the disagreement over the quality of stakeholder-based decisions, it would be ideal to compare—using a common metric—a set of decisions made through stakeholder involvement with a similar set of decisions made without stakeholder input. However, finding an opportunity to conduct such a natural experiment on more than a handful of case studies is unlikely. To date, comparative studies have only been successful for the more exotic manifestations of stakeholder participation. Coglianese (1997), for example, used a comparative approach to evaluate regulatory negotiations, but the outcomes of interest were speed and conflict resolution rather than decision quality. Even if a broader opportunity for comparison presented itself, the question of whether stakeholders contribute to or detract from decision quality would unlikely be settled, because there is no agreement on what "quality" means. Should it account for the multiple objectives of stakeholder participation, such as capacity building and conflict resolution? Should it account for diverse sets of public values?

In this paper, we seek to shed light on the quality of stakeholder-based decisions by departing from the comparative ideal. We evaluate 239 case studies of public participation in environmental decisionmaking against a broad set of rather conventional quality criteria. Data for the analysis were derived from published case studies on 239 cases of public participation. Researchers coded over 100 attributes of each case related to its context, the participatory process used, and the outcomes. To a great extent, the cases examined here do not concern high-profile, federal-level decisionmaking. Most deal with more routine cases of planning, management, and implementation carried out by environmental and natural resource agencies at many levels of government.

The criteria used to evaluate the cases were as follows:

1. Were decisions more *cost-effective* than alternatives?
2. Did decisions increase *joint gains* over alternatives?
3. Was it the *opinion* of participants or authors that decisions were improved?
4. Did *other measures* suggest improvements in quality?
5. Did stakeholders *add information*?
6. Did stakeholders contribute to the *technical analysis* of problems?
7. Did stakeholders generate *innovative ideas*?
8. Did stakeholders introduce a more *holistic perspective*?
9. Did stakeholders bring *technical capacity* to the process?
10. Was there adequate *access to information and expertise*?

The data derived from these criteria were aggregated into two main quality measures. The first measure dealt with the outcomes of stakeholder processes and pulled together the first eight criteria. It reflected a broad definition of quality that incorporated both "technical" considerations, such as cost-effectiveness, and more "political" considerations, such as increasing joint gains. The second measure dealt with process and brought together the last two criteria. It reflected a more specific definition of quality—one focused on scientific and technical quality. Given the difficulty of identifying an outcome measure that can somehow measure "scientific quality," these process criteria may provide the best perspective we have on the specific issue of the scientific and technical quality of stakeholder-based decisions.

The results of the analysis indicate that there should be little concern that stakeholder processes, as viewed through the case study record, are resulting in low quality decisions. Across a broad range of criteria, the majority of cases contained evidence of decisions that were better than alternatives or evidence that stakeholders added new information, ideas, and analysis. In most of the cases, numerous technical and scientific resources were available to stakeholders, either through their own training or through outside expertise. The analysis also showed that stakeholder processes that pursued consensus scored higher on quality criteria than processes that did not seek consensus. Finally, the nature of the lead agency seemed to bear little relation to the quality of stakeholder-based decisions.

Section 2 of this paper discusses the methodology used to collect and analyze the data on stakeholder processes. Section 3 outlines the pool of 239 case studies, describing the range of environmental issues covered, the level of government of lead agencies, and the types and characteristics of participatory processes used. Section 4 turns to the evidence regarding the substantive quality of stakeholder-based decisions. Section 5 examines questions about how the substantive quality of decisions is related to the participatory process and the nature of the lead agency. Section 6 concludes the paper with a brief wrap-up of results and a few issues for further consideration in thinking about the quality of stakeholder-based decisions.

## 2. Methodology and Data

The data for this paper come from a "case survey" of 239 cases of public participation in environmental decisionmaking. A case survey is analogous to a normal closed-ended survey, except that a "reader-analyst" "asks" a standard set of questions of a written case study rather than of a person (Lucas, 1974; Yin and Heald, 1975; Bullock and Tubbs, 1987; Larrson, 1993). It is a formal process for systematically coding relevant data from a large number of qualitative sources for quantitative analysis. Derived data can support data analysis even if the questions addressed in the analysis are different from those posed in the original case study (GAO, 1991).

Researchers screened over 1,800 case studies—drawn from journals, books, dissertations, conference proceedings, and government reports—ultimately identifying the 239 cases making up the data set.[1] Each case was coded for over 100 attributes covering the type of environmental issue, the people who participated, important features of the participatory process, and the outcomes achieved. Each attribute was assigned a score—usually low, medium, or high—based

[1] Case studies were screened based on the following criteria:

- dealt with public involvement in environmental decisionmaking, generally at the administrative level;
- occurred in the United States;
- occurred since 1970;
- had an identifiable lead (or otherwise interested) government agency;
- described a discrete mechanism (or set of mechanisms) used to engage the public;
- described participation of nongovernmental citizens other than regulated parties; and
- contained sufficient information on context, process, and outcomes.

on a standard template. Each score was given one of three weight-of-evidence measures, ranging from "solid evidence" to "best informed guess." Data with the lowest weight of evidence were not used in the analysis. The scores were accompanied by a written justification that recorded important qualitative information.

Each case was coded by one of three researchers or by pairs of them. In order to ensure consistent coding among researchers, a process of inter-coder reliability testing was used. This involved pairs of researchers reading and coding the same subset of case studies independently and then comparing codes. Where there were conflicting codes, they were resolved through consensus and the coding template was clarified as necessary. Pairs of researchers continued to code sets of cases in parallel until they consistently achieved two-thirds agreement, a level of reliability regarded as satisfactory in the literature (Larsson, 1993). Each case was then coded by only one researcher. As the coding progressed, researchers would periodically code a set of cases in parallel to assure that inter-coder reliability was being maintained. Overall, around 10% of the cases were used in the inter-coder reliability process.

Data analysis consisted mainly of counts of scores and a review of the qualitative information accompanying them. Relatively simple comparative statistics were used to develop correlation coefficients and to identify statistically significant differences between sets of data. The statistical analysis used a Kendall's tau-b correlation coefficient and a chi-squared test of significance.[2]

Although it has been used in the policy analysis and business literature, the case survey methodology is still somewhat experimental, and there are a few important caveats to mention. The quality of the data used in a case survey is only as good as the quality of the case studies from which the data come. Moreover, cases by different authors and for different purposes will report on different aspects of a process, leaving some data gaps. The analysis accounted for these problems somewhat by the assignment of weight of evidence scores and by drawing on enough cases to overcome problems with data gaps.

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[2] The Kendall's tau b correlation coefficient is based on the number of concordant and discordant pairs of observations in a contingency table, using a correction for ties. Its calculation is described in STATA (1997, p. 487). It is an appropriate non-parametric measure of correlation for ordinal data (Bullock and Tubbs, 1987, p. 210). A rule of thumb for using the chi-squared test of association is that the expected count of each cell in the contingency table should be greater than 5 (and preferably greater than 10), which was met in most cases here (Stokes et al., 1995).

Perhaps more important is whether the data set is biased. Of particular concern is a success bias—that only successful cases were written up and that authors had a tendency to overemphasize the good things that stakeholders accomplished. We analyze these potential sources of bias explicitly in Appendix B. More generally, there are two reasons to think that a success bias may not be as prevalent in the published literature on stakeholder participation as it is in other research literatures, such as the hard sciences. First, authors don't necessarily have an incentive to write up only successful cases. Many of our cases came from doctoral dissertations or other studies where multiple cases were compared and unsuccessful cases provided as much, or more, insight as successful ones. Second, different authors defined the "success" of stakeholder processes differently, and very few defined it in terms of decision quality. Even if there is an overall success bias, then, it is unlikely to extend to the quality criteria used here. Overall, bias does not appear to have much impact on the main conclusions of this paper.

## 3. Overview of the Case Studies

In discussing results, it is important to know just what kind of participation is being talked about. The bulk of public-participation cases covered here are not those that make newspaper headlines. They concern a diversity of planning, management, and implementation activities carried out by environmental and natural resource agencies at many levels of government.

More than 80% of the cases dealt with decisions that were specific to a single site or geographic feature, such as cleaning up contaminated property, siting an industrial facility, or developing a management plan for a park. The remaining 20% of cases dealt with broader policy issues, such as the development of regulations or the identification of environmental protection priorities for a state or region. Forty-four percent of the cases dealt with pollution-related issues and the rest concerned natural resources, such as wildlife, forests, mining, and agriculture. Figure 1 identifies the distribution of cases among broad categories of issues.

In 55% of the cases, state and local agencies took the lead, with cases covering 40 states (see Figure 2). Most of the remaining cases were led by federal agencies, primarily EPA, DOE, the Army Corps of Engineers, and various resource management agencies within the Department of the Interior. In nearly three-quarters of the cases, the lead agency was actively overseeing or participating in the process. In the remaining cases, the lead agency had either delegated oversight to another organization or was simply part of the intended audience of efforts initiated outside of government altogether.

The types of processes in which stakeholders participated ranged from public meetings to intensive negotiations (see Figure 3). These processes defy easy categorization. However, some of their major differences can be captured with reference to a few design features: the nature of the typical participant, the method used to reach decisions, and the nature of the intended outcomes, as described below.

Twenty-one percent of the cases involved public hearings, meetings, and workshops. In most of these cases, access was open: any interested citizen could participate. While participants might identify with major interest-orientations—pro-environment, pro-business, anti-tax, and so forth—or be members of interest groups, their role was that of individual citizens, not of formal representatives of some group. These processes mainly involved information exchange, with agencies informing citizens about their activities and citizens providing input and individual opinions on agency policy. Agencies were under an implicit obligation to review information from these processes, but in most cases there was little commitment to actually share decisionmaking authority with the public.

Fifty-six percent of the cases concerned the work of advisory committees. Unlike public meetings, advisory committees typically had a defined and consistent membership. In most cases, participants were selected to represent various interest groups or points of view, although in a few cases they were selected to be “representative”—that is, a microcosm of the socioeconomic characteristics and issue-orientation of a particular area. In contrast to public meetings, these processes were as much about the interaction among participants—who frequently brought very different views on a decision to the table—as about providing input to a lead agency. The work of advisory committees typically took place in ongoing, regular meetings, some of which stretched out over years. Typically the outcome of advisory committee work was a set of recommendations to a lead agency.

**Figure 1: Type of Decisionmaking**

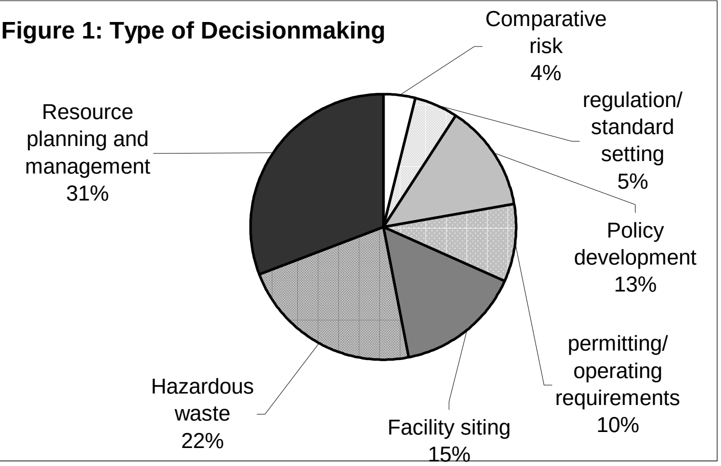



**Figure 2: Level of Government**

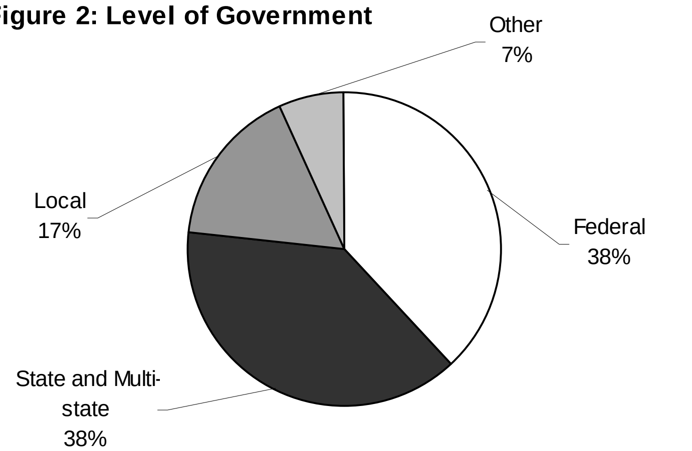
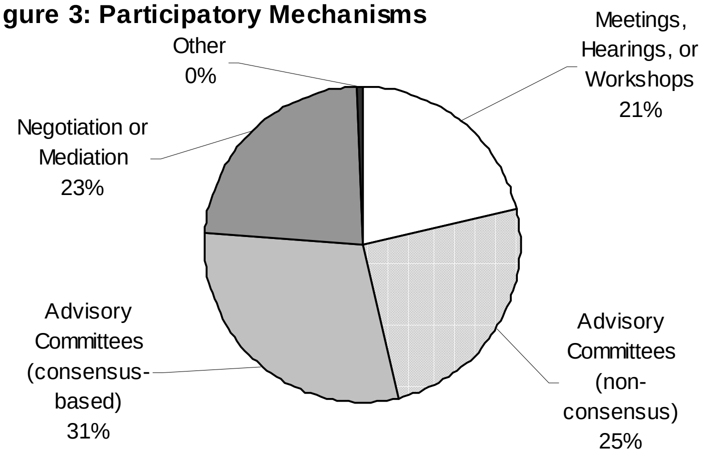



**Figure 3: Participatory Mechanisms**



A major distinction can be made among advisory committees based on whether they operated by consensus or not. In the cases using consensus, decisionmaking took on aspects of internal negotiations among participants, often complete with facilitation by a third party. In about half of the advisory committee cases, consensus was eschewed in favor of voting or the presentation of competing sets of recommendations. The other half of the advisory committee cases used consensus, forcing opposing interests to work together to come to a common and acceptable solution to a problem.

The final 23% of cases dealt explicitly with negotiations and mediations. In negotiations and mediations, unlike the public meetings or advisory committees, stakeholders were actually formulating agreements that would bind their organizations to particular courses of action. In some cases, the negotiating parties themselves implemented the agreement, as was the case with many watershed management groups, for example. In other cases, parties agreed to be bound by a decision in exchange for a strong commitment that a lead agency would act on it. The participants in a negotiation or mediation were typically professional representatives of organized interest groups or other entities. They spoke for the views of those they represented and made commitments on their behalf. By definition, decisions were made by consensus.

Regardless of the participatory process, the level of government of the lead agency, or the topics under discussion, in all of these cases stakeholders had some direct or indirect role in affecting the quality of environmental decisions ultimately made. The next section discusses the criteria used to examine the quality of stakeholder-based decisions and what the cases show about it.

## 4. The Quality of Stakeholder-Based Decisions

Posing questions about the quality of stakeholder-based decisions raises important and difficult issues about the purpose and appropriate evaluation of stakeholder processes. When confronted with the myriad motivations for bringing stakeholders to the table, some of the traditional criteria for assessing quality—such as cost-effectiveness or improved information—appear to be quite narrow measurement tools. Stakeholder processes have many and varied purposes beyond making decisions, such as capacity building and social learning, conflict resolution, and networking. Perhaps more importantly, the adoption of a stakeholder process is an implicit acknowledgement that the environmental decision in question has important value-dimensions that are not captured by traditional quality measures. In fact, many analysts of public participation have eschewed evaluation of decision quality, because defining "quality" is so value-laden.

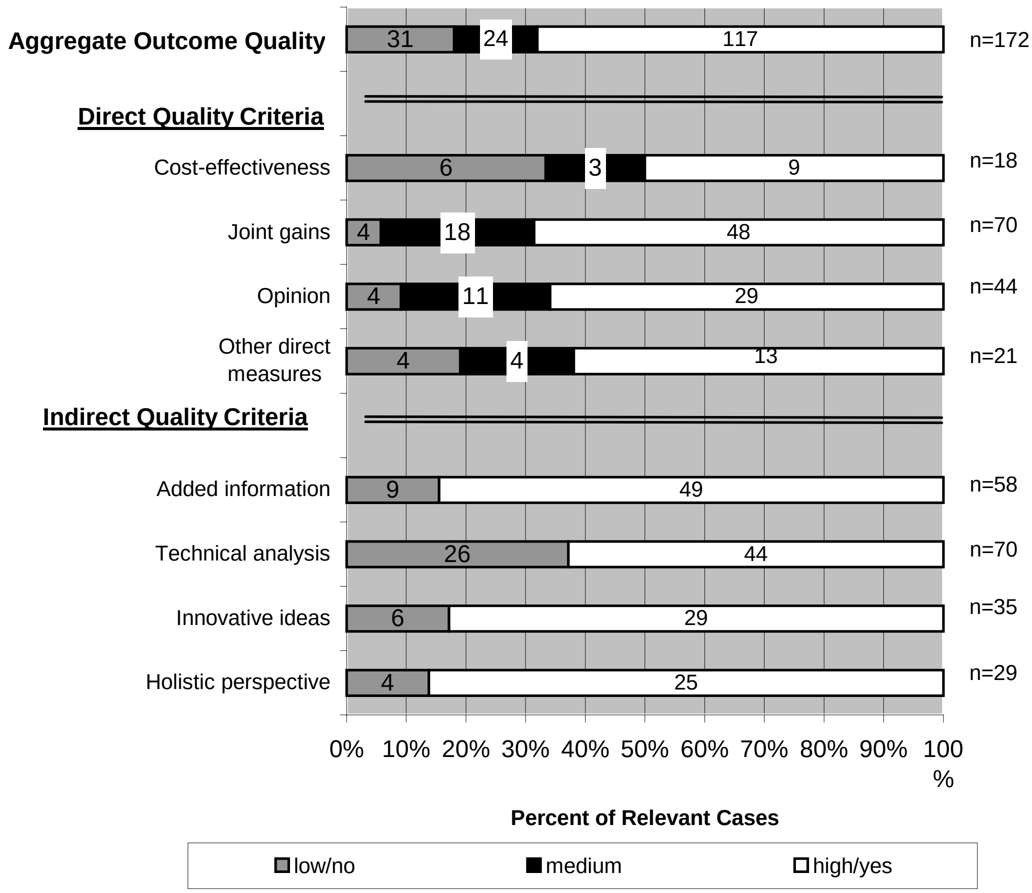
Although the reluctance in the literature to address the quality dimension of stakeholder decisions is understandable, it has left a void in knowledge about how the move toward stakeholder decisionmaking is affecting environmental policy. There are, in fact, a number of measures of quality—however imperfect or incomplete—that can be applied. We can distinguish two sets of quality criteria. The first examines the substantive quality of outcomes. The second examines the process, focusing on the technical and scientific resources available to stakeholders. Each is discussed below along with the results of the data analysis.

### *Substantive Quality of Outcomes*

To measure the substantive quality of outcomes we use an aggregate of eight separate, but related, quality criteria. It is appropriate to use a variety of criteria here because different kinds of processes will affect decision quality in different ways. An agreement developed through mediation, for example, can be evaluated against a likely alternative. The contributions that citizens make at a public meeting, however, require criteria that look to these contributions specifically, rather than to the decisions ultimately made.

Figure 4 shows the results, across cases, for the eight individual criteria and for an aggregate outcome quality measure, which runs along the top of the figure. (Details on how the aggregate measure was constructed are contained in Appendix A.) As shown in the figure, 172 cases out of a total of 239 were scored for the aggregate outcome quality measure. There were roughly twice as many high scoring cases as low- and medium-scoring cases combined. This means that in roughly two-thirds of the cases for which information was available, evidence—sometimes from multiple component criteria—suggested that outcomes were of high substantive quality. To better understand what substantive quality means in these cases, we turn below to a more complete explanation of the eight component quality criteria, four of which evaluate quality directly and four indirectly.

**Figure 4: Outcome Quality**




Notes:
1) Numbers within bars refer to the number of cases in that category
2) Direct quality criteria were measured as high/medium/low; indirect quality criteria were measured as yes/no and translated into high/low for the aggregate.

The direct measures rank decisions along a single quality dimension: decision A is better than decision B according to criterion X. Some of the more concrete direct measures come out of the program evaluation literature, where they are used as proxies for the extent to which the public interest (however interpreted) is being served. Others are less specific. In each case, the direct quality criteria were scored as high, medium, or low based on how well the criterion was met in a particular case.

The direct criteria are most applicable to cases where decisions were actually made by stakeholders, either in the form of group recommendations to an agency or actual agreements among participants on a course of action. Most of these cases were scored based on comparisons that participants or case study authors implicitly made between stakeholder decisions and likely alternatives. Such comparisons provided a case-specific baseline—albeit often a rather vaguely defined one—against which the stakeholder decisions could be scored.

The direct quality measures used were:

Cost-effectiveness. Were the decisions or recommendations made by participants more or less cost-effective than a probable alternative? This criterion does not refer to the cost-effectiveness of undertaking a stakeholder process relative to some other approach to making decisions, but looks at the decision itself. For example, the DOE credited the Fernald Citizens Task Force—a stakeholder advisory committee established to advise DOE on the remediation of its Fernald, Ohio, nuclear weapons facility—with designing a cleanup plan that saved taxpayers over $2 billion over the life of the project (Applegate, 1998). Only 18 cases could be scored for cost-effectiveness. For these, the number of high-scoring cases matched the number of medium- and low-scoring cases combined.

Joint Gains. Were some participants made better off through agreement without any participant becoming worse off? This is a standard measure in the negotiation literature that traces its roots to measures of “Pareto optimality” in game theory and the economics of Coasian bargaining. In an analysis of environmental mediation, Bingham (1986) used agreement among parties as a proxy for joint gains, arguing that if they could get a better deal somewhere else they would defect from the mediation. The joint gains criterion was coded for more cases than any other direct quality criterion, with 48 cases showing an improvement, 18 showing no change, and only 4 showing a decrease in quality.

Opinion. Did participants or case study authors feel that decisions were better than a reasonable alternative? Often quality was not expressed according to concrete criteria but as general satisfaction with an outcome or in terms of a range of quality criteria. For example, in the Woodburning Stove Emissions regulatory negotiation, one participant said that the regulations developed by the group were "more effective, more environmentally-oriented, fairer to the industries, and more creative than those EPA could have been expected to develop." Of the 44 cases scored for this criterion, 29 were high, 11 medium, and 4 low.

<u>Other measures</u>. Were decisions deemed substantively better due to some other measure of quality? All other direct measures of quality mentioned by case study authors were collected here. They encompassed a variety of criteria, such as the scientific foundation of the decision, its technical quality, or whether it resulted in a more environmentally beneficial outcome. For example, some participants in the development of a habitat management plan for Clark County, Nevada, "acknowledged that at times the biological ideal was compromised, but the best possible outcome was achieved." The compromise in the biological ideal "at times" earned this case a medium score for this criterion. Of the 21 cases scored for this criterion, 13 were high, 4 were medium, and 4 were low.

The four indirect quality measures look less at the overall quality of decisions than at what stakeholders brought to decisions. Did stakeholders add new information, ideas, or resources to the decisionmaking table that would not otherwise have been available? The indirect criteria were more appropriate for examining cases where the public was not actually making decisions, but was contributing to the knowledge base that government agencies would then use to determine a course of action. In scoring these cases, we assumed that some public input of information, ideas, or analysis was better than no public input at all. The indirect quality criteria were scored as "yes" or "no" based on whether the criterion of interest was met in the case or not. To construct the aggregate outcome quality score, "yes" scores were interpreted as "high," and "no" scores were interpreted as "low" as detailed in Appendix A. The indirect criteria are as follows:

<u>Added information</u>. Did participants add information to the analysis that would not otherwise have been available? One of the primary substantive rationales for stakeholder involvement is that the public brings a wealth of local knowledge about issues such as environmental conditions, land use, and exposure that can improve environmental assessments. In some cases, stakeholder groups even provided the impetus and resources for collecting new information. The Buffalo River Citizens Committee (BRCC), for example, was a major force behind better data collection on the water quality of the Buffalo River, which was part of an effort to clean up the area where the river joins Lake Erie. According to the researchers who analyzed BRCC's role in the cleanup, their work "led to a better environmental database on the river" whose information was

"co-produced and shared" between the BRCC and the New York Department of Environmental Conservation (Kellogg, 1993, 237). In 49 cases, participants added important information, and in 9 cases their failure to do so was noted.

<u>Technical analysis</u>. Did participants engage in technical analysis to improve the foundations on which decisions were based? Beyond providing information, participants can perform the analytical work of understanding problems, evaluating options, and identifying the likely results of different alternatives. For example, in the development of the Missouri River Basin Plan—concerning navigation and flood control on the river between Kansas City and St. Louis—stakeholders performed analyses on the economic, hydraulic, recreation, environmental, and land use aspects of various levee alternatives (Mazmanian and Nienaber, 1979, 75). In 44 cases, participants contributed to the technical analysis, and in 26 cases they did not.

<u>Innovative ideas</u>. Did stakeholders come up with innovative ideas? Stakeholder processes can be thought of as expanding the resources available for problem solving as many people approach the same problem from different perspectives. One example is a group of local ranchers and landowners in southern New Mexico and Arizona who came up with the idea of using protected grasslands as a "grass bank" to encourage conservation and discourage development of farmlands; under this plan, ranchers could use the grass on protected land in exchange for granting conservation easements on their own land (Bernard and Young, 1997). In 29 cases, participants were credited with contributing innovative ideas, and in 6 cases their failure to do so was noted.

<u>Holistic approach</u>. Did stakeholders develop a more holistic and integrated way of looking at an environmental problem? While agency personnel are often constrained by program mandates to look at problems in narrow ways, the public is not. The public's broader perspective can help define problems in ways that lead to more effective management. It can also broaden the opportunity for agreement among parties. Narrow water quality questions turn into watershed solutions; environmental cleanup decisions turn into economic development plans; resource permitting debates turn into comprehensive resource management planning. For example, in the case of a mediation regarding the damming of the Snoqualmie River in the 1970s, the question evolved from a yes/no question about building the dam to the question of "how do we provide some level of flood control, ensure the continued economic viability of the farmers and the towns, and build the kind of land use plans and controls that maintain the valley as a greenbelt with broad recreational value?" (Cormick and Patton, 1980, p. 88). Participants pushed decisionmakers to be more holistic in 25 cases, and their failure to do so was noted in 4 cases.

As a window on the outcomes of a varied set of stakeholder processes, the case study pool brought together here should lead us to an optimistic view of what such processes can accomplish. Across all of the direct and indirect criteria, considerably more cases appeared to produce good outcomes than bad. The aggregate criterion, which pulls together the varied definitions of quality and accounts for multiple criteria scores for a single case, reflects this balance in favor of good outcomes.

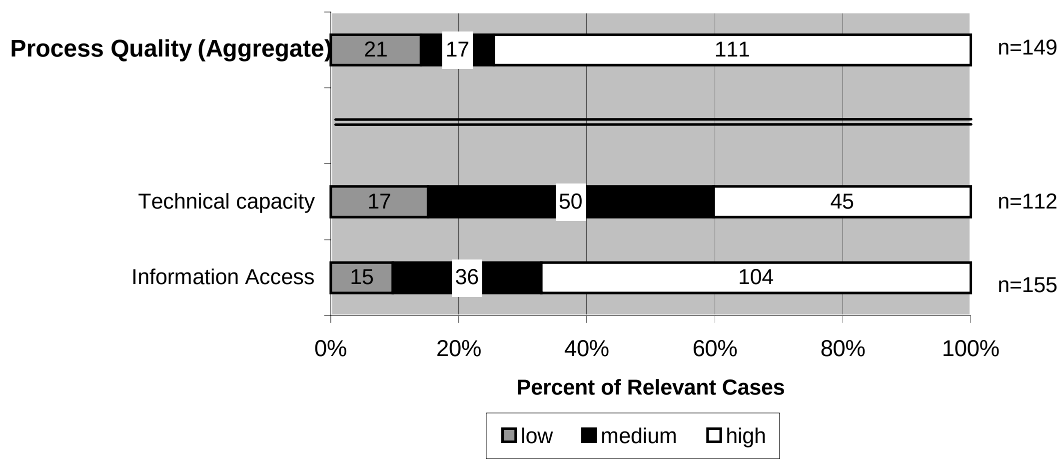
But outcomes are not the only way to judge the substantive quality of stakeholder decisions. We can also look to the process of participation and examine whether the scientific and technical resources available to stakeholders were adequate.

### *Substantive Quality of Process*

To look at whether participatory processes provided adequate scientific and technical resources, two criteria were brought together into an aggregate measure. The first criterion evaluated the technical capacity of participants as defined by their training and experience with the issues under discussion. It can be thought of as a measure of "internal" technical resources. The second criterion evaluated participants' access to technical resources, in the form of information availability and access to expertise. It can be thought of as a measure of "external" technical resources.

The aggregate procedural quality measure and its two components are shown in Figure 5. A high score on the aggregate meant that the combination of internal and external resources provided participants with a relatively high level of technical resources. A low score meant that the process was deficient in internal and external technical resources. (The details on how the aggregate was constructed are included in Appendix A.) As shown in Figure 5, 149 cases out of 239 received an aggregate score. Nearly three times as many cases scored high as those that scored medium or low. The abundance of high-scoring cases suggests that the technical and scientific resources available to most of these cases were indeed quite good.

**Figure 5: Process Quality**




Note: Numbers within bars refer to the number of cases in that category.

The individual component criteria in the aggregate measure are described below:

Technical capacity. The technical capacity criterion looks at the scientific knowledge and technical training that stakeholders brought to the process. There is a tendency to assume that the citizens participating in environmental policy decisions are lay people rather than experts. Yet the capacity that participants bring to the table can often be quite impressive, both in terms of scientific and technical training and in terms of in-depth knowledge of the issues under discussion. An example of a highly skilled group is the Northern States Power Advisory Task Force, which included 2 physicists, a university biologist, other scientists and engineers, and many people with long histories of involvement in energy issues (Ducsik and Austin, 1986).

In roughly 40% of the cases for which data was available, there was a significant level of technical capacity among most of the participants. In another roughly 45%, there were at least some participants with significant technical capacity who could act as internal technical resources for the rest of the group. In the remaining cases, participants had little overt technical or issue-related expertise. It is only to this last 15% that the label “lay public” most appropriately applies.

Access to technical resources. The access to technical resources criterion looks at whether stakeholders had access to information and expertise that they felt were adequate and unbiased.

One of the long-standing concerns in public participation is that the public will have inadequate access to technical expertise or will have to rely too heavily on potentially biased information generated by agencies. Under some programs, agencies can provide technical assistance grants to public groups to help alleviate such imbalances of information. With or without agency funding, participants in the cases discussed here accessed expertise through a variety of methods, such as hiring consultants, interacting with technical advisory committees, or otherwise querying outside experts. An interesting model for these types of consultations were citizen juries, where a panel of citizens (the jury) listened to testimony and asked questions of a series of experts (the witnesses) in order to render informed judgement on a particular policy topic.

In 67% of the 155 cases for which data were available, participants had access to what they regarded as credible, relevant, and high quality technical information and expertise. In another 23%, there was some limited access to technical information and expertise.

Like the measures of outcome quality, the measures of process quality led to an optimistic view. On the individual criteria and the aggregate measures, processes with adequate technical and scientific resources far outweighed those that lacked them. The results seem to run counter to a concern raised by Yosie and Herbst (1998) that science and scientists were not well enough integrated into stakeholder processes.

### *Comparing Outcome and Process Measures*

The two approaches to measuring substantive quality, one based on outcomes and one based on process, provide two perspectives on stakeholder-based decisionmaking. Surprisingly, the two measures were not highly correlated across cases.[3] Although there were many cases that scored high on both of the aggregate measures, unexpectedly, a number of cases scored high on one and low on the other. Why would quality outcomes not always be related to a quality process? Examining the cases where the two measures were not in agreement generates three insights into the criteria and the cases themselves.

The first answer is that the two measures are not reflecting the same dimensions of quality. The criteria that make up the process measure deal explicitly with scientific and technical dimensions of quality. The criteria that make up the outcome measure reflect a much

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3 The correlation between the aggregate outcome quality measure and the aggregate process quality measure is 0.22 and is significant at the 90% confidence level (chi-squared probability=.10).

broader definition of quality. Some of the outcome criteria—such as cost-effectiveness, added information, or technical analysis—are arguably closely related to technical quality. But other criteria—such as joint gains or the opinion of participants—look at quality in terms that are much more subjective and dependent on the interests of the participants. If we are interested in scientific and technical quality specifically, we may want to look to the process quality measure. But if we are interested in a broader definition of quality, the outcome quality measure is more appropriate.

The second answer lies in the scope of the process being examined. The process measure is open-ended—it says nothing about actual decisions made. In a number of cases, highly trained participants or those with access to high quality technical resources did not have much of an impact on substantive outcomes because the design of the process gave them little ability to make or contribute to decisions.

The third answer deals with what the stakeholder-based decisions are being compared to. As outlined above, the outcome criteria incorporate a comparison to an implicit or explicit alternative or baseline. The direct quality measures are scored against a plausible alternative: for example, participants felt that decision X was more cost-effective or more satisfying to a broader range of interests than decision Y. Even the indirect quality measures assume an alternative: participants added information that otherwise would not have been available or lobbied for a more holistic approach that would not have been undertaken otherwise. The process criteria, on the other hand, are not scored relative to a baseline. In these cases, we often don't know what the alternative to a stakeholder process would have been.

The two substantive quality measures, then, give us two distinct ways of looking at substantive quality. One looks at the quality of outcomes, broadly defined. It takes into account the scope of a particular process and makes a comparison to alternatives. The second looks more explicitly at scientific and technical quality as process inputs but ignores the scope of the process itself, alternatives to the process, or the outcomes it might generate. Neither measure tells the whole story, but together they provide insights into the quality of stakeholder-based decisions. They also provide rankings that we can use to ask how different attributes of stakeholder processes affect quality.

## 5. The Importance of Process and the Lead Agency

The case studies examined here are quite heterogeneous, with wide differences across a number of characteristics, including the environmental issues under discussion, the types of participatory processes used, and the level of government at which decisions were made. Such differences among cases may affect the quality of the decisions stakeholders would make. This section examines two of these differences—the type of participatory process and the identity of the government agency leading it.

The methodology used here is a relatively simple process of stratifying the sample set based on a single attribute and comparing results between the two sets of cases. It uses a standard statistical test (a chi-squared test) to judge whether differences between the two sets are statistically significant or not. Using this approach has advantages in terms of ease of explication and is sufficient to illustrate the points made below. Its main weakness, however, is that it can mask the influence that unobserved factors are having on the results. The “unobserved factor” that is probably of principal concern here is the type of issue being addressed—whether it be land use planning, a hazardous waste cleanup, or the development of regulations. Preliminary data analysis using a more complex multivariate approach suggests that introducing considerations of issue type into the analysis does not have much impact on the results reported here. Instead of delving into more complex statistics, the discussion below addresses the multi-variate nature of the data qualitatively, examining how results for the entire data set compare to those for subsets focused on specific environmental issues, such as hazardous waste cleanup and resource planning and management.

### *Type of Participatory Process*

As outlined in Section 3, stakeholder processes can take on many forms, from a series of public meetings to an intensive negotiation among disputing parties. In Section 3, the cases were described in terms of four categories, each accounting for roughly a fourth of the data set. The first two categories did not involve consensus decisionmaking; these were public meetings and non-consensus advisory committees. The second two categories did involve consensus decisionmaking; these were consensus-based advisory committees and negotiations/mediations.

The consensus-based processes were generally more intense, and required more commitment from participants. Rather than simply expressing positions, participants were seeking common ground. In the negotiation/mediation cases, participants were actually forging agreements. Recent years have seen a rise in these more intensive consensus-based forms of participation to inform and make environmental policy, including the use of federal advisory committees at contaminated DOE sites, national policy dialogues, and regulatory negotiations. EPA has embraced consensus-based stakeholder processes in many of its reinvention initiatives, such as Project XL and the Common Sense Initiative. At more local levels, consensus-based grassroots stakeholder councils have sprung up around the country to agree on how to manage natural resources (Weber, 2000).

It is the rise of the more intensive processes of consensus-building and agreement-seeking that have raised concern about the quality of decisions made, or influenced by, stakeholders. If the "political" element of stakeholder processes is indeed leading to a sacrifice in quality, then such a sacrifice should be most obvious in cases emphasizing consensus—and perhaps more so, those explicitly seeking an agreement among parties through negotiation and mediation.

Across both the outcome and process measures, however, the data suggest that negotiation and mediation, and consensus-seeking processes generally, score higher on quality criteria than less-intensive stakeholder processes. Figures 6 and 7 compare the four different types of participatory processes on the outcome quality and process quality measures. Looking first to outcome quality in Figure 6, the difference between negotiation/mediation cases (D) and the rest (A, B, and C) is positive and statistically significant.[4] The same is true if we compare the consensus-seeking group (C and D) with the non-consensus seeking group (A and B).[5] Looking next to process quality in Figure 7, the results are similarly positive and statistically significant but the magnitudes of difference are even higher.[6]

A subset of the data dealing with the cleanup of Superfund sites provides insight into the trends in the overall data. There are twenty-five Superfund cases in the dataset with information on the outcome or process measures. All of them involve EPA, and many involve DOE in the cleanup of its nuclear weapons facilities. The distribution of high, medium, and low scores for these Superfund cases across the outcome and process measures are roughly similar to the full

4 The chi-squared probability is .015.

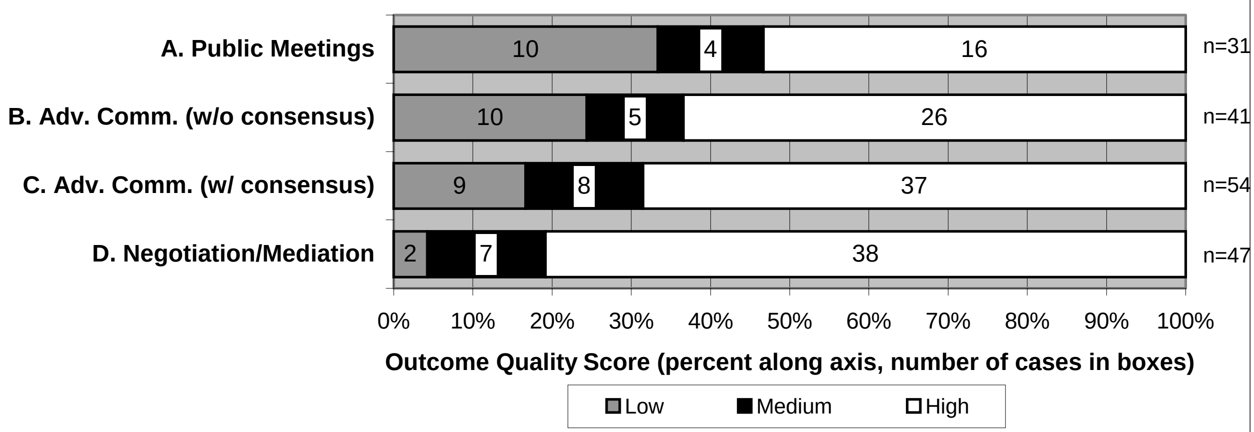
5 The chi-squared probability is .015.

6 In comparing type D to A, B, and C, the chi-squared probability is .009. In comparing types C and D to A and B, the chi-squared probability is .000.

data set. The relationship between substantive quality and process type also appears to hold up in the Superfund subset of the data. Brief descriptions of four cases serve to illustrate the results linking the type of process to substantive quality.

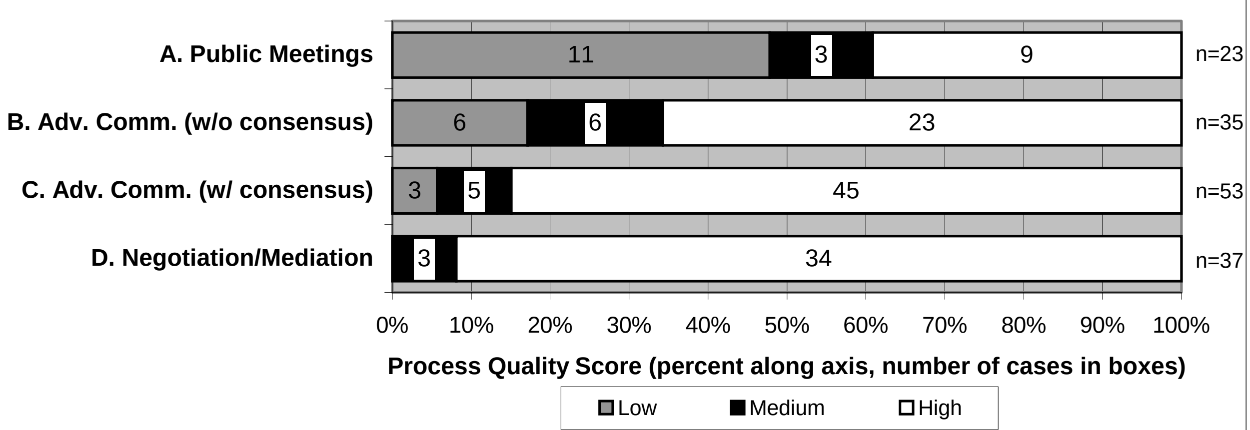
The two cases of the Lipari Landfill in Pittman, New Jersey, and Fort Ord near Monterey, California, illustrate how process can conspire to limit the public's contribution to the substance of decisions. At Lipari in the early 1980s, public meetings were the primary means to engage the public (Kauffman, 1992; Kaminstein, 1996). An agenda and scope tightly controlled by EPA, combined with few technical internal or external resources for participants, meant that local residents were effectively shut out of decisionmaking, and left feeling "ignorant and overwhelmed." (Kaminstein, 1996, 460). Accordingly, the local residents contributed little to the substance of decisionmaking. The situation in Fort Ord was similar. At Ford Ord, the participatory process was an advisory committee but one that explicitly did not seek consensus and was not intended to develop or recommend policies to the U.S. Army, who was cleaning up the site (Wernstedt and Hersh, 1997). Like the Lipari cases, participants had little technical training and little access to other resources, which effectively kept them out of any technical decisionmaking. In both the Lipari and Fort Ord cases, the participatory process was simply not robust enough to allow participants to develop ideas, share information, and formulate alternatives that might promise to improve decisionmaking. In both cases, cleanup decisions remained mired in controversy.

**Figure 6: Outcome Quality and Mechanism Type**




Note: Numbers within bars refer to the number of cases in that category.

**Figure 7: Process Quality and Mechanism Type**




Note: Numbers within bars refer to the number of cases in that category.

The Lipari and Fort Ord cases stand in stark contrast to two other cases of decisionmaking about hazardous waste sites—the cleanup of a hazardous waste site in New Bedford, Massachusetts, in the early 1980s and the remediation of a contaminated DOE facility in Fernald, Ohio, in the early 1990s. At New Bedford, years of controversy over whether or not to incinerate contaminated material were settled by a consensus-based stakeholder process called the New Bedford Harbor Forum (Hartley, 1998; Hartley, 1999). The forum brought together a group of local residents and officials, all with varying degrees of expertise in the issues. Citizens hired a technical advisor and got involved in the technical analysis; they contributed local information about the site. The deliberations generated a more holistic cleanup solution that incorporated the role of the site in the economic revitalization of the community. The process ultimately resulted in what the case study author called "better decisions that reduced risk" (Hartley, 1998, p. 6). The experience in Fernald, Ohio, was similarly successful (Applegate, 1998; Duffield and Depoe, 1997). There, DOE established a consensus-based advisory committee to make decisions about complex and intertwined issues, such as on-site or off-site disposal, future use of the site, the acceptable level of residual risk, and appropriate cleanup technologies. In two years of work, utilizing both the internal expertise of some of the members of the committee and external consultants, the participants arrived at what was considered to be a fair and balanced cleanup strategy, which DOE regarded as faster, cheaper, and more holistic than what DOE would have developed alone. Noted earlier in this paper is the fact that DOE considers the outcome to have saved taxpayers $2 billion.

The pursuit of consensus through deliberation is the defining feature of these successful hazardous waste cases, and the higher-scoring cases in the larger data set more generally. Of course these kinds of cases are often longer, better funded, and attract more committed participants than less intensive decision processes. All of these factors are all likely reflected in the result that links consensus-based processes with higher quality. But there are reasons to think that consensus-seeking plays a more direct role in supporting decision quality. Resolving conflict often requires dealing with scientific uncertainty through appeals to independent expertise, joint-fact finding on the part of all participants, or new research altogether. Arguments are generally won or lost based on the quality of the information. Mistrust among stakeholders and between stakeholders and government may uncover questionable science and bad ideas. Building trust may require tapping into independent sources of expertise or generating new knowledge. All of these suggest that the "political" features of these more intensive stakeholder processes may create a positive synergy with the quality of its outcomes.

### *The Nature of the Lead Agency*

Lead agencies play a large in role in the design and execution of stakeholder processes. So too might the locus of decisionmaking, whether it is national, state, or local in scope. We examine two questions related to the nature of the lead agency. First is whether processes led by state and local governments compare favorably to processes led by federal agencies. Second is how processes led by the EPA compare to both federal agencies alone and to agencies at all levels of government. The results of the analysis are shown in Figures 8 and 9 and are discussed below.

One of the surprising aspects of the research described here is the large number of cases of stakeholder processes undertaken at the state and local level. State and local decisionmaking is likely to increase in importance as local issues, such as land use, come to the forefront of environmental concern. Stakeholder participation at the state and local level is likely to increase as well. In fact, the National Governor's Association has adopted collaboration among stakeholders as one of the core principles of its "Enlibra" doctrine, which outlines a vision for environmental policymaking in the states. A shift toward participatory decisionmaking at the state and local levels could be cause for concern from the point of view of quality, particularly if fewer scientific and technical resources are available at these levels.

As indicated by Figures 8 and 9, however, there is not much of a difference between the results for state and local lead agencies as compared to federal agencies for either quality measure.[7] For example, on the aggregate outcome measure there was a higher percentage of high scoring cases led by state and local governments, but there was also a higher percentage of low scoring cases. To see how the results play out for specific types of issues, we briefly examine the set of cases dealing with resource planning and management.

State and local governments play a large role in developing policies regarding how resources will be used and managed. There are 74 cases in the data set dealing with resource planning and management, encompassing land use decisions, habitat conservation planning, watershed management, the management of parks and other designated areas, water quality planning, and wildlife management. Nearly all of the cases dealt with specific sites or geographic regions rather than overarching policy issues. Of these 74 cases, 38 were led by state

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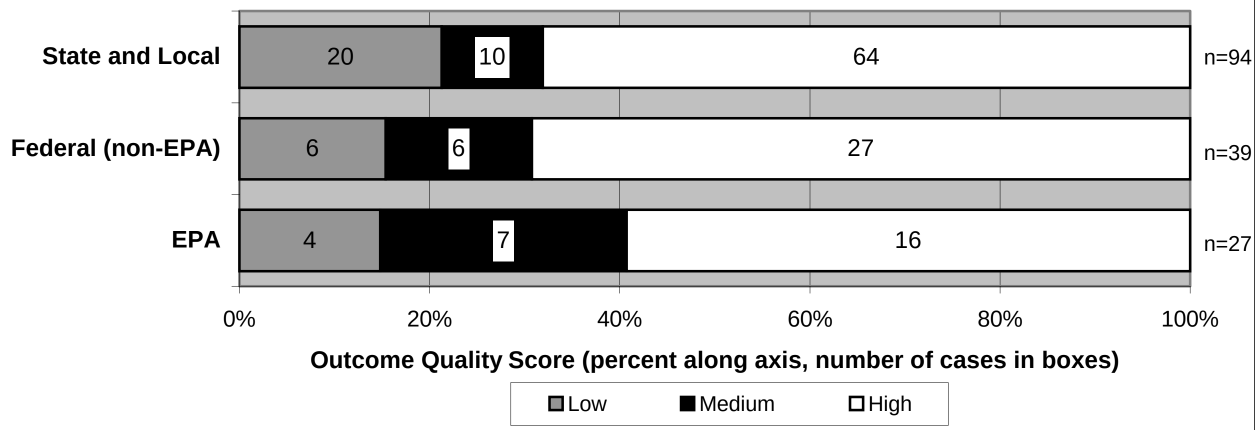
7 On neither measure is the difference between state/local agencies and federal agencies statistically significant. On the outcome measure, the chi-squared probability is .219. On the process measure it is .972.

and local agencies while 26 were led by federal agencies. The other ten were jointly led by state and federal agencies or some other arrangement. Like the data set as a whole, state and local agencies performed about the same as federal agencies in resource planning and management. High scoring cases made up 60% to 80 % of the sample, and low scoring cases made up to 10% to 30%, regardless of the level of the lead agency. The fact that state and local agencies do not appear to be doing worse on quality measures—either across the data set or for resources planning and management specifically—should help quell concerns that increased state and local stakeholder decisionmaking may sacrifice quality.

A second issue related to the nature of the lead agency is whether processes led by the EPA compare favorably to those led by other federal, state, and local agencies. Because some of the recent concern over the role of such processes has centered on EPA, it makes sense to single the agency out for analysis. EPA has embraced stakeholder-based processes in many of its reinvention initiatives but has also been the target of criticism for how it handles participation in some other programs, such as Superfund (GAO, 1994).

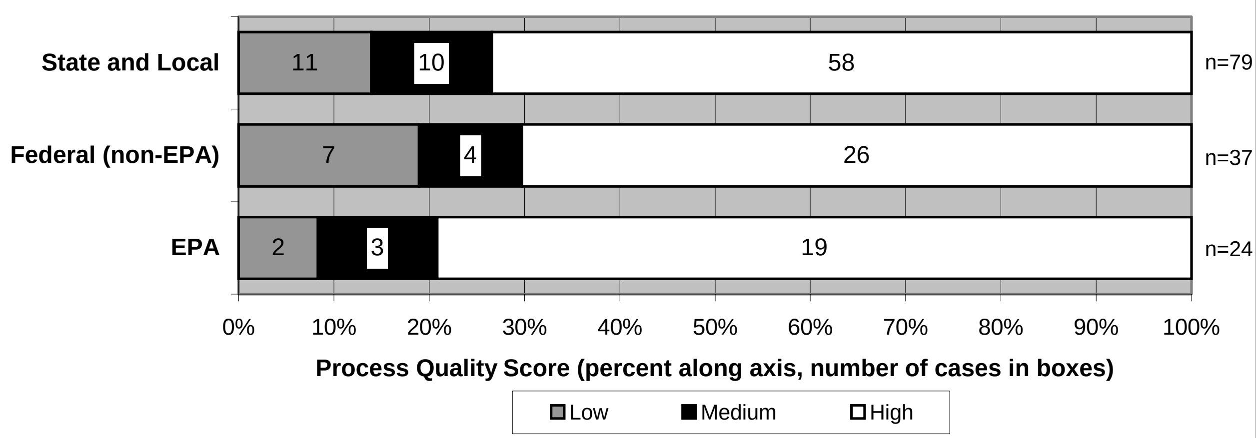
Thirty-two of the 239 cases involved EPA as the primary lead agency; it was represented the most out of all single agencies in the set of cases. The EPA cases in the dataset tended to be relatively high profile. Fourteen dealt with oft-contentious Superfund cleanups and related issues, seven concerned regulatory negotiations, and another three dealt with the EPA reinvention program Project XL. The remaining eight covered a variety of other regulatory and policymaking arenas.

Figure 8: Outcome Quality and Government Type




Note: Numbers within bars refer to the number of cases in that category.

Figure 9: Process Quality and Government Type




Note: Numbers within bars refer to the number of cases in that category.

As with state and local governments, there was little difference between EPA-led cases and those led by other federal agencies or agencies at all levels of government.[8] Even taking into account the relatively high-profile kinds of cases that EPA gets involved in, the agency's stakeholder processes appear to be doing no better or worse than the norm.

The analysis of the relationship between the nature of the lead agency and the quality of stakeholder-based decisions suggests that it is not the place to look for explaining differences in the quality of stakeholder-based decisions. Processes led by state and local governments do not appear to be more or less successful in quality terms than their federal counterparts, even for the subset of the data focusing on resource planning and management. Of particular interest, they don't seem to result in less technical capacity or less access to scientific and technical resources. Likewise, processes led by EPA do not appear to result in higher or lower quality decisions than processes led by other agencies. All agencies likely face similar challenges in developing processes that adequately incorporate scientific and technical resources and that support quality outcomes.

## 6. Conclusion

Based on an examination of 239 case studies, we should be rather optimistic about the quality of stakeholder-based decisions. Even though the data are not as systematic and complete as the ideal, and the case study record may be an imperfect window on the world of stakeholder processes, the analysis should give some reassurance that the "political" aspects of stakeholder processes are not sacrificing decision quality. Across a diversity of process types, levels of government, and environmental issues, most of the evidence points toward quality decisionmaking from stakeholder processes.

The analysis should help clarify, as well, how to think about the quality of stakeholder-based decisions. The outcome criteria sketch a broad and complex understanding of quality. The process criteria provide more narrow insights into scientific and technical quality. In fact, it may be the only perspective into how stakeholder processes utilize science, given the difficulty

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8 None of the differences were statistically significant. Compared with only federal agencies, the chi-squared probability for the outcome measure was .564 (n=66) and for the process measure was .523 (n=61). Compared with all local, state, and federal agencies, the chi-squared probability for the outcome measure was .168 (n=160) and for the process measure was .66 (n=140).

of identifying an outcome measure that can somehow measure the “scientific quality” of a decision.

Beyond the direct question of the quality of stakeholder-based decisions, there are two other issues that ought to be considered in thinking about the impacts of stakeholder processes on environmental policymaking. They deserve at least passing mention here.

The first question is whether stakeholder decisions are being implemented. There should be far less concern about the quality of stakeholder decisions if administrative and political checks and balances are in place to halt bad decisions on the road to implementation. At a very basic level, agencies rather than stakeholders usually implement decisions, creating a strong filter between stakeholder decisions and action. Indeed, various studies of implementation suggest that agreements among participants do not necessarily translate directly into actual impact on policy. In a study of mediated environmental issues, Bingham (1986) noted an important gap between agreements among mediating parties and the implementation of those agreements. In research on regulatory negotiations, Coglianese (1997) found that agreements reached through negotiations were often revisited after subsequent controversy. In an earlier study by the author, no consistent link between good public participation and implementation could be identified in a series of cases of stakeholder-based planning in the Great Lakes region (Beierle and Konisky, 2000). Another analyst of the same Great Lakes cases concluded that whatever implementation had occurred had very little to do with the stakeholder planning process (Gurtner-Zimmermann, 1996). While much more work on the relationship between participation and implementation needs to be done, there is much evidence to suggest that various checks and balances on stakeholder-based decisions are solidly in place—for better or worse.

The second question is what we should be comparing stakeholder processes to. There is a tendency to contrast stakeholder processes with more expert-led scientific decisionmaking—another chapter in the long running debate about whether pluralism or managerialism should inform agency discretion (Stewart, 1975; Reich, 1985). Yet studies of agency decisionmaking suggest that the status quo to which stakeholder processes are an alternative are not these more idealized technocratic approaches. Rather, agency decisionmaking is already quite “political,” subject to partisan winds and interest group influence. Charnley (2000) points out that it is just such criticisms of the status quo that have raised concerns about the use of science in environmental decisionmaking in the first place. Dissatisfaction with the status quo is one of the primary reasons that stakeholder processes are on the rise. Finally, many decisions made by agencies, even EPA, are not really about science at all (Powell, 1999). Stakeholder processes may work to improve on traditional agency decisionmaking by making processes more formalized and transparent and by giving non-scientific issues the “political” hearing they should appropriately have.

Evidence about the quality of stakeholder decisions, the presence of checks and balances in the implementation process, and the less-than-stellar status quo come together as a strong endorsement for stakeholder-based decisionmaking.. There may be many ways to produce decisions of high technical quality, but there are relatively few that do so while also educating the public, eliciting public values, resolving conflict, and building trust in agencies, as many stakeholder processes do.  That we can make some headway on these more “political” features of decisionmaking while not also sacrificing quality is indeed a positive endorsement for opening the doors of decisionmaking to the public.

## Appendix A: Construction of Aggregate Measures

Outcome Quality Aggregate

The outcome quality aggregate combines data from the eight component quality criteria listed in Figure 4 of the paper. The range of eight quality criteria reflected the different aspects of "quality" relevant to different kinds of cases. For example, one could judge a mediation case on the basis of whether the decisions reached increased joint gains for those involved. A public meeting, however, would be more appropriately judged on whether participants contributed information or ideas that would not otherwise have been available.

Because different criteria were appropriate for different kinds of cases, it was quite rare to have more than two criteria scored for each case. In fact, out of 172 cases—for which at least one of the eight criteria were scored—none were scored on more than five criteria, and only 47 were scored on three to five criteria. Fifty-three were scored based on two criteria; and 72 were scored based on only one criterion. The lack of substantial overlap among the quality criteria meant that it was problematic to inter-correlate them in order to see whether they described some overarching conceptual meaning of "quality." As shown in Table A1, the largest number of pairwise comparisons that could be made was for 32 cases; and for many pairs of criteria, correlation coefficients could not be calculated because there was no variation in one of the criterion. Nevertheless, some of the eight criteria appear to hang together quite well.

**Table A1 Inter-correlation of Outcome Quality Criteria**

| | cost-effective | joint gains | opinion | other direct | infor-mation | technical analysis | innova-tive ideas | holistic perspec-tive |
|---|---|---|---|---|---|---|---|---|
| **cost-effective** | 1 | | | | | | | |
| **joint gains** | -.17 (n=11) | 1 | | | | | | |
| **opinion** | .49 (n=7) | .64 (n=18) | 1 | | | | | |
| **other direct** | 1.0 (n=4) | -.37 (n=11) | *6/8 agree | 1 | | | | |
| **informa-tion** | .29 (n=4) | .60 (n=13) | *6/8 agree | *4/4 agree | 1 | | | |
| **technical analysis** | .29 (n=4) | *12/13 agree | .82 (n=10) | *4/4 agree | .84 (n=32) | 1 | | |
| **innova-tive ideas** | .63 (n=6) | *14/18 agree | .65 (n=8) | *2/2 agree | .85 (n=13) | 1.0 (n=16) | 1 | |
| **holistic perspec-tive** | .13 (n=6) | *7/9 agree | *9/9 agree | *1/2 agree | 1.0 (n=12) | 1.0 (n=11) | 1.0 (n=10) | 1 |

*No coefficient calculated because of no variation in one of the criteria. The ratio of agreements to total is reported.

If not describing a stand alone concept of "quality" derived statistically, the aggregate measure is at least an accurate reflection of the underlying quality criteria. The rules used to construct the aggregate were as follows:

1. For indirect quality measures, "yes" and "no" scores were converted into "high" and "low" scores, respectively.
2. If there were no low/high combinations for a given case (suggesting a wide divergence of scores), the scores were averaged (using 3, 2, and 1 for high, low, and medium, respectively). For cases with low/high combinations, we skipped to step 4.

3. Averages were rounded to the nearest score. Where the average fell exactly between two scores (e.g., 2.5) it was rounded up to the higher score.
4. Where there were low/high combinations, scores were determined on a case by case basis.

In developing an aggregate measure for 172 cases, 156 (90%) of them could be scored after step 2. This means that where there were multiple scores, they were all in agreement. Seven cases required averaging (step 3), but only one of these had to be rounded up from an average score that fell midway between two scores. For 9 cases, the aggregate was determined on a case-by-case basis (step 4)—all of these cases were given a "medium" based on mixed results.

<u>Process Quality Aggregate</u>

The process quality aggregate was constructed from two measures: the technical capacity of participants and their access to technical resources. In developing the aggregate, the following rules were used:

1. Cases scored high if at least one of the criteria were scored high and the other medium. This meant that high quality internal or external resources were present without an off-setting lack of one or the other.
2. Cases scored medium if both criteria were scored medium or if there were high/low combinations. This meant that either internal and external resources were moderate or that a high level of one of the two was offset by a low level of the other.
3. Cases scored low if at least one of the criteria was scored low and the other medium. This meant that the process was deficient in internal or external resources and the deficiency was not compensated by either internal capacity or external access to information
4. Data in which only one of the two components were scored were given a score based on the most likely score for the missing criterion.

The data fell into categories outlined in Table A2.

**Table A2 Combinations of Process Quality Criteria Used to Construct Aggregate**

| Technical Capacity →<br>Access to Technical Resources ↓ | **no score** | **low** | **medium** | **high** |
|---|---|---|---|---|
| **no score** | No score (n=65) | Assumed **Low** (n=2) | No score could be assumed (n=9) | Assumed **High** (n=8) |
| **low** | Assumed **Low** (n=6) | **Low** (n=6) | **Low** (n=3) | **Med.** (n=0) |
| **medium** | No score could be assumed (n=16) | **Low** (n=4) | **Med.** (n=12) | **High** (n=4) |
| **high** | Assumed **High** (n=40) | **Med.** (n=5) | **High** (n=26) | **High** (n=33) |

## Appendix B: Examination of Bias

As mentioned in Section 2 of the paper, the potential for bias in a case survey is always of concern. This appendix deals with three possible sources of bias, all of which would make the pool of cases look more successful than the norm. The first potential source of bias arises if case study authors are more likely to write up successful cases than unsuccessful ones. The second potential source of bias arises if certain kinds of case study authors have a particular interest in making a case appear more successful than it really was. The third potential source of bias relates to the coding of the indirect quality measures. The first two can be treated together and the third treated separately.

### Potential Bias in Case Selection and Description

While coding the cases, researchers flagged cases that 1) were picked to explicitly illustrate a successful or unsuccessful process or 2) were written by someone closely affiliated with the case (such as a participant or lead agency staffer) who might have an incentive to over-emphasize the case's success. Out of a total of 239 cases, 70 were picked to illustrate successful or unsuccessful cases, 150 were not, and in 19 it was not known. Sixty-six cases were written by someone closely affiliated with the case, 114 were not, and it was unknown for 59. Combining the two sets of cases, where the presence of one or both possible sources of bias made the case potentially biased, we were left with 118 potentially biased cases, 87 unbiased cases, and 34 in which it was unknown. Figure B1 compares the potentially biased cases with the unbiased cases across both the outcome quality and process quality measures. Although the potentially biased cases appear to be slightly more successful, the difference is small and not statistically significant for either the outcome measures or the process measures.[9] These two sources of potential bias, then, do not appear to be having much of an impact on the results described in this paper.

### Potential Bias in Indirect Quality Measures

The third possible source of bias deals with the indirect quality measures. The indirect quality criteria describe what the participants did or did not do. Did they add new information or did they not? Did they come up with innovative ideas or did they not? It may be that case study

9 For the outcome measure, the chi-squared probability is .821 (n=148). For the process measure, the chi-squared probability is .295 (n=133).

authors were more likely to report positive information on these criteria than negative information. In reading through a case, coders could tell when stakeholders were adding information or doing analyses, for example, but were never quite sure what was going on if case study authors didn't report on these kinds of activities. Where they not done or were they just not deemed important by the case study author? In short, we can never be sure how to interpret gaps in the data.

Without more information on the actual cases, it is difficult to definitively tell whether the indirect criteria results are biased toward positive information or not. What we can do is compare the results for the indirect criteria with the results for the direct criteria, which are not subject to the same potential bias. Out of 172 cases with an outcome measure score, 69 were based only on indirect criteria and 103 could be recalculated to be based only on direct criteria. Figure B2 compares the direct and indirect criteria scores. Rather than being more positive, as would be the case if the indirect scores were biased, the indirect scores actually appear to be more negative (i.e., a higher percentage of low scores), and the difference between the two sets of cases is statistically significant.[10] The indirect criteria do not appear, then, to be adding a success bias to the results described in this paper.

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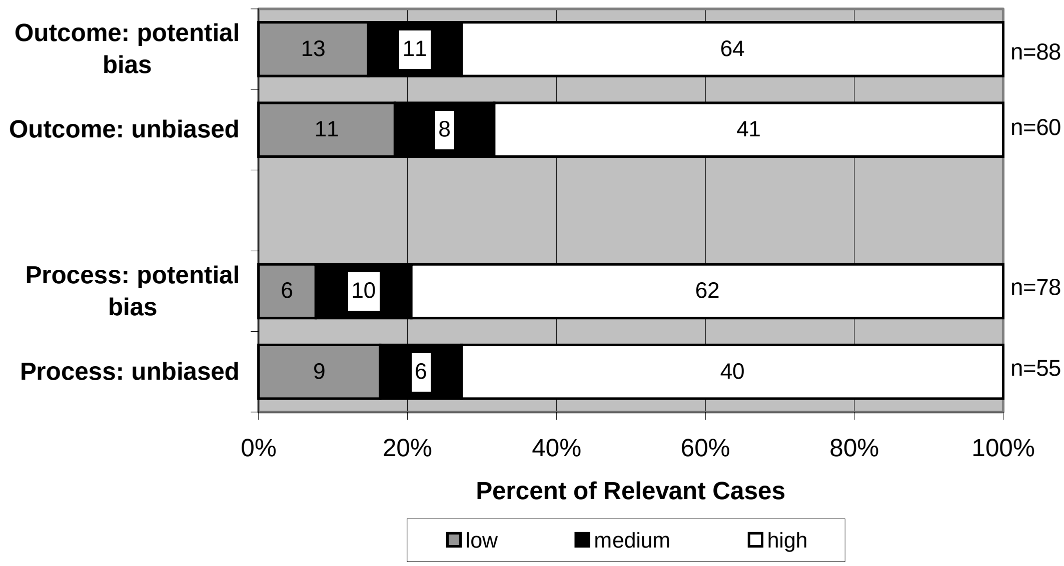
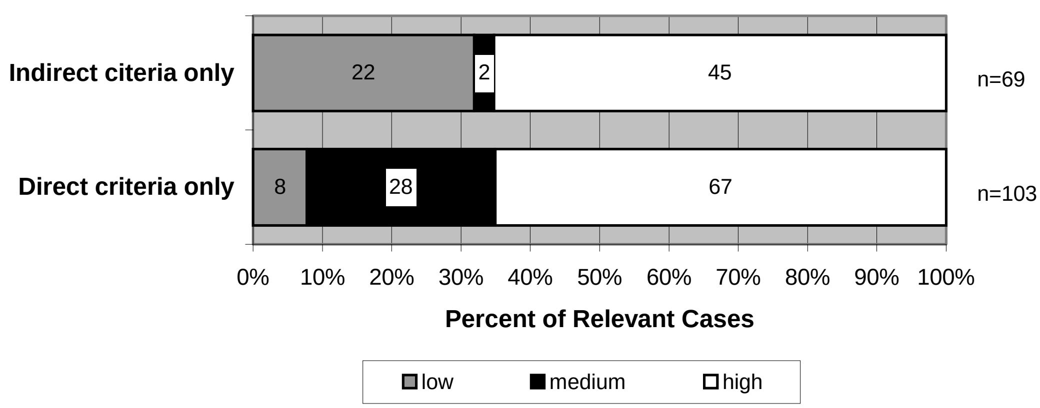
10 The chi-squared probability is .000. The significance of the difference between the two sets of cases can probably be explained by the low number of "medium" scores for the "indirect criteria only" category. This is not surprising because indirect criteria were only coded as "no" (translated as "low") and "yes" (translated as "high"). The two medium cases reported in Figure B2 come from the few cases where one indirect criteria was coded as "no" and another was coded as "yes."

**Figure B1: Examination of Selection and Author Bias**




Note: Numbers within bars refer to the number of cases in that category.

**Figure B2: Examination of Indirect Criteria Bias**




Note: Numbers within bars refer to the number of cases in that category.

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Appendix D--Peter S. Adler, Robert C. Barrett, Martha C. Bean, Juliana E. Birkhoff, Connie P. Ozawa and Emily B. Rubin, "Managing Scientific and Technical Information in Environmental Cases: Principles and practices for mediators and facilitators," a study co-sponsored by RESOLVE, Inc., the U.S. Institute for Environmental Conflict Resolution, and the Western Justice Center Foundation, Washington, DC, Fall 2000

# Managing Scientific and Technical Information In Environmental Cases

## Principles and Practices for Mediators and Facilitators

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# Table of Contents

# I. Preface

This effort represents ideas gathered from more than a hundred individuals[1] as well as a review of some, though certainly not all, of the relevant literature.[2] The document is an initial attempt to distill and disseminate those key principles and practices that are relevant to managing scientific and technical information in environmental conflicts. Through this project, we hope to advance both the practice and theory of environmental mediation and to launch further thinking and discussion on the issues raised.

The information age has increased the pace of information development, dissemination, and application. As more scientific information enters the public domain, it is increasingly important to use science wisely and to understand its interactions with other modes of thought and inquiry. We hope this source book will be helpful to that end.

Readers are encouraged to freely use and disseminate this document but are asked to credit the authors and the sponsors of this project -- RESOLVE, Inc.; the U.S. Institute for Environmental Conflict Resolution (USIECR); and the Western Justice Center Foundation.

- Based in Washington, D.C., and Portland, Oregon, the nonprofit RESOLVE, Inc., www.resolv.org, specializes in environmental dispute resolution, environmental mediation, consensus building, facilitation, and policy dialogue. RESOLVE is a leader in mediating solutions to controversial problems and broadening the techniques for consensus building on public policy issues. RESOLVE is dedicated to improving dialogue and negotiation between parties to solve complex public policy issues and to advancing both research and practice in the dispute resolution field. RESOLVE works in the U.S. and abroad. 1255 23rd Street, NW, Suite 275, Washington, D.C. 20037. Phone: (202) 965-6390; fax: (202) 338-1264.

- Based in Tucson, Arizona, the U.S. Institute for Environmental Conflict Resolution, www.ecr.gov, assists parties across the country in resolving environmental conflicts that involve federal agencies or interests. Operating under the aegis of the Morris K. Udall Foundation, the Institute offers expertise, guidance, and training in environmental conflict assessment, facilitation, and mediation. The Institute maintains a network of programs and practitioners around the country who can be called on to assist in environmental conflict resolution. 110 South Church Avenue, Suite 3350, Tucson, Arizona 85701. Phone: (520) 670-5299; fax: (520) 670-5530.

- The mission of the nonprofit Western Justice Center Foundation, www.westernjustice.org, is to create and enhance models for resolving conflict; improve the quality of justice and appropriate uses of the legal system; create knowledge through research and evaluation; and instill conflict resolution skills in children. The Western Justice Center conducts programs in California, across the nation, and abroad, all in collaboration with carefully selected partner groups. 85 South Grand Avenue, Pasadena, California 91105. Phone: (626) 584-7494; fax: (626) 568-8223.

This document is located on the Web sites of these three organizations and also of the *Society of Professionals in Dispute Resolution* and *Policy Consensus Initiative*. Other organizations and agencies are encouraged to post it on their Web sites and to disseminate it as they wish. Readers are also encouraged to contact any members of the working group to contribute further thoughts and comments.

The authors intend for this document to be accessed in any ways that readers find most valuable. Some might prefer to read it from beginning to end as a narrative. Alternatively, others will use it as a reference manual, focusing on portions that they find relevant to a past or present challenge. The organization of the document is intended to accommodate either objective.

After this preface, the paper begins by presenting the central challenges in dealing with science and technical information in environmental cases. Then it presents the specific challenges that stakeholders and mediators identified in the literature and focus groups. The fourth section outlines some key ideas and practice principles underlying the more specific guidelines in the fifth section. The sixth section consists of "how to's" and "to do's" from experienced environmental and public policy mediators. The endnotes include information on the origins of this project. Appendices include information on how to contact the working group; a list of participants and contributors, for whose encouragement, expertise and insights the authors are most grateful, and selected readings.

# II. The Challenge

> "*In a major move to protect wildlife in old growth forests, a judge has halted nine federal timber sales in the Pacific Northwest and ordered further reviews that could stop logging in large sections of Washington, Oregon, and California*." ("Judge Halts 9 Northwest Timber Sales," wire report in *The Spokesman-Review*, Spokane, Washington, August 4, 1999).

> "*A Federal investigation has concluded that a scientist at the Lawrence Berkeley Laboratory in Berkeley, California, faked what had been considered crucial evidence of a tie between electric power lines and cancer*." (William J. Broad, "Data Tying Cancer to Electric Power Found to be False," *The New York Times*, July 24, 1999).

> "*More than a century and a half after it was built, the Edwards Dam made a new mark in history as the first dam the federal government demolished against the wishes of its owners*." (Traci Watson, "After 162 Years, Maine River Finally Running Free," *USA Today*, July 2, 1999).

Environmental disputes pose powerful challenges to civil societies. More often than not, they are complex and hard fought affairs that present urgent and practical problems to be solved. Frequently, they are laden with contested scientific and technical information and important collisions of social and economic values. Inevitably, they are also political fault lines in larger ideological wars.

At the start of the 21st Century, citizens and decision-makers are hungry for ways to improve environmental discussions. As a country, we need wiser outcomes that are conceptually more sound, explicitly equitable, and have practical staying power. Simultaneously, we need to reduce the transaction costs (both human and financial) that are associated with public interest conflicts over timber, land, water, hunting, pollution, fishing, and energy development, to mention just a few.

The use of strategies based on 'joint gains,' problem solving, mediation, facilitation, and consensus building offer promise for many cases. While these approaches are not a panacea, thousands of significant cases involving public health, public lands, and natural resources have been successfully mediated or facilitated since the early 1970s. This includes 'upstream' cases when rules and policies are being made and 'downstream' issues when parties are involved in enforcement and compliance.[3] The authors and sponsors of this document believe many more cases could be wisely and amicably resolved if good scientific and technical information were better integrated into the search for solutions.

While the term joint gains problem solving suggests that a rational, interest-based approach to problem solving is inherently useful, many environmental disputes also are driven by personal and political factors. Nonetheless, at core, they often focus on any of several questions:

- Who bears responsibility for something that allegedly went wrong environmentally?
- How shall a current condition that is harmful be remedied?
- Will a proposed project, policy, or rule prove potentially deleterious to human or environmental health?
- How should an environmental resource with its attendant issues of risks, costs, and benefits, be managed into the future?

Environmental conflicts tend to be broad in their scale of impacts and laden with values that are seemingly at odds. Environmental disputes are also emotional. The parties may include both conscience as well as beneficiary constituents. At issue in many cases are matters of culture, economics, justice, health, risk, jobs, power, uncertainty, and professional and bureaucratic politics. Elections are sometimes won or lost because of environmental conflicts. In some cases, the outcomes of specific conflicts have inter-generational or global impacts.

When specific controversies in any or all of these areas emerge, advocates, policy makers, and adjudicators look to science and technical experts to help improve their decisions. Scientific data and knowledge also form the building blocks necessary to ground consensus-seeking deliberations. The kind of science-based information that is available and how it is used are important factors in helping the parties affected by a decision to gain confidence in the process and the outcome.

In the abstract, infusing high quality information into a controversy and having it serve as a foundation for decision-making should be a straightforward matter. One asks the right questions, obtains data through rigorous and accepted methods, analyzes and interprets the data in ways that are logical, and then submits the findings to peer review. Unfortunately, information rarely threads into solutions in such a direct way.

More often, information gathering is done by warring experts as part of an adversarial and contentious process tinged with suggestions of actual or implied litigation. Productive lines of communication are often severed. In other cases, vital information is an afterthought to the economics and politics of deal making. Alternatively, vast amounts of money may be spent on irrelevant or unusable research or information collection. Surprisingly often, disagreements on key points remain unresolved and uncertainties that can undermine the future stability of an agreement are left unaddressed.

Some of the confusion and complexity of environmental conflict is directly attributable to the way information is organized, interpreted, communicated, and differentially judged to be useful. Government agencies, community groups, environmental advocates, academics, and businesses each approach the gathering and explication of data in their own way and with their own needs in mind. Moreover, different disciplines and professions implicitly value or devalue scientific information according to their training and the rules of their professional cultures.[4] The traditional means of grappling with this complexity tend to rely on adversarial legal and scientific truth seeking.

Joint gains approaches such as mediation and facilitation, however, also offer excellent forums for managing the tensions, crosscurrents, and data clashes in environmental conflicts. Organized properly, these processes can provide a powerful complement to the formal structures of governance and a promising set of tools for decision-makers. However, those who advocate for these processes and those who participate in them, those who pay for them and those who use them, need to develop stronger, more self-conscious and more coordinated approaches to the gathering, sorting, integrating, packaging, and interpreting of information. Ideas and tools in this somewhat specialized area are essential and this document attempts to address that need.

At the onset of this project, we hoped to illuminate a set of questions that are, in part, practical, technical, and procedural and that, in other ways, reflect our differing and intellectually incomplete understanding of the dynamics of environmental conflict. All of the questions center on the role of the third party as he or she attempts to provide management and choreography of scientific and technical information in environmental cases. The questions, along with the material itself, are not meant to be definitive. They offer a starting point for additional inquiry.

1. What exactly are the different roles scientific and technical information plays in environmental conflicts? Do differences over science and technology actually *cause* environmental disputes or do they simply affect the way disputes and conflicts escalate and are handled?

2. When is science really relevant to the core issues in environmental conflicts? When is a dispute truly a technical dispute and under what circumstances is it irrelevant or a small

side issue?

3. When and how do parties strategically frame disputes as being about science and technology in order to pursue their interests?

4. What is the appropriate role for mediators and facilitators seeking to integrate science and technology into their processes? Conventional conceptions of mediation and facilitation place a strong emphasis on process and relationship management. In science-intensive environmental disputes, should mediators play a stronger substantive role?

5. Beyond high quality communication, negotiation, and process management skills, what value-added tools and strategies can mediators and facilitators bring to the table that will increase the clarity, rigor, and likelihood of good decisions coming out? For example, should a mediator effectively press the issue of burden of scientific proof?

6. If there are logical rules-of-the-road for effectively integrating scientific and technological data into consensus-seeking processes, how insistent and forceful should one be in pressing them?

7. What is the responsibility of the mediator to help non-experts understand the science involved? Which tools and strategies can be employed without the mediator taking, or being seen as taking, a position on the issues?

8. How can mediators and facilitators help disputants effectively manage the warring or contested science that is often at issue in environmental cases? For example, in what ways might mediators and facilitators help disputants manage scientific and technical uncertainty and the balancing of the Precautionary Principle and doctrines of Reasonable Risk?[5]

9. How do you (and how should you) get scientists who are naturally resistant to making recommendations because of inconclusive data to ‘jump the breach’ so that their work is useful in making practical decisions?

10. Is *more* or *better* scientific information always necessary to narrow the foundational factual issues?

11. Are some kinds of knowledge inherently more relevant than others in resolving environmental conflict? Within the different life sciences (e.g., chemistry, biology,

ecology) and the social sciences (e.g., sociology, economics, anthropology), is there an overarching hierarchy of relevance to environmental issues that should be given primacy, or does it simply depend on the facts on hand in a given dispute?

12. Are there different roles for environmental mediators depending on whether the case is ‘upstream’ or ‘downstream’?

13. In situations of disparate power, or where problems of environmental justice are at the forefront, should environmental mediators work with aggrieved parties using the same principles family mediators use with abused spouses? Should they be treated differently to empower them to participate in public debate?

# III. Rocks on the Road to Agreement

Formally or informally, negotiating parties, environmental mediators, facilitators, and consensus-builders confront an extraordinary variety of problems and fact-patterns centering on the generation, management, interpretation, and use of scientific and technical information. This section presents some of the situations that confront negotiating parties and those who seek to assist them.[6]

1. **Multiple Disciplines**. There are various specialized sciences involved in providing critical scientific and technical information but the conclusions do not converge to a logical policy choice.

    **Example**: Environmental groups seek to prevent an agricultural operation from withdrawing additional water from an aquifer. Geologists and hydrologists find the water is available. Ecologists and wildlife biologists show that withdrawal will harm nearby stream biota. Sociologists and economists conclude that new farms revitalize an economically depressed area.

2. **Access to Data**. There is good scientific or technical information available but some or all of the parties have trouble accessing it. They cannot quite articulate what they need to know, how to identify it, or whom to contact.

    **Example**: Competing recreational users (hikers, horse riders, and bicycle riders) are engaged in a rule-making dispute over management practices in a multi-purpose wilderness area. Although the stakeholders are bright, intelligent people, they are highly positional and unaccustomed to these kinds of conflicts.

3. **Adequacy of Existing Data.** There is missing scientific or technical information that could be researched and brought to the table but the process of doing this needs to be organized and supported by adequate resources.

    **Example**: A community group and a resort developer are in conflict over short- and long-term traffic impacts of a new golf course. The developer believes enough studies have been done. The community believes more are required.

4. **Unclear Significance.** Scientific or technical information is brought to bear on a given topic but the significance of it is unknown or of marginal value, or there is no technique or methodology to evaluate or compare the information.

> **Example**: Proponents and opponents use computer-generated pictures to simulate the proposed visual and aesthetic impacts of a series of microwave relay towers on a ridge over a park and residential community. People are intrigued with the pictures but some participants are not convinced that the simulations give them the information they need to make decisions.

5. **Restricted Data.** Several parties have critical information that could help resolve the matter but the data is confidential or proprietary.

> **Example:** Water well drilling permits must be issued by a certain date, or the project proponent will lose the opportunity to proceed. A government agency, different from the one issuing the permit, is unable to release its latest study of chloride buildup because it has not been approved for release. Simultaneously, the drilling company is fearful of disclosing trade secrets that might give its competitors an edge.

6. **Politicized Information.** There is salient scientific or technical information that could be brought to the table to enhance decision-making but people perceive the information as skewed and overwhelmed by political spin and media hype.

> **Example**: Proponents and opponents are engaged in a dispute over improvements to a highway that is statistically safe but perceived to be dangerous. Numbers suggest that although the highway has a high proportion of dramatic accidents, the overall accident rate remains low. Citizen groups have taken out ads calling for expensive improvements. The city has appeared on talk shows arguing that the proposed improvements are expensive and will not make a difference.

7. **Lack of Expertise.** There is good scientific or technical information available and the parties think it could be relevant to their decision-making but some or all of them do not understand it.

> **Example:** Various private and civic sector organizations come together to resolve opposing positions about a huge public expenditure over

secondary and tertiary sewage treatment. They are confounded by complex and often conflicting toxicological, engineering, and ecological studies.

8. **Inconclusive Data.** The scientific or technical information disputants are relying on is spotty, does not show strong cause and effect relationships and does not invite anobvious decision. Conclusions can be suggested or inferred about cumulative effects but there is no completely logical basis for policy.

   **Example:** A large oil company is proposing to build a lengthy oil transmission line. They have done several studies, each time using slightly different assumptions and criteria in order to find the best route. Based on these studies, and believing they have been responsible to various public interests, they re-routed their line several times. Opponents believe the line and its construction will contribute to fragmented habitats, non-point source pollution, and the disruption of several very small and fragile wetlands.

9. **Purchased Information.** Credible scientific or technical information is available but all of it has been commissioned or produced by some of the parties and is therefore distrusted by the others.

   **Example:** Several large manufacturing companies have been sued over the contamination of a river. The government agencies and citizen groups that are involved refuse to rely on the studies that the companies are using but have no funds to do their own.

10. **Uncertainty and Division among the Scientists.** Despite great amounts of advocacy, research, and applied studies, massive scientific and technical uncertainty remains. Peer reviewed studies are equivocal and the opinions of credible experts are deeply divided.

    **Example:** In a conflict over the construction and routing of new transmission lines, an electric company cannot avoid bringing their lines through certain residential areas. Credible evidence is presented on both sides about electromagnetic frequencies as a cancer cause.

11. **Distrusted Science.** There is a fair amount of scientific and technical information available but the science itself is distrusted.

**Example:** Local food producers propose to build a food irradiation facility to control insect infestations in export fruit and to reduce the risks of *E. coli* outbreaks. Anti-nuclear opponents organize to defeat the proposal. They believe that the use of radiation will poison their food.

12. **Irrelevant Information.** Scientific and technical information exists and the parties know it exists but they choose not to examine it. They believe the information is irrelevant to reaching an agreement or there is no practical solution to the problems of conflicting interpretations.

    **Example:** Government agencies and environmental groups sue several industries over the removal of PCBs from river sediments. There are major scientific and factual disagreements over the levels of PCB contamination that actually warrant action. There are also disagreements about the amount of sediment that has been deposited on the river bottom and bank? Plaintiffs and defendants agree to a settlement that results in a cleanup with no admissions of liability.

13. **Data Overload.** There is too much data at hand, and either the data is unorganized or the volume of data overwhelms parties as they attempt to sort through what is relevant, synthesize it, and apply it to the problem at hand.

    **Example**: Various industry and public policy groups are involved in a rule-making negotiation over microbial disinfectants. The data on human health, microbiology, chemistry, water quality, and treatment makes the rule-making process time consuming and very difficult because there is so much information and so many complex relationships between the different kinds of information involved.

14. **Theory Unsupported by Sufficient Research.** Predictive scientific theories have been postulated but little or no empirical research has been done. While differing sides in a dispute resolution or conflict management process preoccupy themselves with arguing conjectural positions, government agencies have a compelling need to regulate.

    **Example:** After several cases of Mad Cow Disease, policy makers determine that there is a need to create regulations of the beef industry. Theories about the origins and transmission of the disease exist but there is almost no research available to inform the regulatory process.

15. **Scientists Ahead of the Stakeholders.** Funds from a limited research budget are allocated by a government agency and studies are commissioned. Data are collected and analyzed. After the studies are completed, a stakeholder process is initiated.

> **Example:** State park officials concerned about the ecological impacts of recreational uses on a coastal island organize a series of scientific inquiries. After concluding their studies, the park officials gather together a stakeholder group that quickly identifies other kinds of data that are needed for regulation. Park officials have no budget left for gathering additional data.

16. **Information Not Yet Usable.** A time-sensitive problem needs to be resolved and all of the parties want to resolve it, but it requires specialized scientific information and/or new technological processes that are not fully developed and available.

> **Example**: A community pressures the commander of a military installation to cleanup a disused training area that has unexploded WWII ordinance below the surface of the ground. Old methods of cleanup will be destructive to many environmentally and archeologically valuable sites. The military and the community agree on the goals and priorities for cleanup but the specific techniques needed for a low-impact cleanup will not be available for another eight years.

17. **Poor Issue Framing.** There is either an incorrect, incomplete, or competing framing of the problem in a manner that excludes critical value questions that are central to some of the parties.

> Example: Officials from a well-regarded research institution propose to build a large, multi-million dollar infrared telescope on the top of a mountain used by local hunters and hikers and held sacred by native people. The scientists are prepared to address mitigation but insist on using standard western scientific nomenclature and criteria for mitigation plans. Representatives of the native people do not believe their issues are being adequately discussed.

18. **Pseudo-Professional Posturing.** An expert attempts to dominate the presentation or interpretation of critical scientific or technical information but actually does not have expertise in that area.

**Example:** In settlement discussions over pollution damages, a lawyer exaggerates his grasp of the hydraulics involved in the migration of underground contamination. In those same discussions, scientists retained by the community are arguing constitutional questions.

19. **Shifting Conceptual Framework.** Data or technical information exists but the framework or paradigm for interpreting and understanding the meaning and relevance of the data is undergoing a significant knowledge shift.

    **Example:** Global warning scientists and policy makers have gathered to develop proposed policies that would dramatically affect business economics. Environmental advocates argue for stringent regulations to prevent ozone depletion and the buildup of greenhouse gasses. Representatives of major industries object.

20. **Unrealistic Expectations of Scientists.** Parties to a conflict assume that there is a technically correct solution to a problem that is causing great controversy. Once engaged, scientists and technical experts come up with multiple answers, none of which are wholly satisfying to any of the parties.

    **Example:** Environmentalists, farmers, loggers, and government officials are engaged in an acrimonious planning problem, one aspect of which is the adoption of in-stream flow standards. After a round of initial meetings, the working group engages a group of scientists who cannot give them a single answer.

21. **Outdated Data and Organizational Lag.** New research suggests that current standards could and should be changed. The agency responsible for undertaking such reviews is preoccupied with what they consider to be more important matters.

    **Example:** Small businesses that rely on a specific technology believe that a constituent metal should be de-listed as a toxic substance because new research indicates it is not a public health threat. De-listing would translate into economic efficiencies. The government agency responsible for small business sees this as a low-priority issue. They are willing to meet but not willing to take it up on their docket of rule-making issues.

22. **Differential Tolerance for Complexity.** Some parties are able to tolerate a great deal of technical complexity and scientific ambiguity. Others are impatient with the process.

The disconnect leads to irritation, quarreling, and persistent fights over the production of useful and usable information.

> **Example:** In a technically complex and long-running rule-making case over synthetic chemicals in food, scientists must analyze many different kinds of medical and public health data. They are insulted when busy lay participants in the negotiation begin asking for a synthesis or the ‘short version’. Conversely, the lay participants are running out of time, money, and the patience needed to engage in the process.

23. **Pseudo-Scientific Environmental Conflicts.** One or more of the parties to a conflict nests their issues in a contested scientific matter as a strategy or tactic for accomplishing other objectives. The core of the real dispute is about deeply held values.

> **Examples:** Abutting neighbors oppose the construction of a municipal solid waste incinerator. Neighbors fear a drop in property values and increased (but still legal) levels of noise and traffic. Because the legal policy framework recognizes human health concerns, but not inconvenience, as a legitimate basis for a negative decision, the community files suit alleging a deterioration of air and water quality.

# IV. Key Concepts and Practice Principles

The theory and practice of environmental mediation derives from concepts in many fields and, increasingly, from research on actual cases. Some of this literature is referenced in Appendix C, Selected Readings. The following assumptions constitute some, though by no means all, of the elements of a framework for managing scientific information in environmental disputes. More directly, they are the building blocks for the rules of thumb and practice tips that follow in Sections V and VI.

Like all the others presented in this document, this particular list is neither conclusive nor exhaustive. It is offered as a specific addition to the customary methods and processes taught in training programs and found in the general literature on mediation, facilitation, and consensus building.

## A. On the Nature of Knowledge

2. By itself, scientific and technical knowledge is neither a be-all nor end-all in environmental conflicts. Parties bring to the table difference kinds of knowledge: traditional knowledge, cultural knowledge, and remembered knowledge, all of which have a place at the table in environmental conflict resolution.

3. All information (regardless of whether it is scientific, technical, traditional, cultural, local, or remembered in nature) is subject to questions about validity, accuracy, authenticity, and reliability. Every type of knowledge has standards of quality that can be examined, debated, or shaped. Thus, the issues of what is examined, how it is examined, who examines it, and when it is examined are negotiable.

4. Useful knowledge rarely remains static in the subject matters that come into play in environmental conflict. Knowledge builds off new questions and new information.[7]

5. Many lay people think science is conducted wholly in the realm of testable knowledge. Scientific methodology stresses experimentation and quantifiable conclusions: observation, hypothesis, experiment, and conclusion. Subjective knowledge, however, plays a larger role than many people know or that scientists will often admit to. Past experiences, intuition, hunches, values about what is important to know, and even bidding/betting processes like ‘Monte Carlo’ analysis often enter into the scientific process, particularly in framing questions for research and data collection.

6. Scientific and technical research in the life, engineering, and social sciences rarely provides definitive and unequivocal answers. More often, knowledge is expressed in terms of probabilities, beta-weights, and standard deviations. There is usually room for reasonable people to disagree on both the methods by which knowledge is generated and the evidence used to substantiate it.

7. Environmental disputes often deal with systems where the whole is different from the sum of the parts. Reductionism–seeking to understand the system by looking only at the units and their relations with one another–is prone to inducing error, where problems cannot logically be traced to faults in any particular element or to the relationships between elements.

## B. On Uncertainty

1. However great our information and knowledge base is, our understanding of environmental, social, and economic reality remains incomplete. We will never know everything we need to know to make perfect decisions, particularly when the decisions concern predictions of the impacts. Biological and social uncertainty is a fact-of-life, though it may not be at issue in every environmental conflict.[8]

2. In environmental conflicts, risks and uncertainties cannot be ignored. In cases of future consequences and impacts, research and inquiry by the parties are usually necessary and advisable, either within the conflict resolution process itself or as part of the outcome.

3. Risks and uncertainties must be clarified and understood both in lay terms and in scientific or technical terms. In general, there are three kinds of uncertainties that tend to arise in environmental cases: (a) uncertainties in which the measurements or observations are insufficient to bound explanation and interpretation; (b) uncertainties that arise because the measurements conflict; and (c) uncertainties over competing or fragmentary theoretical frameworks.[9]

4. The greater the level of scientific or technical uncertainty about significant outcomes or impacts associated with proposed actions, the more future research is warranted, either as part of the conflict resolution processes or as part of the agreements that are being made. In turn, the greater the uncertainty, the more 'adaptive and heuristic' the resulting agreement should be. By adaptive, we mean that an agreement should ideally seek to incorporate mechanisms that build in future information and it should be protean enough to be altered in the face of compelling new evidence.

5. Most environmental decisions have unintended consequences. For every action, law, policy, or program adopted to manage a conflict, no matter how well intended, there is a real risk of unintended consequences. They are not merely calculated risks, side effects, of trade-offs. 'Revenge effects' happen because new structures, devices, and organisms react with real people in real situations in ways that cannot be foreseen.

## C. On Information and Environmental Conflict Resolution

1. Conflicts over information, data, ideas, and knowledge are an inevitable and integral part of most environmental conflict resolution processes. This holds true whether the conflicts are 'upstream' in the policy formation or rule-making stages or 'downstream' in enforcement proceedings.

2. Environmental disputes are rarely caused by scientific or technical information *per se*. Most often, they tend to be about: (a) perceived or actual competition over interests; (b) different criteria for evaluating ideas or behaviors; (c) differing goals, values and way of life; (d) misinformation, lack of information, and differing ways of interpreting or assessing data; and/or (e) unequal control, power, and authority to distribute or enjoy resources.

3. In environmental conflicts, scientific and technical issues are embedded in a political context where value choices are at play. These underlying values are the ultimate arbiters of political decision-making, even when a plethora of scientific information is available. Substituting scientific and technical information cannot finesse value choices. However, information can more fully inform the value choices that need to be made.

4. Not every environmental case is actually science-intensive, nor is scientific and technical controversy the primary story in many seemingly science-intensive cases. Parties often use scientific and technological issues as a strategic or tactical weapon.[10] Even when it is not a camouflage for other issues, parties typically bring information to the table that bolsters their position. Consensus-based environmental conflict resolution is a search for jointly usable information, which requires a joint inquiry.

5. Jointly usable information requires trust in information and the methods by which it is produced. Trust tends to diminish when parties perceive that the science has been generated from a particular point of view or with a particular outcome in mind. Conversely, trust often can be built if the questions asked and the methods employed in information gathering are jointly negotiated.

6. Scientific and technological complexity plays a role in escalatory conflict dynamics. The intricacy and technicality of some information can exacerbate a dispute by creating mystery, by obfuscating options, or by alarming or overwhelming people with too many countervailing ideas.

7. Parties are entitled to have the lid of the black box of science opened for them, and illuminated, if they so choose. In joint gain proceedings, parties have a right to understand the science that informs their choices rather than being asked to trust the experts.

8. Some of the confusion and complexity of environmental conflicts are attributable to the presence of multiple parties and multiple issues and the innate intricacy of systems that have interconnections, emergent properties, and ripple effects that are not immediately apparent. Reductionist thinking ("here is the problem and these are the options") does not sufficiently take into account the potential for unintended consequences that may not be readily or easily forecast.

## D. On Research and Information Gathering

1. Stakeholders should drive the technical process and determine the kinds of questions they need answered, when, and at what level of detail.

2. Overly simplified or excessively summarized information often discounts the potential impacts of the policy choices that are at stake in environmental disputes. Adequate detail is critical to assessing the strengths and weaknesses of each policy choice involved.

3. Information and research costs money. The better the research, the more it may cost. In mediated environmental conflict resolution, the rigor and depth of the scientific and technical information used in the search for consensual solutions should ideally be matched to the seriousness of the problem at hand and the significance of the risk associated with bad decisions. Scale and level should ideally be appropriate so as to avoid the costs of doing too much information gathering or the dangers of too little.

4. Either within the conflict resolution process itself, or as a product of it, more research is warranted when potential impacts are great or uncertain. This research can be part of the dispute resolution process, or can be built into an agreement. If parties choose not to have this research done, or cannot have this research done, it may be helpful to indicate an explanation to future stakeholder groups so they understand why.

5. Some disputes have urgencies that require action prior to doing all the research that would be desirable. In these instances, agreements that impact others not at the table but affected by the decision should spell out why a decision was made and offer clear assessments of the risks and benefits of doing so.

6. The process of generating, compiling, analyzing and ultimately utilizing technical information should, wherever possible, be coordinated with the stakeholder process and avoid either getting too far ahead of decision-making or being seriously delayed by it.

## E. On Modeling

1. Many environmental conflicts benefit from some form of modeling in order to define problems, review impacts, or illustrate choices. The promise of models may seduce policy makers and disputants into believing that the models are infallible. However, all models have uncertainty. It is misleading to believe that a number generated by a model is a singular value that predicts a future state with absolute certainty. Stakeholders must understand (and scientists must be assisted to honestly portray) that there is a range of quantities that surround any number output from a model. This variance reflects, among other things, the assumptions of the modelers and the complexity of the natural system. Models will help differentiate answers, but will not enumerate the one true and correct answer. Models are rarely fully predictive; they are best thought of as illustrative. Models serve best when stakeholders understand that models describe ranges of options and are merely tools – albeit sophisticated tools – to aid in making informed choices.

2. Scientists working for opposing parties may bring different models to the table based on differing assumptions about inputs, interactions between variables, and outputs. The models then are stage to be in opposition to one another, when in reality they simply miss or talk past each other because they are, at their core, incomparable. This also occurs when scientists of different disciplines modeling the same natural system view that system from different perspectives. For example, an earth scientist analyzes global climate change through the lens of geologic time. On the other hand, an atmospheric scientist may make many detailed measurements of the present day climate and believe that such measurements are the key to predicting climatic change. Both approaches are correct. However, the results of the two models may yield different conclusions and advocates of each approach may disagree. It is the responsibility of the mediator to help parties and scientists integrate and understand each other’s work and

perspective, and learn how each perspective can benefit from the other.

3. Ideally, a mediator works with opposing scientists and stakeholders at the outset to have them develop a joint concept for how modeling should be accomplished. This early agreement regarding modeling must include, at a minimum, agreements regarding the question to be answered by the model, the inputs for the model, the assumptions that modify and affect the model, and the expected outputs from the model. Some scientists may also be unwilling or unable to combine their work in a single modeling effort. Cost considerations, legal mandates, pride of authorship, or simply the timing of the intervention may all prevent the joint development of models. In these circumstances, it is critical that assumptions used in all models be transparent, so that stakeholders can make their own choices on how to combine the information from opposing models in their decision-making process. This is something that a mediator or facilitator can more safely urge than an opposing party.

4. Recently, scientists and policy makers have developed methods for allowing modeling and decision-making to be more iterative, and to truly inform each other as each progresses. In disputes involving public or environmental health, scientists may be asked to apply 'risk based' analysis to their modeling, carefully identifying who or what may actually be impacted under any given scenario. For resource allocation or environmental restoration issues, scientists may be asked to construct an adaptive management plan that allows policy choices to be refined as knowledge is accumulated about a given resource. Mediators should help stakeholders and the scientists serving them to determine when it is appropriate to move to a risk-based analysis or an adaptive management analysis.

## F. On the Mediator's Role

1. Mediators, facilitators, and consensus-builders have their own modes of thinking and problem solving and their own vocabulary. Many third parties tend to think in terms of agreements, decisions, and solutions, all of which somehow imply failure when there is no tangible result to a process. Managing and sometimes limiting the inherent third-party bias for action is important. In many environmental conflicts, the right action will be no action.[11]

2. Mediators, facilitators, and others charged with consensus seeking often play a critical role in framing or re-framing the scientific and technical issues in dispute. They and the parties whom they seek to assist should be cognizant of the potential for bias that this might create.

## G. On Stakeholders, Experts, and Other Third Parties

1. In environmental conflicts, parties usually come to the table with unequal scientific and technical resources. Cooperative inquiry, shared scientific and technical support, and equal access to all critical information are the highest ideals but may not always be possible. Information, technical resources, and the inquiry process should therefore ideally be explicit items of party negotiation.

2. Public agencies, community groups, and private businesses often approach the scientific aspects of their cases differently. For example, private businesses may sometimes feel compelled to put out information defensively, offering only that which they believe is required by law, and no more. Community groups and environmental advocacy organizations, which often have fewer resources to work with, may feel compelled to use their information offensively and in terms that may appear strident and accusing. Government agencies charged with making decisions (particularly those involved in enforcement and compliance) are usually required by law to meet standard burdens of scientific proof. It may also be in the nature of higher intensity conflict to selectively limit the information put out and to confine it to that which bolsters one's own position. None of these dynamics are immutable and roles often shift when a government agency or community group is a proponent and private interests are the challengers, such as might happen in a standard setting or rule-making effort.

3. Classically trained theoretical scientists are less likely to offer solutions or make practical conclusions than applied scientists are. Conversely, they are more likely to identify further questions that could be explored and answered. Applied scientists are more likely to offer a range of solutions, and professions such as medicine, engineering, and the design professions are more likely to offer specific fixes.

4. Scientists with apparent disagreements among themselves often have less disagreements than parties believe they have.

5. Technical information often needs translation for lay users to be useful in dispute resolution and conflict management proceedings. In turn, stakeholders often need to be extra-diligent and study the scientific and technical information that becomes available.

6. In some instances, the role of 'expert' and the role of 'stakeholder' may be synonymous. Scientists become stakeholders when, for example, the site or issue involved is also the

subject of their professional work. This is often distinct from the paid or volunteer expert who has studied a problem in question, a marshland for example, or who has general expertise on such issues and is brought in to provide scientific support for one side or to provide neutral information or assessment. Stakeholder-scientists may rightfully want and need to claim a place at the table. In these circumstances, the impartiality of their advice may become and issue.

7. Scientific inquiry and obfuscation can be used to delay needed decisions. Parties should articulate the events, occurrences, and points in time that will trigger decisions being made even if the desired scientific information is not available.

8. Scientists often believe their work to be value-free and their methods to be observable and replicable truths. However, all science is based on assumptions. These assumptions are affected by culture, perspective, prior experience and other influences. It is particularly important in science-intensive disputes for the mediator to help the scientist understand his or her role and possible role conflicts.

9. Peer review is a powerful tool for party-driven evaluations of contending scientific claims. Within the conflict resolution process, parties usually confront the following choice: (1) do we trust the work of the scientists sufficiently well that we do not need to fully understand and agree with their underlying assumptions or (2) do we need to understand, cross check and perhaps even affect the underlying assumptions in order to find the work of the scientists useful to the resolution of our dispute?

10. Public agencies need to rely heavily on the best scientific and technical information as the settlement of disputes is pursued. Public agencies are usually the targets for legal tests of decisions. As representatives of the public interest, public agencies may have an additional incentive to ensure that consensus-seeking procedures are based on informed science in order to help formal decision-makers clarify, narrow, or bracket technical issues that may, in turn, resolve or streamline major conflicts.

# V. Rules of Thumb for Mediators and Facilitators

The practice of environmental dispute resolution and consensus-building draws on theories, principles, and guidelines from difference disciplines, among them, public administration law, applied psychology, planning, industrial relations, public health, and communications. While mediation and facilitation are, at their best, rigorous and robust practices, they remain more art than science. Practice strategies tend to be tacit, reflexive, and improvisational. They are developed and refined through experience and take form in training as rules of thumb.

The following ideas try to make these implicit rules explicit and are offered as supplements to the conventional methods and procedures taught in training courses or found in the literature on mediation and consensus building. They pertain exclusively to the management of scientific and technical issues.

None of these guidelines are infallible or applicable to every dispute. Real conflicts are chaotic and assisting disputants to thoughtfully confront the mess is an integral part of the conflict resolution process. This often requires multiple passes through the legal, social, economic, and technical issues at hand, rather than one definitive or determinative effort. In recognition of the fact that situations vary from case to case, in this section we offer suggestions with the caveat that each suggestion must be applied appropriately.

## A. Substantive Knowledge

1. If sufficient experience or knowledge is lacking, do not hesitate to team up with a scientist, technical expert, or more experienced mediator. This person can advise you and serve as a sounding board in private, or can serve the group as a co-mediator in partnership with you. In either case, it is essential that the parties view this person as impartial or otherwise acceptable to the group. This is especially important if your partner will be working directly with the group. Your own generic process and relationship skills are necessary but insufficient for complex, science-based multi-party cases.

2. Immerse yourself in the issues, language, and terminology of the dispute to sharpen your own insights and ask better questions. Environmental mediation usually requires some knowledge of the institutional arrangements that parties face and at least a passing facility with the jargon of the area in dispute. Do not pretend to be an expert if you are not.

3. Allow yourself to be fully educated by the parties on technical and scientific issues. This will help you discern where their conflicts are scientific in nature and where they are not. Be a quick and savvy learner. Use your keen outsider's insights as an asset, but frequently cross check to allow parties to give you an honest assessment of when your astute naivete is help and when it is a hindrance.

4. If the parties are not professionally represented or advised, do not become their technical adviser. Help them confront their own needs for independent assistance with scientific matters. Your impartiality must not become an issue with the other stakeholders.

5. If you do not have expertise in a given area, exercise great self-restraint in demonstrating your knowledge, suggesting solutions, or inadvertently creating the appearance that you have the answer of will somehow be arbitrating instead of mediating. If you feel compelled to offer your own insights, clearly state that you are temporarily taking on the role of a technical expert. It is best to ask the group's permission before you do so.

6. Be prepared to manage the different kinds of substantive expertise that stakeholders bring to the table. It is useful to remember that different professions are schooled to different kinds of problem solving.

7. Insure that a mixture of types of scientists appropriate to the case is involved in any given resolution process. Some professionals are primarily field and lab experts. Others have qualitative, quantitative, applied, or theoretical knowledge. I n many complex high-stakes cases, a mixture of disciplines, experience, and perspectives will be useful to the search for resolution.

## B. Pre-Case Consultation

1. Work early and closely with the sponsoring or convening agency, court, or organization to identify potential scientific and technical issues. Raise good questions that spot and then probe the technical issues that may be involved. Identify the information needs of the parties up front, the kinds of data that people are relying on, and the potential data conflicts that may emerge as a case or project unfolds.

2. Do not assume because one group has chosen you, you have been accepted by all. You will still need to gain the acceptance and confidence of all the protagonists.

3. As early as possible when an agency has asked for your assistance, form a coordinating committee composed of representatives of the main players or some other mechanism to ensure that stakeholders are included in the early assessment and planning.

4. Draw a picture or map of the key players, groups, and interests that, if left out of the process, might be affected, might contribute to a solution, or could potentially sabotage a whole process. Identify their technical and scientific sophistication early. Do not presume this has been done by the sponsoring organization.

5. Find out what sources of information, what methods, and what specific scientists are most trusted by each party. Find out why.

6. Question your own assumption that scientific or technical matters are actually the question at hand. Lack of data, misinformation, or different interpretations of data are often a part of a dispute without necessarily being at the center of it.

7. Adequate funding for specific conflict resolution processes is often at issue. Often, sponsoring groups have finite resources. Make your own preliminary estimations of how resources might be most appropriately balanced among technical assessment, public involvement and skilled mediation. Be prepared to change these estimates as the case unfolds and as stakeholders come to the table and begin their advocacy.

## C. Scoping and Conflict Assessment

1. Do a formal conflict assessment and incorporate scientific and technical issues into your preliminary scoping. Collect information about the technical and scientific aspects of the dispute (along with all other aspects of the conflict) through observation, secondary sources, or interviews with the parties. Raise questions that identify potential information needs, the kinds of data that stakeholders are relying on, and the potential data conflicts that are likely to emerge.

2. Get the scientists to explain how they define risks by talking about specific levels of statistical significance and map accuracy for the particular problem or analysis.

3. Formulate good questions out of strong party-proffered assertions. Once clarified, frame (or re-frame) the technical and scientific issues in ways that pose them as problems to be solved and questions to be answered rather than lines drawn in the

sand. Phrase questions as 'how' rather than 'should' questions.

4. Identify the critical matters in dispute in ways that do not privilege or reify scientific and technical matters over political, social, economic, and cultural matters. There is a great temptation by mediators to try and rationalize or 'scientize' conflicts when, as it turns out, they are merely tinged with technical and scientific matters and are, more fundamentally, ideological or political fights.

5. Question parties' assumptions that science-related issues (lack of data, not understanding the data, misinformation, or different interpretations of data) are actually the core of the questions at hand. Ask parties whether or not they think the principal issues are technical in nature. Often parties wills say publicly that they are but then allow privately that they are not. Third parties should ideally seek to help frame issues in ways that do not privilege some issues or parties over others. It is important not to reduce or trivialize institutional racism, power relationships, risk preferences, the economic distribution of costs and benefits, or issues of management. A solely scientific focus in environmental conflicts may miss or distort the issues and the process that follows such definition.

6. In discussions with actual or potential disputants, raise questions about the kinds of information they anticipate needing and the potential impacts, risks, precautions, and benefits that are likely to emerge as a case or project proceeds.

7. Acquire a preliminary understanding of how much outside information may be available to help focus the issues, what is proprietary, and what can be freely shared with other parties.

8. As part of the assessment, or at the earliest stages possible, coach the parties on the different approaches that might be used to resolve information-intensive issues and, to the greatest extent possible, enlist them on how information will be jointly gathered and/or examined by all parties.

## D. Process Design

1. Help the parties assess (and pre-negotiate) the financial and time investments that will be needed to grapple with scientific and technical information.

2. At the earliest possible opportunity, get the parties to jointly decide what is adequate

information. Lead them through a process of thinking out what the right kind of information is and how best to bring it to the table. Ask them to identify not just the kinds of information they need, but how much of it and at what point in the process. Have them define in advance what they will do with new information, how they will (or will not) incorporate this into their decision-making process, and possibly even what kind of information would change their minds.

3. Design a mediation of collaboration strategy that anticipates and intentionally incorporates the technical and scientific issues at hand. Any strategy will usually involve choices between joint working sessions, private caucuses, delimited position papers, oral presentations, single-text negotiating documents, or the use of outside experts.

4. Anticipate and help organize the role of partisan and outside experts, preferably before positions are fully hardened. There are many different design strategies worth considering among them:

    a. A scientific or technical fact finding team appointed by the parties.

    b. Facilitated science summit in which experts (i) isolate disagreements; (ii) clarify what, for purposes of settlement, need not be contested; and (iii) search for areas of agreement that can be jointly recommended to the stakeholders.

    c. A roundtable of experts convened as an auxiliary process or sidebar discussion in which scientists and technical experts have an opportunity to disagree in safety and away from lawyers, clients, and stakeholders.

    d. A moderated panel discussion in which the parties pose questions to the experts.

    e. A jointly selected third-party researcher to gather and annotate relevant peer-reviewed studies or illuminate the state of available information.

    f. A Daubert hearing (real or simulated) in which a third party scientist or technical expert interrogates all sides to make admissibility determinations based on scientific validity.[12]

    g. Public technical or scientific discussions or poster sessions to educate interested citizens on the issues, answer questions, and/or explain the state of the theory and research in a given area.

h. Jointly created background papers to advise the parties on the issues in dispute, the respective positions, and areas potentially worth pursuing for purposes of forging a practical consensus.

i. A fish bowl science discussion which is facilitated and observed by other scientists and the parties, the purpose of which is to arrive at a fuller understanding of the strengths and weaknesses of the scientific contentions and to educate the public about their constraints.

j. A focused session in which scientists or technical experts are invited to draft proposed language for a single-text negotiating document, to comment on a draft, or to help the parties as they deliberate on a draft.

5. Make advance preparations to ensure the proper level of confidentiality for technical and scientific discussions by creating submission documents or contractual agreements to participate in consensus-seeking discussions. Explicitly referring to Rule 408 of the Rules of Evidence or other forms of privilege or evidentiary exclusion may increase the willingness of parties to be open.

6. Strategize how much of the process needs to be behind closed doors versus how much needs to be in the public eye. This requires a careful and collective understanding of legal requirements as well as a political balancing of public input versus private deliberation and disagreement seeking.

## E. Initial Meetings

1. Insure that the conventional start-up process (ground rules, limiting topics, learning about each other’s interests) is inclusive of the anticipated scientific and technical exchanges that will likely be a part of the mediation process. State the obvious: There are policy considerations that are latent in this issue or dispute. As we negotiate, we will probably identify economic, political, social, and public policy issues within the scientific issues. Assure parties that those will be addressed (make sure to address them).

2. Explain the process. Chart a path for the joint production and analysis of technical information that leads to the development of criteria for judging options and the eventual development of the options themselves.

3. Generate multiple descriptions of the technical and scientific problems as opposed to a more inflexible single problem definition. Grappling with descriptions often will

stimulate an understanding of how problems are linked with each other in the minds of both scientists and stakeholders.

4. Don't focus on data and data analysis too early. It is usually more important to understand the legal, political, social, economic and scientific context to generate a clear set of questions and to position the search for high quality information as a vehicle for informing these other kinds of judgments.

## F. Structuring and Managing Discussions

1. Craft opening moves that will help the parties manage complex technical discussions. For example, ask the parties to identify when they are speaking officially or unofficially. As a collateral procedure, it is often useful to have the parties identify what the impacts of a decision or agreement might mean in their own lives versus for the community or society at large.

2. Actively coordinate the process of generating, compiling and analyzing technical information. Strategic timing can be critical. To the extent it is within the mediator's or facilitator's role, help the parties pace their technical inquiries to ensure that some parties are not left behind and to prevent the scientific process from either getting too far ahead of legal issues or slowing down the problem solving process.

3. Discuss the parties' various perceptions and definitions of 'risk' and 'precaution'. Find out how their ideas apply to the case. Definitions will vary among stakeholders. Discuss the nuances so that the many meanings of both terms are understood.

4. Use data as a discussion point rather than assuming it will inherently lead to an answer.

5. In the face of unequal access to scientific and technical expertise, discourage the use of overly sophisticated presentations by one side. PowerPoint presentations, slick graphs and charts, and complex maps can create an overwhelming impression that certain solutions are predestined. Instead, or in addition, use jointly constructed decision trees, flow charts, cognitive maps, and other visual tools to help display the thinking of the parties as regards content and process.

6. Encourage lay stakeholders to rely on the persuasiveness of evidence, not the 'weightiness' of the expert. As in trial, creative uses of statistics presented by skilled experts can overshadow the fundamentals of good scientific method.

## G. Working with Experts

1. If it is useful, assist stakeholders in clarifying the kinds of scientific and technical activities that may prove pertinent to a resolution. Usually, these will fall into one or more of several categories:

    a. Description: Generating accurate inventories, maps of habitats and natural features, critical areas, descriptions of natural processes, etc.

    b. Casual Analysis/Diagnosis: Explicating the causes and consequences of public health or ecological disturbances, e.g., what's causing reef bleaching, forest die-offs, the bad taste in the water.

    c. Prediction and Modeling: Identifying probable ecological effects of specific land, water, or public health decisions, e.g., dredging 300, 500, or 900 yards away from a reef; in-stream flow levels under different diversion scenarios.

    d. Prescriptive Design: Providing advice in formulating performance standards, emission standards, etc.

    e. Valuing: Placing economic ecological or economic values on resources or impacts, e.g., variable abilities to pay, shadow prices, internalized vs. externalized costs, pristine vs. disturbed habitats.

2. Include social scientists. While biophysical and life science experts tend to be more obviously relevant to environmental issues, social scientists will often bring rigor to the analysis of cultural and social impacts and to some of the more qualitative and subjective aspects of decision-making.

3. Build bridges between scientists and non-scientists by helping each to understand the other's perspectives, values, and ways of knowing. Experts and lay people often talk past each other. Choreograph the proceedings and schedule time to help stakeholders understand the orientation of scientists and scientists to understand how important other ways of valuing, knowing, and deciding are.

4. When scientists present models, maps or graphs, be sure to take the time to explicitly

present and clarify the assumptions behind the date and the ways to understand or appreciate the maps or the models.

5. Technical experts and scientists often become infatuated with their own curiosities and with issues in their own fields of expertise. Rope-in the science so that the questions under discussion and the data and information being examined are germane to the issues at hand. Frequently, this requires that the mediator have scientists conduct a dry run of their presentation. During this dry run, continually (and ruthlessly) ask the scientists to illuminate the relevance of what they are asserting to the decisions that are in front of the group.

6. Urge parties to bring forward studies and data that have been peer reviewed. Lack of peer review does not inherently disqualify information from being useful. However, the peer review process gives weight and credibility to scientific and technical information in the face of contending claims.

7. Technical and scientific presentations often need explanation and translation. Encourage scientists to use plain language and good visuals (pictures, photos, maps, and cartoons) so that participants can understand the issues, the data, and the uncertainties.[13]

8. Assist dueling experts by bringing in an acceptable third-party scientist. Experts are often amenable to discussing their differences with a respected colleague in their field. To help the parties choose this person, ask first about the criteria for selection, then for prospective names.

9. When dueling parties (who themselves may or may not be scientists) utilize an adjunctive or 'sidebar' meeting process, create specific terms of reference for the working group. Help stakeholders focus their questions. Write them down and reach explicit consensus on the wording. Avoid threshold questions ("Should we?"). Instead ask questions to elicit responses that allow finder judgments to be made, for example, "Under what circumstances might we?" In some cases, stakeholders may be willing to agree in advance to abide by the answers provided by the sidebar.

10. In most environmental conflicts, the mediator or facilitator needs to act as an 'agent of reality' and pose reality-testing questions that lead parties to question whether, in fact, their positions are tenable and can be sustained. For example: "The judge has said the present situation is unacceptable. It is incumbent on everyone to re-examine his or her

point of view since it seems implausible that one side's point of view will prevail and everyone else's will not." In some cases, it is useful for the mediator to orchestrate an examination of the expert(s) in front of the parties to help stakeholders assess the expert's trial potential.

11. Be mindful that scientists are people with a range of personal skills and styles and their own political preferences. No scientist is perfectly neutral. Allow parties to confront the assumptions, proclivities, and predilections of their own and each other's experts. Mediators and facilitators can help with this by also asking each expert to state what his or her understandings of the pertinent risks, benefits, and cautions are, how those matters can be quantitatively and qualitatively described, and how their definitions apply to the facts at hand.

12. Be prepared to illuminate (or have someone else illuminate) the base assumptions behind any scientific assertion, especially if there is a conflict over it. Take care to preface this information in ways that help the parties understand that differences in assumptions are rarely the result of malice or ignorance but, more often, legitimate differences in professional approach, scientific judgment, previous experiences, and party interests.

## H. Negotiation and Problem Solving

1. Many disputants in environmental cases are repeat players and sophisticated in negotiation and settlement. Let the "natural mediators" among the stakeholders do what they do best. Have the good sense to get out of their way.

2. Privately explore the best and worst alternatives to a negotiated agreement (BATNA) to understand how each party proposes to handle scientific uncertainties if there is no agreement.

3. As part of a negotiation, it may be useful to secure a commitment from the stakeholders to do a representative test or data collection. Have them decide in advance what decision they will collectively make under different outcomes of the test. Then have them agree on the method to be used to conduct the test or generate the data. The data collected or experiment conducted should provide enough information for the parties to make a decision or justify their joint decision to others.

4. Scientists, engineers, and technical experts often have psychological barriers to making trade-offs. If they are uncomfortable with the bargaining process, do not ask them to

barter. Instead, ask them to articulate a rational framework for the decisions or options that are under consideration. Appeal to their expertise and attempt to validate their differing conceptual frameworks. Help them understand that there are alternative ways to approaching complex policy problems and that to reach resolution it is often possible to balance several competing frameworks. As with other kinds of negotiations, explore bundles of gives and takes and suggest that the scientists think in terms of agreeing on probable ranges rather than trying to find a perfect number.

5. Help the scientists and technical people, along with all other parties, grapple with the idea that compromise solutions are not inherently dirty or unethical.

6. Stakeholders may want to abstractly argue about the ‘Precautionary Principle’ versus ‘Reasonable Risk’. At core, this debate is ideological and too broad to resolve in the context of any given case. In a mediated or facilitated process, parse this debate into explicit pieces that allow sides to make trade-offs according to their tolerances for risk.

7. Expressly discourage traditional offer/counter-offer negotiation styles that imply right and wrong judgments. When complex technological questions are at issue, parties will often retreat into what they believe is the right answer that cannot be compromised. Frame the negotiating discussion as not about what is right, but rather how everyone can find a livable solution.

8. Modeling is a routine procedure in understanding the magnitude and consequences of variable resources. It is often also a methodological issue in environmental disputes. However, modeling, whether it be of a drainage system, a forest regeneration plan, or an oil spill, also presents an opportunity to bring the parties closer together in the search for wise answers. Have the parties negotiate the critical assumptions that will be used in either a single model or in competitive models. Stress the need for transparency of assumptions, the tentativeness of the model(s), and the limitations and uncertainties of the modeling being done. Make sure the models logically track back to the fact patterns at hand.

## I. Agreement-Making and Implementation

1. Help parties understand when they have sufficient agreement on technical issues to go ahead and negotiate solutions. Often, scientists want to keep fighting until they get complete agreement on precise numbers. However, the accuracy that is necessary to develop a solution may not be as extreme as scientists would prefer. For instance, it

may not be necessary for all parties to agree on the exact level of pollution in order to recommend a remediation strategy which handles both the high and low estimates of the various parties and achieves regulatory criteria.

2. Assist the parties in making as explicit as possible the key scientific assumptions on which the agreement is based. Explore with them what mechanisms they will put in place to monitor those assumptions and what they will do if those assumptions turn out to be different or untrue.

3. Promote dynamic, flexible, and adaptive agreements that balance reasonable stability (which is usually needed for business reliability) with flexibility and performance-based adaptability (which are needed for higher levels of environmental assurance). While it may not always be possible, try to help the parties craft an agreement that allows for change so that if they are wrong about the science, they can revisit and re-negotiate the issues. This kind of agreement-making is intrinsically difficult, especially in public health issues. Defendants and respondents usually require closure and release so that they do not have on-going liability or adverse publicity. Plaintiffs and complainants are often unwilling to concede closure because of scientific uncertainties. Options to consider might include:

   a. A contingent agreement for additional rounds of negotiation based on further research and testing.

   b. The capping of future liabilities by private parties through the purchase of an insurance policy or bond to cover unknown exigencies. For example, and insurance policy could be made to cover a capped high and low of the disputed potential cleanup costs for an underground cleanup.

   c. An agreement that will be revisited within a certain period of time.

4. Help parties understand that all scientific decisions are provisional despite the seeming finality of legal, administrative, and political decision-making. In essence, it may be important to help parties understand that they are fashioning a resolution that is temporary until such time as future scientific evidence can better inform the decision.

5. It may prove critical for the mediator to bluntly confront the parties to make their best case/worst case arguments to the other stakeholders. The mediator may need to state: We are not going to settle this unless you can convince the other side to agree. Let's

chart out everyone’s best facts and arguments.

6. Help the scientists maintain face at the conclusion of an agreement that still poses great uncertainty.

7. Include the scientists when you celebrate closure.

## VI. Navigating the Rocks on the Road: Practice Tips

Section III listed 23 fact-patterns that mediators and facilitators sometimes encounter. While there are many possible responses to these challenges, we asked a number of experienced practitioners to suggest what tools, techniques, or tactics they might use in each situation.

**1. Multiple Disciplines**. The Problem: Environmental groups seek to prevent an agricultural operation from withdrawing additional water from an aquifer. Geologists and hydrologists find the water is available. Ecologists and wildlife biologists show that withdrawal will harm nearby stream biota. Sociologists and economists conclude that new farms will revitalize an economically depressed area.

> **Gail Bingham, RESOLVE, Inc. Washington, D.C.:** *Information from different disciplines has the potential to create confusion and, thus, magnify environmental disputes. However, solutions also need those very differences. To increase the likelihood of benefitting from multiple disciplines, I would clarify as early as possible what decision the parties are trying to make. This has two benefits for parties' criteria for determinating what are decision-relevant information and a focus for integrating disparate information. I recognize that scientists (and people generally) often ask different questions from their different perspectives and/or disciplines. This is strength in problem solving if the interaction is explicit, but it creates the potential for discord if it isn't.*
>
> *In this and many similar situations, I would encourage the parties to have an explicit conversation about what question(s) they are trying to answer. In this way, they can be proactive in obtaining decision-relevant information, avoiding gathering information that appears to diverge because it actually answers different questions.*
>
> *This approach also will provide scientists a concrete focus for integrating the different information from their different disciplines. In this case, the geologists and hydrologists probably are asking whether water is available, whereas the biologists are asking what the harm will be from withdrawing water. Both are likely to be right, but neither may be answering the question that is most helpful to the parties.*
>
> *If I bring the tools of interest-based negotiation to bear (specifically reframing the question to be as inclusive of different interests as possible), the parties may actually be able to agree that the questions are as follows: How much water can be withdrawn? From where? And under what conditions without harming nearby stream biota?*
>
> *Many times, once the question is framed to be as sensitive to as many interests as possible, the strengths of different disciplines can be integrated toward finding creative, interest-*

*based solutions.*

**Greg Bourne, Public Decisions Network, Cave Creek, Arizona:** *On the surface, it seems "the adage the more information the better" applies to solving tough scientific or technical problems. But this is not always the case. This example highlights a missing link, which limits the value of information: values.*

*Values ultimately will provide the basis for decision-making. If they are ignored or not properly accounted for, the appropriate context for analyzing and using the information is lacking. In this case, the most effective use of the information is to support the discussion and prioritization of values.*

*I would use available information to clarify the resources under greatest pressure, most highly prized, most sensitive to impact, etc., as an essential step toward sound decision-making. Where competing uses for resources is the issue, I would try, through strategic planning, goal setting, and techniques such as values mapping, to prioritize values and help people understand potential resource-management tradeoffs.*

*I would use tools such as geographic information systems and visual overlays to help the parties make sense of diverse information and apply it in a manner most helpful for prioritizing values. Then it will be clearer about which information is most useful in decision-making.*

**Tom Fee, The Agreement Zone, Freehold, New Jersey**: *My objective would be to try to help the participants understand and assess their perceptions about competing world views, the clash of data, rival reports and enemy evidence, and what William James called "mind created manacles".*

*Participants come from very different backgrounds, education, training, and experience, even when they are all experts on the same subject. I would create opportunities for them to see the varying perspectives of the colleagues.*

*If the participants are amenable, we would work to design an approach that will invite them to look at the world from different points of view, rather than from the perspective they have or had when they came to the negotiation. This approach would invite the group to try on different lenses and look from different angles of observation.*

2. **Access to Data.** The Problem: Competing recreational users (hikers, horse riders, and bicycle riders) are engaged in a rule-making dispute over management practices in a multi-purpose wilderness area. Although the stakeholders are bright, intelligent people,

they are highly positioned and unaccustomed to these kinds of conflicts.

**David Keller, Mediator, San Diego, California:** *Categories of uses need to be critically evaluated by the group to determine if user categories may need to be added or subdivided. For example, 'hikers' might have to be divided into day hikers and backpackers, and so on. The mediator will then need to help the parties ferret out all sources of information relevant to the various uses and ensure that the data is compiled in a format that is understandable and helpful.*

*I would look to the managing government agency as a likely source of quantitative data that could include, for example, what damage there has been to the environment, whether it is repairable (sustainable) under existing guidelines, and the costs of repair and maintenance.*

*All of this information would ideally be graphically displayed on a grid so that the different recreational users can immediately see the ecological and monetary cost of their own particular activity in comparison to others. Data from other comparable wilderness areas might also be used to get cost comparisons.*

**Lucy Moore, Lucy Moore Associates, Albuquerque, New Mexico:** *Here are some options I might pursue. I could find mentors for my group. I would look for a comparable situation elsewhere, hopefully not far away. I would invite a couple of those participants (from the process to revise the forest management plan, or create open space for a neighboring town, or whatever) to talk to the group. I would ask them to walk through their process and focus on the points where information needs were identified and how the answers were secured.*

*Hopefully, they will have a good outcome that highlights the kind of data that is useful in helping craft a solution. I could find a professor who might come and outline for the group the kind of data they might need, and give them generic ideas about where to find it.*

*I could hold a "Let's Look at the Landscape: session, in which I would bring in experts, scientists, policy people, tribal leaders, and others to educate the group on the ecology, law, institutional authorities, and cultures which make up the proposed wilderness landscape. I would suggest to the group that although they are of course educated, highly intelligent, committed, and motivated, there are facts about the area we will be negotiating that are important for us to understand together.*

*We need a common language and platform from which to work. I would encourage questions to identify additional data needs, and get direction from the presenters about how to get that data. Hopefully, I would end the session with a common understanding of* *the landscape and a list of questions and sources for answers that will spur the group to learn more.*

*I could arrange a group field trip to the area in question. I would let each interest take a turn in leading a trip, through a section important to them. I would encourage other interests to ask probing questions: Will your bicycles cause erosion if you ride down this hill in the mud? I would keep careful track of the questions and lack of answers, and save part of the day to sort out the data needs together.*

*I have found field trips to be great equalizers when there is a disparity of interests, or when there are some highly trained technical people and some uneducated community members. For example, subsistence farming community members took EPA and Colorado State technical people on a field trip to the headwaters of the Alamosa River to look at contamination from an abandoned gold mine. Because the local people were hosting the field trip, there was a shifting of the power balance that had not occurred before. The locals knew the roads better, dressed more appropriately, had stories to tell, and showed a sense of pride and ownership in the landscape.*

*For all their expertise in geology, hydrology, and chemistry, the technicians were out of place and in a sense dependent on their hosts. The field trip also gave validity to the anecdotal kind of data, which the locals had been trying to push on the scientists for months: "I caught fish in the Alamosa River when I was a kid in the '40s. That proves there were fish in there then".*

*In the field, that anecdotal data seemed to have more credibility with the scientists. You could see them looking at that spot, just above the fork, where the big trout was caught.*

3. **Adequacy of Existing Data**. The Problem: A community group and a resort developer are in conflict over short- and long-term traffic impacts of a new golf course. The developer believes enough studies have been done. The community believes more are required.

**Mary Margaret Golten, CDR Associates, Boulder, Colorado:** *The first thing I'd do is question if these data are really necessary or if the group is obsessing about this as a form of avoidance. If the traffic questions were answered to the satisfaction of all parties, would that solve the problem or are there other value differences?*

*Recently I had two clients arguing fiercely about facts. We could have worked hard to clarify, get a third party view on the facts, work on where to agree to disagree, etc. However, I asked one side if the data question were resolved, would the dispute be over?*

*They gave a resounding "No".*

*The problem was really about relationships and a total breakdown of trust. If, however, there is really technical information missing, the second big issue is where to find resources to do additional studies.*

*My 'interest analysis' with the developer will go something like this: If you were in a similar position as the community and you didn't agree with or trust the research done by your opponent, would you ever give up the dispute? Is it important for you, the developer, to get the community's agreement on this issue? Are you comfortable with your data? What would you be willing to do to help the other side get more comfortable? Would you be willing to assist them in getting a Technical Assistance Grant? Form a joint committee with them to look carefully at your studies? Provide funds for them to do their own study?*

*As the focus on the studies progresses, it would be crucial to avoid escalating the 'data wars'. I'd be careful to get agreement on exactly how the question to be researched is framed, as well as what the parameters of the studies should be.*

***Martha C. Bean, Mediator, Seattle, Washington:*** *When parties challenge the adequacy of data, it can be a stalling tactic. To say "we don't know enough to make that decision" is a dandy way to avoid making a decision at all.*

*In time-critical negotiations, where one party would benefit from a delay, it is my responsibility as the mediator to ascertain (most likely in caucus) if the request for more information is really a play for more time.*

*Another technique I have used is to ask again, first in caucus: "What decisions can you make with the information you have at hand? What decisions do you think the other parties would be willing to make with the information we have on the table now"?*

*Comparing these answers among caucuses can wholly re-define the critical path for decision-making, often to the surprise (and sometimes to the relief) of the parties.*

*I might also ask a 'do no harm' question: "Are there any decisions you might make now, with the information you have now, that might eclipse other critical decisions later or prevent something beneficial from happening in the future"?*

*In the Northwest, people are becoming accustomed to using an 'adaptive management' approach to natural resources decision-making. Parties jointly design a decision tree that allows them to move forward and take action, but requires re-assessment and revision at specific future points in time. The checkpoints are defined either by time, or by results from* *monitoring.*

*An adaptive management approach has the dual advantage of allowing action, while retaining the ability of the parties to make course corrections as experience is gained and as more data become available. It would only be ethical for me to encourage such an approach if all parties clearly understood the potential consequences of moving forward without full and complete information. For instance, more parties in the Northwest believe adaptive management is well suited to salmon recovery efforts because to do nothing means almost certain doom to endangered salmon runs.*

*Development, on the other hand, is often a different story. Imagine a controversy over the re-zoning of a piece of open space so that low-income housing can be built. If the housing were built, it would mean permanent loss of that open space. If the housing is not built, it could mean permanent loss of the potential for low income housing in that area.*

*There may not be an 'adaptive' solution; it is an all or nothing choice. Waiting for all the right information may be essential in such a case.*

4. **Unclear Significance**. The Problem: Proponents and opponents use computer-generated pictures to simulate the proposed visual and aesthetic impacts of a series of microwave relay towers on a ridge over a park and residential community. People are intrigued with the pictures but some participants are not convinced that the simulations give them the information they need to make decisions.

**Daniel Bowling, Society of Professionals in Dispute Resolution, Washington, D.C.:** *I would initially work with the parties to help them tell their story of the dispute. I would ask them to focus their conversation on the fundamental elements of the dispute to illuminate in what arena the dispute lives — be that economic, relational, legal, scientific, informational, power, etc.*

*The focus of this initial conversation would be on building an appropriate level of relationship among the parties to support a deeper exploration of the nature of the conflict. Given that clear scientific and technical information does not exist, greater trust and relationship within the group is necessary.*

*Next, I would focus on identifying the fundamental wisdom in the group regarding the dispute that is <u>not</u> based on scientific or technical information. I do not mean the critical issues in dispute. I mean the non-scientific and non-technical wisdom among the parties regarding how to resolve the dispute.*

*This portion of my facilitation would examine what potential solutions exist that do not depend on the unclear information. In order to draw out this wisdom, I would first focus on the criteria on which an ideal solution should be based and then on the options for resolution.*

*Next, I would work with the scientific and technical advisers and the parties to determine whether there is some level of the issues at which there is greater scientific certainty. I would re-examine the unclear scientific and technical information to determine whether there are some of the criteria that support or advance or inform any of the potential resolutions. I would assist the parties in determining whether the unclear information becomes clearer at some level of the conversation or at some level of potential resolution.*

*Any time the group got stuck, I would create a separate 'fish bowl' dialogue among the scientific and technical advisers to discuss and analyze the data, illuminating for the parties the nature of the information, the range of differences among the advisers, and the basis of those differences. I would work to focus this dialogue on the criteria and options.*

*Finally, I would return the focus again to the fundamental wisdom of the group as informed by this process, assuring the group that the ultimate resolution was within that wisdom and not hidden in the unclear scientific and technical information.*

**Bob Barrett, Collaborative Decisions, Menlo Park, California:** *The parties are probably proceeding from very different sets of assumptions and value systems and do not understand nor appreciate those of the other parties.*

*My approach would be, first, to encourage the parties to tell their stories about the place of concern and the need for microwave relay towers. I would encourage residents to talk about living in the community and their use of the park and the meanings that those places have for them. I would encourage the proponents to describe the benefits that would flow from the project and the need for the microwave towers as an integral part of it.*

*If discussion alone did not lead to breakthroughs in empathy and mutual understanding, I would try other ideas. For example: (a) ask the parties to construct an audio-visual presentation, perhaps on flip charts, with photographs, or on computer screens, that would convey what the towers would mean for the community and for the proponents; (b) make available a small film or video crew to be directed by the parties in constructing a short film in which the computer-generated pictures can be presented in the context of the project's needs and the community's values; or (c) assuming the parties were comfortable enough with each other to permit taking some personal risks, ask the parties to construct a short dramatization or skit that they could play as a group, using the computer-generated pictures as a theme.*

*My expectation would be that one of these methods would succeed in achieving a level of trust and understanding. This would permit the parties to talk directly about whether the computer-generated pictures, or some other means, would best permit them to communicate the deeper meaning of the project to each other.*

5. **Restricted Data.** The Problem: Water well drilling permits must be issued by a certain date, or the project proponent will lose the opportunity to proceed. A government agency, different from the one issuing the permit, is unable to release its latest study of chloride buildup because it has not been approved for release. Simultaneously, the drilling company is fearful of disclosing trade secrets that might give its competitors an edge.

**Martha Bean, Mediator, Seattle, Washington**: *As a first step, I would probe the time-sensitive nature of the permit process. Is there really no recourse for the project proponent if the permits are not issued by a certain date? Is it weather conditions, financing agreements, or commitments made to investors or other agencies that drive the time sensitive nature of the permits?*

*I would explore with that party what alternatives they see – if any – for extending the issuance date, and the consequences of either doing or not doing so. Next, I would work with the two agencies (the permitting authority and the research agency) to determine if there are reasonable ways to use existing data to make rational decisions. If there are, I would fully document how this can be done, noting assumptions made, risks taken, and remedies that can be implemented if the decision based on older data turns out to be wrong.*

*As a last step, I would work with the drilling company to better understand what it is they do not wish to disclose and get them thinking creatively about mechanisms for demonstrating their competence to the permitting agency without disclosing this information.*

*There may be performance standards that can be used. For example, rather than saying, "We will use this technology," they could say, "We will produce X percent less effluent, to be measured and recorded hourly". These alternatives would then be negotiated with the permitting agency. The permitting agency may be loath to set precedents they do not wish to make available for others in the future. Agreement language may need to include descriptions of why this is a special case.*

**Tim Mealey, Meridian, Washington, D.C.**: *First, I would explore the nature and* *degree of confidentiality and/or proprietariness of the data. In the example posed, I would try to find out whether the government agency that claims it is unable to release the latest study on chloride buildup, because it has not yet been approved for release, can nevertheless release a draft which would be properly caveat.*

*Often government officials believe they are unable to release draft documents when in fact they can. Furthermore, more often than not, they may be required to make documents publicly available when they sometimes would rather not. So, I would not take "no" for an answer to begin with.*

*If this did not succeed, I would try to find a way to share the information that is contained in the document and would be critical to resolving the decision, without necessarily releasing the document. Which is another way of not taking "no" for an answer.*

*Finally, if it really were not possible to release the government report, I would determine what date they do intend to release the report. Then I would determine whether there were other issues that the parties could effectively address while awaiting the release of the report, find mechanisms by which the agency could be held accountable to the release date, and return to the issues associated with the report when it has been issued.*

*With regard to the proprietary data, once again I would probe as to the nature of the information to make sure there really are 'trade secrets' that needed to be protected, or whether the information really is critical to resolving the dispute. Assuming the information is proprietary and critical to resolving the dispute, I would explore ways in which the information can be filtered and utilized through a third party. The third party could be either me as mediator/facilitator, or some other trusted expert who would agree to abide by confidentiality agreements to protect the proprietary nature of the information.*

6. **Politicized Information.** The Problem: Proponents and opponents are engaged in a dispute over improvements to a highway that is statistically safe but perceived to be dangerous. Number suggest that although the highway has a high proportion of dramatic accidents, the overall accident rate is low. Citizen groups have taken out ads calling for expensive improvements. The city has appeared on talk shows arguing that the proposed improvements are expensive and would not make a difference.

**Peter S. `Adler, The Accord Group, Honolulu, Hawaii**: *Once a mediated process has been established and the parties convened, I would work with the stakeholders to isolate the core technical questions that need to be answered.*

*The challenge here will probably involve ventilating some of the initial emotion and* *drama, narrowing the technical questions, and reaching agreement on what constitutes salient information. I think a well-constituted technical team might productively clarify and decode the accident rates.*

*Once the data has been explicated and interpreted, the group can begin to tackle the political problems involved in various possible solutions. I may do a lot of that in private. If there are public meetings that need to be planned, I will do a lot of choreography (poster sessions, Q & A with the experts, brief background papers) aimed primarily at enhancing the public's understanding of the issues, the data, and the options.*

**Bob Barrett, Collaborative Decisions, Menlo Park, California**: *The problem here appears to be that there is no forum for collaborative problem solving, only the political process. The need is to generate the political will and vision in sufficient numbers of people to permit a collaborative process to begin and be sustained over the time required for it to have a chance of success.*

*One approach to this would be to identify a neutral, respected agency or organization, perhaps a community foundation or a university center or good government group, and suggest that they convene an initial meeting to address the situation on this particular highway segment. At this meeting the city's representatives might be asked to make a presentation about the evidence supporting the conclusion that the highway meets current safety standards. Also on the agenda would be representatives of the citizens groups who believe safety improvements are warranted.*

*It might be possible to stage a game or simulation focusing on the multiple perceptions of the safety of this highway or perhaps focused more broadly on how best can safety on our community's highways be enhanced. The games/simulation would need to be prepared by the convening organization and could be played several times with different groups of role players from the community. Parties to the political dispute might be asked to play, first, one set of roles and, later, another set of roles, so they have the experience of seeing the multiple dimensions of the problem.*

*Based on this experience, it may be possible to suggest a collaborative process that would take the problem out of the realm of the hypothetical and into a real search for a lasting solution to the problems that have been identified and acknowledged by both sides.*

**Suzanne Orenstein, Mediator, Prides Crossing, Massachusetts**: *In a situation where the scientific information has become politicized, my first step is to find a way to acknowledge that the information sources for discussing the problem are not sufficient for everyone to trust them. Naming the situation and then discussing how to improve the information base can be a powerful mechanism for beginning to problem solve as a group.*

*If some or all parties were using the press as their primary method of engagement with each other and the public, I would work with the parties to determine how this strategy fit with their desire for a settlement. Often, parties go to the press independently because they believe that the press provides a valuable forum where they can demonstrate strength and acquire leverage.*

*If the parties are truly seeking settlement, I have at times suggested that the parties depoliticize the debate by working jointly with the press, describing their differences (including their scientific differences), and correcting any misapprehensions about the dispute or the dialog. This strategy allows them to provide explanations to their constituencies for some of the decisions they may make in the process of settlement.*

*It is standard practice for groups to devise a protocol for addressing press contacts in order to avoid the politicization of information that can occur when the negotiation is conducted in the press. Sometimes a group will ask me to play the role of liaison with the press; other groups appoint a committee or executive group to do this.*

*My approach with parties was to help them see that the press could be helpful to them in promoting public understanding of the differences of opinion, many of which were technical, which would need to be addressed in any eventual settlement.*

7. **Lack of Expertise.** The Problem: Various private and civic sector organizations come together to resolve opposing positions about a huge public expenditure over secondary and tertiary sewage treatment. They are confounded by complex and often conflicting toxicological, engineering, and ecological studies.

**Christine Carlson, Policy Consensus Initiative, Santa Fe, New Mexico**: *As part of the conflict assessment or when the situation arises, I would ask the respective organizations for the names of experts whom they rely on for information. I would work with the group to formulate and refine a series of questions they want to pose to the experts.*

*Then I would call the experts to screen them and to learn what they know about the toxicological studies in question and ask them how they would respond to some of the questions. I would be listening for how effectively and objectively they explain the information. I would ask them about the conflicting*

*information. I would also ask them for names of experts who hold views different from theirs that they respect and can communicate with effectively.*

*Based on what I learn I would report back to the group and suggest alternatives for how* *they could proceed. Alternatives could include: (a) invite a select panel of experts who hold different views, but who have the ability to communicate effectively with each other, to meet with the group to explain the studies and answer the questions; (b) invite a single, select expert to explain the studies, conflicts, and reasons for the conflicts from the different perspectives and answer the questions; or (c) invite a select panel to answer the group's questions in writing, and then, based on the answers, decide whether to bring a panel or individual expert before the group to pursue the discussion.*

**Tom Fee, The Agreement Zone, Freehold, New Jersey:** *I would make several suggestions. Especially when the issues in controversy are place-based, I would propose field trips and site visits.*

*If participants representing different interests or areas of knowledge and experience entangle the conflict in competing interpretations, I would propose moving the locations of the meetings. Shifting the meeting sites can help participants understand the place where the other come from---for example, meet at their offices, laboratories, factories, or community halls. The act of going to the place where your perceived adversaries work or live is a terrific way to get participants to listen and observe as allies and comprehend another way of knowing and seeing the issues.*

*Meetings can begin with tours and information sharing. The whole group thus shares the experience of being together in different settings while focusing on mutual understanding of the underlying interests.*

8. **Inconclusive Data**. The Problem: A large oil company is proposing to build a lengthy oil transmission line. They have done several studies, each time using slightly different assumptions and criteria in order to find the best route. Based on these studies, and believing they have been responsive to various public interests, they re-routed their line several times. Opponents believe the line and its construction will contribute to fragmented habitats, non-point source pollution, and the disruption of several very small and fragile wetlands.

**Peter S. Adler, The Accord Group, Honolulu, Hawaii**: *Presuming we have the right representation at the table, I want to try and help the parties organize a process in which they jointly set forth the explicit scientific criteria by which they are evaluating routing options. I want this to be a group exercise in which they actually score alternatives against each other. Essentially, it's going to be a big criteria/option matrix.*

*There is a lot of preliminary conversation to be had about the nature of the problem and the meaning and impact of the dispute in each person's life. However, the precursor to* *decision-making is arraying criteria and potential solutions. To do this, the stakeholders must first examine the three issues (habitat, NPS pollution, and small wetlands) in depth and one-by-one.*

*I will ultimately encourage them to bring their best evidence to the table and discuss the comparative value of the studies they are relying on (e.g., published, unpublished, peer-reviewed, more analogous or less analogous facts). Then, we'll do an actual scoring. The rankings are going to be a backdrop and starting point for the much harder political discussion that will ensue.*

**Elaine Hallmark, Hallmark Pacific Group, Portland, Oregon**: *In this situation, I have used specific dialogue and reality testing. The steps and goals of the dialogue are generally as follows:*

*First, acknowledge the current status. The data is inconclusive; therefore, the decision is not obvious from the data. If parties cannot accept this or do not acknowledge it, it may be difficult to move forward. Sometimes a panel of technical experts jointly presenting and being interviewed by the parties will help to gain acceptance of the reality.*

*Second, review the best alternative to a negotiated agreements. Are the parties better off agreeing on how to proceed? If one party believes the lack of data is sufficient to stop the project legally (or get their way in a different type of dispute), they will likely not proceed. However, if they have seen that the data is inconclusive and will not likely prevent the project (or persuade a decision-maker/court to do what they want), they will likely be willing to proceed.*

*Once parties believe that they need to reach an agreement in spite of the inconclusive data, they can focus on the best next step and on future adjustments that can be made. I would help them brainstorm ways that the project can go forward with the least possibility of harm, while also gathering data about the effects. I would also encourage them to look for ways the parties can work together to monitor and get the information needed to evaluate cumulative effects. Some effective approaches have been to jointly apply for grants to study the future effects, or set up some other funding mechanism for the future monitoring and research.*

*Both parties must assess the risk they see to their own interest and the other's interest. They need to find an agreed-upon path forward that will minimize the risks to the interests of both, and provide a mechanism for future correction based on the feedback data.*

9. **Purchased Information.** The Problem: Several large manufacturing companies have been sued over the contamination of a river. The government agencies and citizen

groups that are involved refuse to rely on the studies that the companies are using but have no funds to do their own.

**Lucy Moore, Lucy Moore Associates, Albuquerque, New Mexico**: *Here are some of the things I would consider.*

*Peer Review: Hire an expert who is trusted by everyone to review the data for the group. I might also work to let those without the data hire the peer reviewer. This will cost some money, but nothing compared to doing additional studies.*

*Public Debate: Bring in the leading expert in the country on this particular kind of contamination, and hold a public forum, where s/he can grill the other experts who have prepared the studies. Just give in, and let it be as adversarial as everyone wants. It will be of limited duration (one evening), and will at least provide some satisfaction on the part of the government and citizen groups. They will have the chance to see their big gun go after those with all the data, the way they wish they could do themselves. Again, it will cost something, but not as much as doing more studies.*

*I have done this, and the company defending their studies paid for it. It was an issue of EMFs from electric transmission lines, and the debate made everyone realize that there was going to be no answer to the big question about health risks from EMFs. Surprisingly the group settled down after that, each with a sense of smugness (well, I guess we showed them!), and worked out guidelines for transmission lines through the city.*

*Put Data in Perspective: At some point, it can be helpful to put the role of data in perspective. The data-less side may not want to hear that data isn't all that important. But it still needs to be raised.*

*"What difference would it make if you had a million dollars and bought a big, fat study for yourself? Do you think the company would believe it if it differed from theirs? We need to get this river cleaned up as quickly as possible. Do we want to get into data wars? Let's try to pick a goal for cleanup that is the best we can do for now, and maybe we can build in some parameters that will allow us to adjust later, as more data comes in".*

**Greg Sobel, Environmental Mediation Services, Sudbury, Massachusetts**: *Contrary to convention, it is possible for scientists paid entirely by one side to provide objective analysis that is trusted by stakeholders and is well-grounded scientifically. This is true even when the parties disagree vociferously about the science-based decisions to be made and notwithstanding deep-seated distrust.*

*This is exactly what occurred at the Massachusetts Military Reservation where branches of* *the military are cleaning up over a dozen plumes of contaminants moving through the sole source aquifer for upper Cape Cod. In 1996, the cleanup program screeched to a halt when a particular pump and treat strategy for handling these plumes was rejected by regulators and citizens as unworkable, ill-conceived and, from both a scientific and social standpoint, fatally flawed.*

*As the lead facilitator at the site, I proposed the creation of a multi-disciplinary, inter-agency team of scientists to critique the failed plan and develop the framework for a new cleanup plan. The new plan would address the failings of the proposed approach and provide a credible, scientifically sound and politically realistic way forward. This Technical Review and Evaluation Team (TRET) reached those objectives and continues to meet periodically to advise the agencies leading the cleanup program.*

*The Air Force, which is the responsible party paying for much of the cleanup, funds the TRET. Moreover, some members of the TRET are employees of the regulatory agencies that frequently differ from the Air Force about specific scientifically based cleanup decisions. Nonetheless, this group of advisers has managed to maintain its objectivity and the perception of most, if not all, stakeholders that it is providing good advice based in sound science without undue influence—either from the funding organization or from the management of the agencies for whom some of the scientists work.*

**Bob Barrett, Collaborative Decisions, Menlo Park, California**: *The root problem here might be lack of trusted data or lack of trusted funding for gathering data. If the information appears complete to the parties, but the government agency and citizen groups need to develop confidence in it, then I would explore whether it would be possible to set up a fund to hire a trusted expert to study the data and report to them on its completeness and/or reliability.*

*If it appears likely that additional information or data gathering will be needed, then I would suggest that the group consider the value of having a committee from all sides develop a consensus protocol to guide a new group of experts in studying the problem or collecting data. One way of setting up a fund is to engage someone to act as a trustee of an account set up especially to collect funding; into this fund all parties would be asked to contribute in suggested amounts or whatever amounts they could manage. The trustee would not disclose to the parties what amounts had been contributed, but would report on whether the aggregate amounts contributed were sufficient to fund the studies or data-gathering efforts needed.*

*Such fundraising efforts could be done in phases (round 1 to support a general assessment of river water quality, round 2 to support a monitoring program, round 3 to support a more detailed search for sources of specific pollutants, etc.) and funded sequentially. If the* *amounts were sufficient, the studies would proceed. If not, the trustee would be authorized to notify the parties of that fact and encourage a further round of contributions, again without disclosing which parties contributed what amounts.*

10. **Uncertainty and Division Among the Scientists**. The Problem: In a conflict over the construction and routing of new transmission lines, an electric company cannot avoid bringing their lines through certain residential areas. Credible evidence is presented on both sides about electromagnetic frequencies as a cancer cause.

    **Gail Bingham, RESOLVE, Inc., Washington, D.C.**: *Consensus-building processes must be structured to help manage the inescapable fact of scientific uncertainty. Human understanding about cause and effect is incomplete, whether the decisions involve complex ecosystems or human health, and the future is uncertain.*

    *I encourage parties to invest in identifying what is known and agreed upon, where information is in dispute, and where there is a lack of information. It is possible that agreement on all the facts by all the scientists may not be needed to make decisions; in other words, decisions may be possible within the bounds of what is known.*

    *In this example, I might create an information exchange forum, in which the parties would pose questions to panels of experts, so that each party can hear an interaction amongst the scientists. It is important in such processes to ensure that each party see that someone in whom they place their trust is involved. The objective of such a forum would be to clarify where scientists agree, where they disagree and what the range of disagreement is.*

    *In some cases, the areas of uncertainty or disagreement turn out to be ones that can be managed by risk mitigation measures. For example (and only hypothetically), if the disagreement in this case centered around certain frequencies or intensities above a certain level—with agreement that risks were low at other frequencies or levels—then the parties might be able to agree on monitoring measures that could allow both local residents and the utility to take appropriate action to avoid the circumstances in which they agree to disagree about risk.*

    **Tom Fee, The Agreement Zone, Freehold, New Jersey**: *Another technique I would propose is to ask each participant to become translators of each other's reports and data. When there are extreme differences in levels of sophistication about technical issues or analysis, I would propose a day for orientation and training.*

    *Many experts are not expected to translate their work for others. A safe way to encourage* *translation to the various audiences at the negotiation is to ask each person to work in teams with representatives from other groups to draft joint reports. This can help build respect for other points of view and helps to avoid discounting of adversaries' perspectives. The group also might hire a journalist or writer to summarize and present the competing reports.*

11. **Distrusted Science.** The Problem: Local food producers propose to build a food irradiation facility to control insect infestations in export fruit and to reduce the risks of *E. coli* outbreaks. Anti-nuclear opponents organize to defeat it. They believe that the use of radiation will poison their food.

    **Martha C. Bean, Mediator, Seattle, Washington**: *I believe the distrust of scientific information is almost certainly based on a fundamental difference over the right and wrong uses of radiation. This is a values issues; science is unlikely to change the mind of anyone. Agreement per se may not be possible. However, dialogue may be possible.*

    *If the parties agree, then we could design an exchange of information about how each side approaches the science that bolsters their perspective. My objective would be to have parties leaving the dialogue saying, "I still don't agree with them, but I understand why they believe what they do".*

    *I would ready myself for the possibility that one or both parties may not want to better understand each other's perspectives. In values conflicts, parties often want forums where they can win, not just be heard.*

    *My job as mediator is to understand why the science is distrusted. This can best be discovered through careful questioning in caucus with each party. "What is it about this information that keeps you from using/believing/hearing it"? Often it is not the science itself, but the source that is the issue. The research entity, or even the scientist, may be the problem.*

    *The same science may become acceptable after peer review by a jointly selected trusted third party. In a case I am working on, parties vehemently challenged basic assumptions used in the central modeling effort, resulting in a resounding distrust of the model results. Usually mild-mannered scientists got nasty and personal. A near fist fight broke out at one meeting, further escalating the conflict and exacerbating the issue of how to get model results that could be trusted.*

    *We were able to make progress only after the scientists could say to one another, in the presence of their clients, that they understood the approach taken by the other, even if they* *respectfully disagreed. We carefully re-framed their differences over assumptions in order to allow the policy-level negotiators to resolve which assumptions should be used in the model. As it happened, it was unnecessary to take the dispute to the policy level.*

*After agreeing to disagree about basic assumptions, the scientists 'ran the numbers' again using a jointly developed, back-of-the-envelope model and both sets of assumptions. Not surprisingly, the two different approaches yielded the same answer! Much storm, drama and distrust was generated over fundamental differences in approach, which ultimately had no bearing at all on the outcome of the negotiations.*

*The take home message here is that the mediator must help parties tease out whether or not their lack of trust regarding science is driven by personalities, values, sources, or misapprehensions over the significance of scientific differences.*

**Juliana E. Birkhoff, RESOLVE, Inc., Washington, D.C.**: *The conflict resolution process can be used to clarify issues, understand viewpoints, and establish rules of engagement. In this case, if the mediator were to construct a forum with the goal of consensus around the design of a safe food irradiation process, then the mediator would be taking sides. That is, the mediator would be constructing a process where the goals of some parties are privileged over others.*

*I would frame the issues broadly: How can we reduce the risks of E. coli outbreaks and enhance fruit production? What are the ways to increase economic stability and prosperity for fruit growers? What is the range of perspectives on nuclear use locally?*

*I would organize a series of small, facilitated dialogues with a representation of stakeholders in each dialogue. The goal of each dialogue would be to learn about each other's stories, interests and values.*

*Then I would organize a working group with representatives from all working groups to develop a range of options about safe food production and economic opportunities for food producers. This working group would then disseminate their options to the media, government agencies, commercial associations, and legislative fora.*

**Bob Barrett, Collaborative Decisions, Menlo Park, California**: *There may be three or more root problems here: (1) that the science is sound, but not trusted; (2) that the science is not sufficiently sound or clear in its implications; or (3) that the main problem is in the underlying values or ideology about how the existing science should be interpreted.*

*I would proceed, first, by trying to understand which of these root problems was most critical to address. Fishbowl presentations or background seminars by trusted experts not involved* *in the controversy at hand might be useful. University professors or retired scientists from industry generally might be hired to fill the role.*

*Another approach might be to form a panel of scientist to conduct a test of radiation under the control of a committee composed of representatives from all sides of the controversy. The test would be conducted over a period of, say, a year, with action postponed until the test results are in.*

*It seems likely that the problem is a political one that is not subject to these approaches. In that event, there might be an effort to re-frame the issue to focus on achieving agreement on labeling requirements, so that parties who object to radiated fruit might avoid buying such products.*

12. **Information is Irrelevant**. The Problem: Government agencies and environmental groups sue several industries over the removal of PCBs from river sediments. There are major scientific and factual disagreements over the levels of PCB contamination that actually warrant action. There are also disagreements about the amount of sediment that has been deposited on the river bottom and bank. Plaintiffs and defendants agree to a settlement that results in a cleanup with no admissions of liability.

**Mary Margaret Golten, CDR Associates, Boulder, Colorado**: *It may turn out to be true that researching or processing information really won't make a major difference to the outcome of the case. However, I would be reluctant to take the parties' word for this at the start. I would be concerned that later, after the case is concluded, one group or another may discover that what they had assumed to be the relevant PCB levels was critically different. Thus, the level of cleanup on which they had agreed could turn out to be too low. I would worry about the parties having buyer's remorse and feeling that they had made a hasty and perhaps untenable agreement based on inaccurate perceptions.*

*In order to avoid such a situation, I might try to slow down the process (which could cause resistance if the parties are rushing to a solution) and pose some scenarios to the parties. For example, if the contamination level or levels of sediment in the river were found to be X, Y or Z, then would the cleanup process change?*

*All parties would participate in developing and costing out several scenarios to determine whether the outcome would change significantly based on the input. A joint evaluation process of this nature, even if cursory, could provide a more secure foundation for a cleanup agreement.*

*If the parties discover a large disagreement on the approaches that each would take to* *cleanup, then they may have to work harder to resolve their disagreements over data, rather than simply letting them go. On the other hand, if, after initial prodding from the mediator, all parties seem to be resolved to live with their data disagreements and are comfortable with their decision to move ahead without a detailed analysis of the data differences, then more power to them! After voicing my concerns, I would certainly not get in the way of solutions.*

**Bill Humm, Environmental Settlements, Lee, New Hampshire**: *I am going to try an approach that succeeded in a similar case I worked on that involved the voluntary cleanup of a municipal aquifer contaminated with hazardous waste. My task was to help a dozen Potentially Responsible Parties (PRPs) allocate cleanup costs. The usual practice of collecting 'waste-in' data seemed unproductive in this case since records were spotty. Moreover, all parties maintained that they were minor contributors to the problem. There was nonetheless a desire to find a basis for settlement.*

*In a brainstorming session, I helped the parties design their own variant on the old silent auction technique. This process required each PRP to convey via the mediator a confidential bid reflecting a settlement offer.*

*I was also authorized to prepare a report on the PRPs reflecting the total value of the bids, and the amounts of the highest and lowest bids, and certifying that all PRPs had submitted bids. Although the first few rounds of bidding fell short of the amount required for cleanup, the tool nonetheless built confidence among the PRPs that an acceptable allocation was within grasp.*

*I was able to reassure the PRPs that no one was 'low-balling' and that one PRP (perceived by the others as being the major contributor to the problem) was making a bid proportionately larger than the others. Individual PRPs increased their bid in the subsequent round of bidding, based partly on their inference of what others were doing. Meanwhile, I encouraged each of them to focus on the value of avoiding lengthy litigation rather than worrying that one of them might commit fewer dollars than another.*

*With settlement close but still elusive, I convened the CEOs, several of whom no longer felt the need for the confidentiality of the bidding process. They openly acknowledged their bid and challenged the other to increase theirs. Within hours a settlement of the cost allocation question was achieved. Though the tool was crude, it was effective in this case, perhaps largely because the parties 'invented' it themselves.*

**Greg Bourne, Public Decisions Network, Cave Creek, Arizona**: *Circumstances exist where political or economic forces overshadow the use of technical or scientific information to reach a solution. In certain cases, this will be the reality faced by* *participants in a conflict resolution process. However, even when political and economic forces may seem to prevail, there may be a way to use information more effectively.*

*First, when decisions are made for political or economic expediency, the decision is more likely to undergo increased scrutiny. In these situations, it may be necessary to determine a clear basis for decision-making using the available information.*

*Second, tools exist that may help make data or information more relevant. For example, parties in a dispute about airport noise, and how to reduce it, initially might consider random noise level readings unusable, and therefore irrelevant to making a decision. However, a computer-based program exists that can help determine the noise levels associated with different jet engines. This program can simulate noise from different types of engines at different locations around an airport, thereby allowing very specific scenarios to be tested realistically. It can provide a tangible basis for decisions.*

*Ultimately, such tools may help participants place more relevance on using information for decision-making.*

13. **Data Overload**. The Problem: Various industry and public policy groups are involved in a rule-making negotiation over microbial disinfectants. The data on human health, microbiology, chemistry, water quality, and treatment makes the rule-making process time consuming and very difficult because there is so much information and so many complex relationships between the different kinds of information involved.

**Abby Arnold, RESOLVE, Inc., Washington, D.C.**: *In the actual microbial disinfectant drinking water negotiated rule-making, which is still in progress, we addressed this issue in three ways.*

*First, we created a technical working group (TWG) made up of experts trusted by one or more federal advisory committee members. The role of the TWG was to advise on specific priority questions, sift the available data, conduct rigorous analysis, debate and discuss the analysis, develop consensus where possible on the results, and report their findings back. Where agreement is not achievable, the TWG lays out the areas of disagreement and why there is disagreement.*

*Second, the TWG is developing very sophisticated models to sort through data and produce an analysis of data. These models and model outputs are being rigorously peer reviewed and tested for validation.*

*Third, we are developing multiple ways to analyze data by separating tasks by substantive* *issue and hiring other technical experts to address specific questions. A small sub-group of the whole committee is also assisting with this process, but buy-in by the full advisory group on the technical expert is essential. The technical experts then review all available data and present findings to the advisory committee in the form of a detailed paper with references.*

**Peter S. Adler, The Accord Group, Honolulu, Hawaii:** *In an analogous case over integrated resource planning (IRP) for potable water, we began our work with an exceptional detailed and lengthy substantive conflict analysis. This analysis identified all current sources of supply and demand, and projected demands based on demographics and growth, potential new sources of water, and areas of uncertainty (including new technologies such as desalinization, changes in water pricing, and ambiguous legal areas over the potentially superior rights of some groups). We also interviewed most of the potential stakeholder groups to gather their ideas on data needs and data gathering.*

*This advance work provided the state of a critical information base at the front end and positioned the eventual IRP to accelerate its learning curve as the actual planning begins.*

**Scott McCreary, Concur, Berkeley, California:** *In a similar case, a dialogue which focused on understanding the sources, fates, and effects of PCBs in the New York Harbor Region, Marc David Block and I identified experts who had published peer-reviewed literature specifically on sources of PCBs in the Hudson/Raritan Estuary. We recruited these experts to form the nucleus of a 'Sources Subcommittee' and teamed them with a representative cross section of negotiators—at least one each from the port, manufacturing, environmental NGO, and agency regulatory communities. The mission of the Source Subcommittee was to synthesize and present available information on PCB sources in a form useful to the negotiators.*

*As preparation for a one day meeting, we caucused with several of the authors and reached two preliminary conclusions. The first conclusion was that the Subcommittee should strive to build a table reflecting a 'PCB budget' for the ecosystem. The second was that the Subcommittee's work could be accelerated by identifying the most comprehensive study of the problem to serve as the foundation. Before the meeting, we compiled and distributed the peer-reviewed studies to subcommittee members.*

*The Sources Subcommittee agreed with the proposal to build a PCB budget, but insisted that there were two prior needs. One was to establish an appropriate threshold for including data in the table. The second need was to define a series of key terms—'reservoirs', 'fluxes', and 'losses'—to accurately define how the contaminant moves through the system.*

*Then the Subcommittee organized the data by reach of the system and the data was sorted by two time periods. Each data entry was keyed to either a published literature source or a specific personal communication. The Subcommittee drafted a series of overarching findings to summarize their work, and suggested a way to graphically represent their findings as well.*

*The mediation team compiled a draft document compiling the data into a single unified table and accompanying text. This document was presented to the Sources Subcommittee for another round of review before being finalized. It was presented to the policy negotiators for review, refined yet again, and incorporated in single text document.*

14. **Theory Unsupported by Sufficient Research**. The Problem: After several cases of Mad Cow Disease, policy makers determine that there is a need to create regulations on the beef industry. Theories about the origins and transmission of the disease exist but there is almost no research available to inform the regulatory process.

**David Keller, Mediator, San Diego, California:** *When the public health is deemed to be at potential imminent risk, government needs to act swiftly to assess the risk and implement all prudent measures. When no cause can be clearly identified, however, the government is in an obvious quandary. The challenge is to assist the scientific community to move quickly away from conjecture to fact finding.*

*My focus would be on gathering what facts do exist and confronting directly the lack of robust epidemiological data or proof of a causative agent. I would then facilitate a search for the 'highest consensus possible' on short-term and long-term regulatory actions.*

*Inevitably, there will be heated debate about competing hypotheses, experimental methods, instrumental analysis, statistical analysis, benefit-cost analysis, uncertainty analysis, and ultimately, the best plans for further research and regulatory action. While my role will probably be more facilitative than evaluative, I think it would be essential that the mediator (or a co-mediator) also be a scientist trained in both the quantitative and qualitative methods.*

**Christine Carlson, Policy Consensus Initiative, Santa Fe, New Mexico**: *I would conduct a conflict assessment, and, as part of it, I would talk to scientists as well as other stakeholders. Assuming this is a federal agency, I want to query both the program and research staff and any of the stakeholder groups with expertise on this issue. I would have them respond to the following scenarios:*

1. *The agency does nothing and there is another outbreak of Mad Cow Disease that*

*excites reaction from the media and the public. How will that affect you?*

2. *The agency begins sponsoring research to determine the cause and control of Mad Cow Disease, but does not issue regulations. In the meantime, another outbreak occurs, causing a strong public reaction. A reporter calls you for a response. How will you respond?*

3. *The agency begins sponsoring research to determine the cause and control of Mad Cow Disease and at the same time proposes to begin a process to consult stakeholders in the development of regulations. How will you respond to their request that you participate in the development of regulations?*

4. *The agency promulgates regulations without input from the stakeholders. What will you do? What will need to happen for you to accept the need to regulate? What kind of regulations, if any, could you accept?*

*Following the assessment, I would report back to the stakeholders the results of the assessment. I would then suggest a meeting for them to explore the alternative approaches they have suggested.*

15. **Scientists Ahead of the Stakeholders**. The Problem: State park officials concerned about the ecological impacts of recreational uses on a coastal island organize a series of scientific inquiries. After concluding their studies, the park officials gather together a stakeholder group that quickly identifies other kinds of data that are needed for regulation. Park officials have no budget left for additional data gathering.

**Lucy Moore, Lucy Moore Associates, Albuquerque, New Mexico:** *Let's start by inviting rich people to the party. You need data and there is no money left in the budget for it. Ask yourself, who else needs to be part of this process? That is, who has money and/or data? Invite them to join the process, or perhaps create a Data Collection Committee, and stick them on it. Find people that know the Internet and how to use it.*

*Make sure these people do not run away with their power, and forget that they are the servants of the group. (In Santa Fe, a local foundation paid $300,000 for an administrative audit of the school system, to try to help resolve a huge battle between administration, board and community).*

*I would also look for free help. Have your group make connections with local schools and universities, or even elementary and secondary schools. Find a graduate student needing a topic for thesis, or needing some field experience. Sixth graders in Santa Fe have become* *excellent water samplers, and junior high kids are building wetlands downstream of the wastewater treatment plant.*

*'Adopt a school' and make them part of your project. Chosen students will get to come to your meetings (ugh!) and see how the adult world works. You can recruit some data collection help in the field or on the Internet, kids can be very useful. They can also bring a sense of calm and dignity to a group of adults, who otherwise might tend to bitch and whine at each other.*

**Abby Arnold, RESOLVE, Inc., Washington, D.C.**: *A major challenge when mediating processes where the scientific community intersects with policy makers and affected parties is when the science used for policy development is developed separate from the stakeholders. My response to this is to have to go back two or three steps in order to move ahead.*

*Even with science completed, stakeholders need to be engaged in developing the questions that they think are important to answer. This would include the sponsoring agency or organization and this is that organization's opportunity to persuade other stakeholders what questions they think are most important (thereby validating the questions researched).*

*Stakeholders then need to have a say in who will conduct the research and what methods are most appropriate. If the negotiation is convened after the research is conducted, then the sponsoring researcher or agency needs to walk through a deliberative discussion about what research was conducted, what methods were used, and offer why these methods were the best to use in this situation. Parties need to buy into the methodology or else their trust in the results is compromised.*

*If parties do not buy into the questions or methods used, options for how to address this distrust of the data need to be incorporated into the process and/or possibly any recommendations that result from the group. For example, parties may ask for technical assistance to develop an alternative method of analysis and see if that makes a difference to the conclusions drawn from the data. Or the final recommendation could include suggestions for what research questions should be addressed in the future, what methods should be used to conduct the research, and how to incorporate stakeholder input into the research in the future. Additionally, it is useful to include stakeholders in a discussion about who will conduct research, and what is the most useful way for the science to be reported back to the group. Workshops where the public can engage with researchers to refine the questions to be answered and methodologies to be used have been helpful.*

*Another option is that if the research is completed and there are no options for additional* *research during the time of the negotiation is to find scientists that the parties trust to teach/work with affected stakeholders about why the science conducted is sound is an alternative. This trusted advisor(s) can be made part of the mediator team and be brought in at various times throughout the process.*

16. **Information Not Yet Usable**. The Problem: A community pressures the commander of a military installation to cleanup a disused training area that has unexploded World War II ordinance below ground. Old methods of cleanup would damage environmentally and archeologically valuable sites. The military and the community agree on the goals and priorities for cleanup but the specific techniques needed to do a low-impact cleanup will not be available for another eight years.

**Gail Bingham, RESOLVE, Inc., Washington, D.C.**: *In this situation time appears to be the variable causing problems. I might encourage parties to develop criteria for separating what they feel is urgent now and what can wait. They then may be able to approach urgent and less urgent problems differently.*

*For the former, they may have to weigh the benefits of solving the urgent problems against the adverse impacts of current technology on other values, such as the archeological and environmental resources mentioned. If the immediate risks are urgent enough, they may be able to agree on mitigation measures for the resources that will be damaged, or if the resources are valuable enough they may decide to move the people who are at risk.*

*For less urgent problems, the parties may be able to agree on monitoring measures to maintain confidence that the risks aren't increasing and to invest in the new techniques on the horizon. I helped mediate a process to re-license two hydroelectric dams. The parties faced a similar challenge regarding the need for additional information and creative technological solutions for mitigating against gas bubble disease in fish. They structured their agreement around principles of adaptive management so that they could continue to gather data to understand how the hydraulics of one dam was causing elevated nitrogen levels in fish so that, in turn, they could evaluate what solution actually would work.*

**Bob Barrett, Collaborative Decisions, Menlo Park, California**: *The problem here is timing. What can be done on the current priorities before better-anticipated methods become available years in the future? This may be a case in which to use joint fact finding.*

*First I would help the parties agree upon a set of criteria for the determinations to be made. Then I would ask the community representatives to identify and list their highest to lowest priority areas for cleanup. I would then look to the military representatives to identify and list the methods currently available for cleanup and new methods expected to become available over the coming years.*

*These sessions might be in caucus or joint, depending on the level of trust within the group. Then, using a single-text approach, I would work with the parties to merge the two lists, setting aside for further discussion any items of disagreement. I would expect to return to the list of items of disagreement after the parties had built greater trust in each other and in the process.*

*The process might contain provisions for meetings periodically (for example, annually) to assess progress and make new decisions about how best to merge the lists of priority areas for cleanup and cleanup methodologies.*

17. **Poor Issue Farming**. The Problem: Officials from a well-regarded research institution propose to build a large, multi-million dollar infrared telescope on the top of a mountain that is used by local hunters and hikers and held sacred by native people. The scientists are prepared to address mitigation but insist on using standard western scientific nomenclature and criteria for mitigation plans. Representatives of the native people do not believe their issues are being adequately discussed.

**Martha C. Bean, Mediator, Seattle, Washington**: *Most mediators have story after story about conducting conflict assessments only to discover that the issue as presented to them by the convening organization is very different from the way other stakeholders wish to approach it. This is particularly true in environmental cases, where conveners often frame an issue as a narrow scientific problem to be solved, while others describe larger, even societal, choices or values. Until and unless the parties have the same concept of what is under discussion, there can be no engagement.*

*In the situation described above, the issue of framing is enmeshed with cultural difference and values, and historic uses of the site. I would have all parties spend at least a day together, each of them telling their stories about how important, even precious, the site is to them. Each group would have the same amount of time, probably several hours, where other parties could ask questions but not assert their own views.*

*I would encourage them to walk together on the site, to touch things, to look at pictures, to listen, to view the sky with the naked eye and with telescopes. The scientists need to get a glimpse of the religious importance of the mountaintop; the native people may not know* *that learning about the heavens is more than a job for the scientists. The recreationists need to convey what it is like for them when they hunt and hike the mountain.*

*The objective of this day would be to allow the issue to be re-framed to accommodate what is most important to each group. Under this scenario, it is possible the issue may be re-framed so that not building the telescope is on the table.*

*A caution is in order here, and it is about power. If the research institution has the power to build the telescope regardless of what others think or want, then it does not need to incorporate the interests of others in order to achieve their desired outcome. It would be counter-productive and disingenuous to even suggest that the issue could be re-framed to include the question of whether or not to build the telescope.*

*If this is the case, the mediator should help the project proponent say clearly and honestly, "We will build a new telescope. We'd like to do this in a fashion that respects the needs and interests of other people who use, love and know the mountain. Will you help us figure out what it might look like to do this?"*

**Tim Mealey, Meridian, Washington, D.C.**: *The phenomenon of poor issue framing is probably the most common yet vexing issue in any public policy dispute or problem solving situation. In the example posed, the scientists who propose building the telescope insist upon using so-called standard western scientific nomenclature and criteria.*

*One of my first tasks would be to understand the legal and political context that would lead them to 'insist' upon anything. There are numerous laws that many people are unaware of that establish rights for native peoples to protect sacred sited or to allow for freedom of religious practice that may be a part of the backdrop of the case. Even without such rights being a factor, it may very well be a part of the political dynamic that must be considered.*

*Thus, I would begin by pushing back, albeit gently but insistently on those who wish to limit or control the framing of the issues. Eventually, this should lead the parties to more fully understand each other's 'BATNAs', which of course is a useful step in any case.*

*Assuming I was successful in getting the reluctant parties to agree to a re-framing of the issues to include issues the native people believe should be considered, there are numerous conventional and unconventional techniques that could be used to build understanding about those issues. These include site visits and storytelling.*

18. **Pseudo-Professional Posturing**. The Problem: In settlement discussions over

pollution damages, a lawyer exaggerates his grasp of the hydraulics involved in the migration of underground contamination. In those same discussions, scientists retained by the community are arguing constitutional questions.

> **Elaine Hallmark, Hallmark Pacific Group, Portland, Oregon**: *I use an approach that I would call "validation and redirection". Basically I try to validate the individual's concern and the attempt to bring out information on a difficult issue. Then I would take one of two approaches (or possibly try both).*
>
> *The point is to break up the dynamic and attempt to address the real underlying interest. It may also help to acknowledge that this process is unlikely to resolve all the technical and constitutional ambiguities.*
>
> *One approach is to pull the group as a whole into a conversation about what is needed on this topic. Do we need more or different technical information before*
>
> *we can proceed? Do we need to structure a discussion with neutral experts on these issues? (Validate the pseudo expert by saying things such as, "I know you know quite a bit and are trying to bring in the challenging questions, but perhaps someone who has the credentials in this area could help all of the parties.")*
>
> *The other approach, which I might choose to use first, is to caucus separately with the 'competing pseudo experts' and explore with them what their concerns really are. Some reality testing about the likelihood that they can actually convince the other party or make them feel they have a weak argument with this approach is appropriate. Getting at the bottom of whether the approach is tied to insecurity, a lack of information, or a procedural tactic on their part with help decide the next best step.*
>
> *Finding another way to bring in the expertise, whether for the one party or for the group, as needed, will address an insecurity or lack of information. If it is a procedural tactic, you as the mediator can brainstorm with them other procedural approaches to convey their views and raise parties' awareness of the weaknesses of their arguments.*
>
> **Howard Bellman, Mediator, Madison, Wisconsin:** *This is a situation where the mediator needs to work with his or her intuition about the relationships and personalities in the situation. In caucus, I would confront it---I would say "This is bullshit, you know it and I know it and you need to get off of it."*
>
> *I would describe to the person the consequences to their best alternative to a negotiated agreement of maintaining their facade. Obviously you need to choose your language*

*carefully depending on whom you are talking to but you need to identify it for what it is.*

19. **Shifting Conceptual Framework**. The Problem: Global warming scientists and policy makers have gathered to develop proposed policies that would dramatically affect business economics. Environmental advocates argue for stringent regulations to prevent ozone depletion and the buildup of greenhouse gasses. Representatives of major industries object.

**Gail Bingham, RESOLVE, Inc., Washington, D.C.**: *People never know everything they want or need to know in making decisions, and efforts to understand the world continuously produce both new information and new ways to thinking about how organisms and ecosystems function. Although taking time*

*to invest in new learning is often preferable, postponing decisions may not be an option or may, in fact, be a way for one or more parties to win over others.*

*I often recommend that parties take a phased approach to resolving the underlying issues and encourage the parties to maintain their interactions so they can obtain and integrate new knowledge collaboratively. Essentially, we did this in a public health regulation I mediated several years ago where the dynamics were similar. The agreement laid out what the parties could concur on based on existing knowledge, articulated the scientific assumptions on which the agreement was based, outlined specific information collection and research steps, and committed the parties to a subsequent negotiation at a fixed time in the future.*

**Peter S. Adler, The Accord Group, Honolulu, Hawaii:** *This is the kind of issue that creates multiple negotiations at many levels and in different places. Part of the challenge lies in the fact that it is impossible to get simultaneous or sequential agreements in the multiple forums that are involved.*

*One version of this is the kind of regional and international environmental accords developed at the Rio summit several years ago. There are other efforts going on at this moment among Pacific Island nations who will probably be the first and most heavily impacted by sea level rise.*

*If I were called in to try and develop a fresh approach, I would explore a more informal or Track-II process organized around receptor/risk-based impacts. The mission of the process would need to be kept modest and a key part of my job will be to lower everyone's expectations. If it doesn't come from others, I am also going to be quite insistent on the use of high quality peer-reviewed research, GIS, digital mapping, and modeling as a way of* *building the strongest possible information base prior to solution-seeking.*

20. **Unrealistic Expectations of Scientists**. The Problem: Environmentalists, farmers, loggers, and government officials are engaged in an acrimonious planning problem, one aspect of which is the adoption of in-stream flow standards. After a round of initial meetings, the working group engages a group of scientists who cannot give them a single answer.

**Kem Lowry, Department of Urban & Regional Planning, University of Hawaii**: *Technical disputes, such as those involving the potential biological impacts of proposed in-stream flow standards, can sometimes be addressed through processes that involve close examination of the causal assumptions of analysts and commitment to a contingent approach to standard setting.*

*I would first urge analysts to participate in a process of cognitive mapping, to specify their assumptions about causal processes that link different in-stream flows to biological impacts. Software now exists which facilitates mapping causal processes, but pencil and paper diagrams are adequate. Once analysts agree that these maps adequately reflect their assumptions, they can be compared and areas of agreement and disagreement can be specified in more detail.*

**Abby Arnold, RESOLVE, Inc., Washington, D.C.**: *Adjusting expectations about what the technical experts will be able to offer up front with all parties is an important first step. You can do this by asking parties to give the scientists or technical team instructions to see where they can agree, or to see where there seems to be a preponderance of evidence, and then to clearly identify for the negotiation committee where differences in interpretation lie and what the differences are, and why those differences are important.*

*Question scientists about what criteria they use to determine whether there is one answer. Offer the parties bounds of error or confidence levels in the original data and interpretation of the science.*

*Another tool is to offer parties comparisons of differences in data analysis: simple matrices comparing using different assumptions. The assumptions need to be noted clearly up front.*

*The mediator's role is to help parties understand up front what they can expect from the scientific community, to review documents before they are brought to the parties to make sure they are clear and understandable, and that differences in data interpretation are clear. The parties need to understand what the science offers, the importance of differences* *in interpretation, and to whom. The parties then have to make the hard policy decisions.*

21. **Outdated Data and Organizational Lag**. The Problem: Small businesses that rely on a specific technology believe that a constituent metal should be de-listed as a toxic substance because new research indicates it is not a public health threat. De-listing would translate into economic efficiencies. The government agency responsible for small business sees this as a low-priority issue. They are willing to meet but not willing to take it up on their docket of rule-making issues.

    **Kem Lowry, Department of Urban & Regional Planning, University of Hawaii**: *This problem is really about power and leverage. Getting a government regulatory agency to change its priorities requires effective advocacy.*

    *If I were assisting a stakeholder group in grappling with this issue, I would caucus confidentially with the industry and business groups and explore their finding a broker within or outside the agency who might advance their argument that de-listing silver is low-risk and cost-effective.*

    *In private, I would also raise a second, complementary strategy: creating a de-listing constituency to lobby the agency. A particularly credible advocacy group might be composed of traditional adversaries in toxic waste regulatory forums. A group that includes small business advocates, specialists on toxic materials, and representatives of consumer and environmental health groups would be viewed as particularly credible.*

    *A third strategy to be explored is to do the agency's work for them by simulating a rule-making process. Representatives of relevant interest groups and the regulatory agency could be convened to engage in a facilitated rule-making process on silver. Such a process would reveal the substantive, economic and political issues to the agency.*

    *Failing all appeals to reason and 'good government,' I might see if they have considered making contact with an ambitious producer at '20/20' or '60 Minutes' to encourage a segment on how government inertia and over-regulation is harming small business interests. If they didn't come up on their own, I would raise all of these ideas through questions.*

    **Bob Barrett, Collaborative Decisions, Menlo Park, California**: *This appears to be a problem of how to motivate a bureaucracy. There may also be a problem with one agency being responsible for promoting small business and another agency being responsible for environmental protection and their priorities may not coincide. Advocacy or behind the scenes political action may be necessary.*

*I would meet with the small business parties and counsel them on the options available. Perhaps it might be possible for a trusted person to approach the agencies and try to persuade them to consider aligning their priorities. Or perhaps ask a third agency to convene a meeting with representatives of the affected agencies and try to persuade them to take up the necessary rule-making. Or perhaps one agency could grant special permission to use the constituent metals even before the rule-making, with protection from prosecution for violation of the environmental regulations.*

**Doug Yarn, School of Law, Georgia State University**: *There are many variables affecting the strategy for the acquisition of restricted data. For example, to what degree is the possessor of the data a participant in the process, or is the possessor unrelated to the process entirely? Does law require the restriction on the data, or does the possessor have discretion over revealing it? Is the restriction permanent and ongoing, or is it temporary, wherein the data will eventually be available?*

*Assuming for the moment that law does not restrict the data and the possessor is a participant in the process, one strategy is to use non-disclosure agreements. Participants in the process agree that they will not reveal the data to anyone outside the process. The person possessing the data would have to decide if such an agreement sufficiently protects their interests in the data.*

*A violation of the agreement would trigger some pre-determined liquidated damages or carry some civil penalty. Clearly such agreements are easier to obtain and enforce when there are fewer people at the table and when the representatives for larger constituencies are authorized and sufficiently trusted to make decisions regarding the data without sharing it with a large number of constituents.*

*Another strategy is to use the facilitator, mediator, or other neutral third party as a confidential repository of the data. The data would be revealed to the third party under the condition that specific details—the revelation of which would undermine the possessor's interests—would remain confidential. However, the third party could advise or make recommendations to the plurality of stakeholders based on that third party's assessment of how the data affects the problem or options.*

*This strategy works best if the parties have considerable trust in the third party's ability to protect the proprietary interests in the data while simultaneously making useful interpretations of the data for the decision-makers. In highly technical matters, an expert neutral fact-finder may be the best person to perform this role, either independently or in collaboration with the facilitator. This quasi-arbitral procedure would result in a non-binding recommendation in light of the data. Examples of this can be found in ADR procedures used to resolve commercial disputes over trade secrets and patents.*

*Certainly much depends on how amenable the data is to this mechanism. Also, this strategy works well if the third party is needed merely to determine whether the data is relevant.*

*If the matter is in litigation, another strategy rests on the possibility of using a court to provide an opportunity for in camera proceedings, essentially closed-door inspection of the data under the court's supervision. There may be circumstances in which one of the stakeholders could force revelation through legal action. Such an adversarial approach might undermine attempts at a collaborative dialogue; however, the possessor of the data may willing submit to in camera proceedings if they perceive that the court would provide better protection.*

22. **Differential Tolerance for Complexity**. The Problem: In a technically complex and long-running rule-making case over synthetic chemicals in foods, scientists must analyze many different kinds of medical and public health data. They are insulted when busy lay participants in the negotiation begin asking for a synthesis or the 'short version'. Conversely, the lay participants are running out of time, money, and the patience needed to engage in the process.

**Elaine Hallmark, Hallmark, Hallmark Pacific Group, Portland, Oregon**: *I think this is a good situation for task groups of some kind. I often try to have a group agree to have the scientific or technical folks, possibly including those other parties, who have a penchant for the details, form a task group to really talk through and understand the data.*

*I believe it is often helpful for the facilitator to assist that task group, depending on the level of cooperation among them, and depending on their ability ultimately to synthesize the information in such a way that the bottom line implications of the data can be brought back to the full group.*

*The key to this approach is getting the right people on the task group so that the scientists do feel heard and validated, limiting the cost of the task group, and getting something useful back to the key decision-makers in the process. I have had good results with charging the task group to come together on a tool (often a table, a chart or a graphic) that integrates and summarizes the data in a way that helps the group walk through the decisions it needs to make.*

*I've had some experiences with the tool being a model that was like a board game with movable pieces, so various alternatives could be visualized by moving the pieces. Each piece has synthesized a lot of data related to that item. It may have rules with it. For example,* *certain pieces cannot be put with others, or, if they are, they add something else.*

**Tim Mealey, Meridian, Washington, D.C.**: *In many public policy dialogues and regulatory negotiations, it is not only helpful but also necessary to separate the technical/scientific issues from the policy issues. Often separate subgroups are formed to make sure both types of issues are being addressed adequately, with certain people taking on the role of translator between the two groups.*

*Essentially, there is no getting around the fact that there are differential needs and capabilities amongst the wide variety of stakeholders, decision-makers, technical experts, and laypersons that are involved in the formation of public policy. In addition to structuring the process to account for these different needs, some of the techniques I have used to address differential tolerances for complexity include briefings, training sessions, and educational efforts in the beginning of a process.*

*It may also be helpful to have the technical experts distill the crucial information for policy makers and/or members of the public who have a stake in the outcome of the process. If the technical experts become insulted by a request to do so, I might call a break or in some other way have a 'reality check' conversation with them. I would converse about what it takes to make well-informed and carefully balanced public policy decisions, and the critical importance of the timing factors in the particular decision-making process in which they are involved.*

23. **Pseudo-Scientific Environmental Conflicts**. Problem: The construction of a municipal solid waste incinerator is opposed by abutting neighbors who fear a drop in property values and increased (but nonetheless legal levels) of noise and traffic. Because the legal policy framework recognizes human health concerns, but not 'inconvenience', as a legitimate basis for a negative decision, the community files suit alleging a deterioration of air and water quality.

**Howard Bellman, Mediator, Madison, Wisconsin**: *This situation is as common as dirt. What the mediator needs to do is surface the parties' real issues. With government agencies the real issues might be policy. With businesses the real issues might be economics. With homeowners the real issues might be aesthetics.*

*The issues are very important, but they end up having to take a legal position to get their interests heard. The first thing I would do, in caucus, is to get people to say out loud what all their real concerns are. I wouldn't ask them to confess that they don't really care about the legal issues but to identify what all their issues are.*

*Then I would get them to talk about priorities. There is a possibility that if some of the core issues were addressed, then the other ones, the more legalistic positions, would fall away. Since they have identified these issues publicly, the process will have to address both their formal public positions and the interests you identify in public. But unless you get all the interests out, then they have just put themselves in a corner.*

**Gregory Sobel, Environmental Mediation Services, Sudbury, Massachusetts**:
*Parties appropriately use whatever forums and arguments will advance their interests. Most forums recognize only certain interests presented in particular ways. Thus, parties are forced to match their arguments to the forum.*

*If I am mediating a dispute raised under environmental laws, the parties will have crafted their arguments in terms of legally cognizable positions, often with an environmental handle. In private, I will ask the parties to articulate their real needs and interests, aside from the formal arguments they have made. If they can develop the terms of an agreement that meet those real needs, the settlement usually can be structured to fit the requirements of the forum.*

*Sometimes the central term of the settlement is entirely outside the formal positions of the parties. For example, in a typical dispute I mediated under state and federal wetlands protection laws, the opponents of a proposed development argued that the wetlands hydrology would be illegally altered when what they really wanted was to stop a building that would block their view. The settlement involved modifications to the construction plans so that the cherished view would be protected. The plan changes had nothing at all to do with the legal requirements but by agreeing on the design change, the project opponents dropped their appeal and the developer, through a binding side-agreement, promised to build the development as agreed in the mediation.*

*Thus, pseudo-scientific and pseudo-environmental conflicts can sometimes be resolved, first, by identifying the true concerns of the parties; second, by crafting terms that meet those concerns aside from the legal arguments; and third, by fitting the settlement into the rules of the forum.*

## End Notes

[1]This project began in February 1999, when Peter Adler, Ph.D., a Senior Fellow at the Western Justice Center Foundation and a Senior Consultant at the U.S. Institute for Environmental Conflict Resolution (USIECR), initiated discussions that involved Ninth Circuit judges, USIECR staff, lawyers and environmental advocates in Hawaii and elsewhere. Together, they focused on ways to strengthen the use of scientific and technical information in the mediation of complex environmental disputes. A focus group convened in April 1999 in Tucson, Arizona, and reaffirmed the need for a statement of mediator principles and practices.

The dialogue initiated in Tucson continued at the Society of Professionals in Dispute Resolution Environmental and Public Policy Sector meeting in May 1999 at Keystone, Colorado. There, Chris Carlson and Adler facilitated a discussion with other mediators on this topic. That session generated additional interest and many specific ideas for further exploration. Following that session, Bob Barrett, Martha Bean, Juliana Birkhoff, and Emily Rudin joined in the formation of a working group to capture the emerging best practices from the field. Connie P. Ozawa, author of one of the central works of the field, *Recasting Science*, joined the group in June.

The Western Justice Center Foundation next hosted a focus group in Pasadena, California, in August 1999. The Hawaii Justice Foundation hosted a third focus group in Honolulu in October 1999. RESOLVE, Inc., in Washington, D.C., convened a final focus group in January 2000. Each of the four focus groups included attorneys, mediators, facilitators, scientists, engineers, planners, public agency staff, environmental advocates, and journalists. Each group discussed specific cases and explored how science and technical information was or was not used in the process.

Over the course of these four meetings, the Working Group concentrated on four main lines of inquiry:

1. Rocks in the Road—clarifying the current understanding of specific science and technology problems that mediators and facilitators encounter;

2. Key Concepts and Guiding Principles—teasing out foundational concepts that underlie the interventions and processes that mediators and facilitators really use;

3. Rules of Thumb—developing and organizing a list of the strategies and approaches that mediators say they use; and

4. Practice Tips—gathering specific tools, techniques, and tactics for addressing the problems identified in (1) above.

In March 2000, thanks in great part to support from the U.S. Geological Survey (USGS), the drafting group met in Menlo Park, California, to discuss the document with Dr. Herman Karl and other USGS scientists. There, they planned to finalize and disseminate the report.

Jonathan J. Hutson, J.D., Communications Director of the Western Justice Center, edited the report. He collaborated with Steven Brehm, the Center's Webmaster, on the graphic design and production.

[2]We are especially grateful to the individuals who attended four day-long roundtable discussions on this topic in Tucson, Arizona; Pasadena, California; Honolulu, Hawaii; and Washington, D.C.; to Drs. Herman Karl, Homa Lee, Michael Fisher, and Steve Vonderhaar and the USGS for their support and assistance during the final editing phase; and to Gail Bingham, Kirk Emerson, and Bill Drake, respectively, the Directors of RESOLVE, Inc., the U.S. Institute for Environmental Conflict Resolution, and the Western Justice Center Foundation, for their unflagging support and sponsorship.

[3]Ms. Christine Carlson, Esq., Executive Director of the Policy Consensus Initiative, developed the concepts of Upstream and Downstream.

[4]Winfred Lang in "A Professional's View," (*Culture and Negotiations*, Guy O. Faure and Jeffrey Z. Rubin, editors, Sage Publications, 1993) offers the following examples:

| *Indices* | *Engineers* | *Lawyers* | *Economists* | *Politicians* |
|---|---|---|---|---|
| **Cultural Values** | | | | |
| Believe in: | The laws of physics | Statutory laws | The laws of economics | The law of survival |
| Have respect for: | Technology, computa-tions, materials, designs | Authority, precedent, the sanctity of contract; rules in | Theories and statistical data | Patrons, parties, and partisan loyalty |

| | | | | |
|---|---|---|---|---|
| **Cultural Perspective** | | | | |
| See themselves as: | Builders and problem solvers | Defenders of justice, partisan advocates | Planners and policy advisers | Defenders of the public interest; mediators, ultimate decision- makers |
| Express themselves through: | Numbers and works | Technical words and documents | Money | Approvals and directives |
| Suspicious of: | Timely project imple-mentation and worker performance | Parties' good intentions and pledges | Socio-political variables | Rival bureaucrats and ambitious subordinates |
| **Negotiating Style** | | | | |
| Team role(s): | Leader or technical specialist | Leaders, spokesperson, technical adviser, or excluded | Leader or financial adviser | Leader |
| Negotiating focus: | Technical specifications | Parties' rights and duties | Costs, prices, payments | Satisfying superiors, avoiding criticism |
| Future concern: | Project implementation | Conflict resolutions | Cash-flow risks | Project completion |
| Communication style: | Precise and quantitative | Precise and logical, but perhaps argumentative | Technical and conservative | Cautious and self-protective |

[5]The Precautionary Principle and Reasonable Risk are terms that are still being defined. Considerable debate is taking place over how the two should be balanced. Reasonable Risk is premised on the notion that public decision-making (legislative, regulatory, and adjudicatory) requires judgments based on tested risk assessment procedures. Advocates of this approach believe that most important environmental decisions can be studied, quantified, and weighed through the use of scientific and analytic tools. Proponents of the Precautionary Principle argue that when an activity appears to present threats to human health or the environment, precautionary measures must be taken, even if cause and effect relationships cannot be established to scientifically acceptable levels of accuracy.

[6]Though cast as hypothetical situations, most of these examples are based on actual cases that have been modified to illustrate common science-related dilemmas that environmental conflicts present.

[7]In her 1991 book, *Recasting Science: Consensual Procedures in Public Policy Making*, Connie Ozawa writes: "Whereas the objectives of science may be to attain truth, individual scientific undertakings represent only tiny steps toward truth. Knowledge gained through the scientific method is the accumulation of bits and pieces of reality, voluminous but

incomplete, and mediated by the collector. Competing visions of scientifically derived truth can, and often do, coexist".

[8]There is considerable scientific uncertainty about natural processes in time and space. Scientists strive to reduce uncertainty through experiments to understand the physical processes at the local scale. The uncertainty in the natural process model increases from the local scale to the regional scale, because of the variability, complexity, and non-linearity of natural systems. For these reasons, many scientists are reluctant to extrapolate from local to regional scale. In addition to variability, incomplete information and disagreement among scientists contribute to uncertainty. Scientists endeavor to reduce the uncertainty in their models by collecting more data, which is a deterministic approach. However, additional information does not necessarily result in consensus, or reduce uncertainty, and could actually increase uncertainty, because scientists may disagree on the interpretation of the data, and more data may raise more questions.

[9]See "Resolving Science Intensive Public Policy Disputes: Reflections on the New York Bight Initiative by Scott McCreary" in *The Consensus Building Handbook* by Lawrence Susskind, Sarah McKearnan, and Jennifer Thomas-Larmer, Sage Publications, 1999, pp. 829-858.

[10]Sometimes, science is used tactically by one or more parties to gain leverage. In the snail darter case, a small, endemic, and localized fish became the means for stopping the construction of a large dam. The fish was listed as an endangered species, which transformed a values dispute about growth and growth management into an endangered species dispute.

[11]Some philosophies of mediation hold that parties are better served by a transformational approach to mediation (as distinguished from approaches that primarily emphasize problem solving). See, for example, *The Promise of Mediation* by Baruch Bush and Joe Folger.

[12]The terms Daubert hearing and Daubert test derive from a U.S. Supreme Court case (William Daubert, Et Ux., etc., et al., Petitioners v. Merrell Dow Pharmaceuticals, Inc., Certiorari To The United States Court Of Appeals For The Ninth Circuit, No. 92-102, decided June 28, 1993). Daubert and a follow up case (Kumho Tire) is the new standard for admissibility of scientific and technical evidence at trial. The standard requires a rigorous but flexible analysis that must be applied to the facts at issue. Considerations bearing on the Daubert test include whether a theory or technique in question can be (and has been) tested, whether it has been subjected to peer review and publication, what its known or potential error rate is, the existence and maintenance of standards, and whether the proposed idea has

attracted widespread acceptance within a relevant scientific community. The inquiry is a flexible one, and its focus must be solely on principles and methodology, not on the conclusions that they generate.

[13]For excellent resources in scientific visualization, see Tufte, E. R. (1997). *Visual explanations: Images and quantities, evidence and narrative.* Graphics Press. See also Tufte, E. R.(1983). *The visual display of quantitative information* (1983). Graphics Press; and Tufte, E. R. (1990). *Envisioning Information.* Graphics Press. Edward R. Tufte is a Professor of Political Science & Statistics at Yale University, where he has also taught in the Department of Graphic Design.

## Appendix A.
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## Appendix E--Gail Charnley, "Democratic Science: Enhancing the Role of Science in Stakeholder-Based Risk Management Decision-Making," Health Risk Strategies, Washington, DC, July 2000

# Democratic Science

**Enhancing the Role of Science in Stakeholder-Based Risk Management Decision-Making**

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Washington, DC
July 2000

# FOREWORD

This report was prepared at the request of the American Industrial Health Council and the American Chemistry Council in response to their concern that the growing use of stakeholder processes in environmental risk management decision-making has the potential to compromise the integrity and importance of science as a guide to risk management. As stakeholders themselves, those organizations believe that all stakeholders should recognize that scientific information and science-based risk analysis are central elements of effective risk management. Their concern is that without the factual knowledge provided by science, risk management priorities will be misidentified and risk management resources will be misdirected.

This report seeks to draw lessons from case examples of stakeholder processes, both successful and unsuccessful. It focuses on the role of science in risk management decisions made by convening groups of stakeholders who met, debated, and either agreed or disagreed about appropriate actions. For example, it evaluates efforts by stakeholders convened to determine whether MTBE should be added to gasoline, to make decisions about cleaning up DOE weapons sites, and to preserve air quality in Alaska. This report does not focus on policy decisions made by regulators, debated in the media and in the courts, where different stakeholders disagreed about the nature of the scientific evidence related to the decisions. In other words, it does not evaluate EPA Administrator Browner's chloroform decision, the events that led to the high-production-volume-chemical testing initiative, or the politics of using disagreements about scientific uncertainty as a trade barrier.

There is a notable absence of literature on the combination of science, stakeholder processes, and decision-making. Yet there is considerable debate about how science gets used in stakeholder-based decision-making, suggesting that this is an area ripe for study and empirical research. It is the hope of this author that the contrast between the somewhat haphazard information on which this report is based and the importance of this topic will provide an incentive to others to study this subject with greater rigor.

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## Table of Contents

## Executive Summary

Involving stakeholders in making decisions about the best ways to characterize and manage risks to our health, safety, and environment has been recommended increasingly over the past decade. This trend reflects a move towards increased democratization of risk management decision-making. One concern about increasingly democratic risk management decision-making is whether stakeholders have the ability to respect and preserve the role that science can play in informing decisions. Some argue that greater stakeholder involvement will marginalize science; others argue that decision-making is already tyrannized by science and scientific experts and that involvement of non-scientific, non-expert stakeholders represents a needed swing of the pendulum back towards an emphasis on social values.

Risk assessment has emerged over the last two decades as the dominant paradigm in the US, and increasingly elsewhere, for including science in regulatory decision-making about the best ways to manage threats to health and the environment. But because both science and judgment play important roles in risk assessment, decisions about the nature, extent, and appropriate response to risks remain controversial. This controversy is exacerbated by the inherent uncertainty of science, and by the concern that those in control of the science can use this uncertainty to serve their own ends. The case examples in this report illustrate the problem of resolving technically intensive policy disputes, as well as the challenges and difficulties associated with using risk assessment as one input to decision-making by stakeholders when the credibility of the underlying science is either in doubt or inconsistent with stakeholder concerns.

The successful case studies examined in this report used stakeholder processes to establish at the outset what the role of science would be in the risk management decision; in effect, practicing Democratic Science. In each case where Democratic Science was practiced, science played an important role, but a role that was shaped by stakeholder values to address their concerns and that was able to inform an evolving understanding of the scope of the problem. The report concludes that scientific integrity is maintained and its credibility is assured when stakeholders are involved in deciding how science is used to answer their questions and in obtaining the scientific information needed to answer those questions. In other words, the case studies demonstrate the effectiveness of implementing what the National Academy of Sciences report *Understanding Risk* called the "analytic-deliberative process" and what the Commission on Risk Assessment and Risk Management outlined with its framework for stakeholder-based risk management decision-making.

Making effective risk management decisions will continue to be a struggle as we seek to give fair consideration to both science and values and to find the right balance between analysis and deliberation. A Framework for Democratic Science is described here that uses stakeholder goals and concerns to guide the use of technical information in risk management decision-making as part of an iterative analytic-deliberative process. In the context of the Democratic Science Framework, stakeholder values help clarify concerns about potential risks and risk management goals. Questions that must be answered to address stakeholder concerns are articulated and the factual information needed to answer those questions is identified. Stakeholders then identify and agree on whom should be responsible for obtaining the needed factual information. After the needed scientific information is obtained, it is combined with other information and used either to re-frame the problem and risk management goals or to guide decision-making. In the case examples described here, a model that seemed to work well involved establishing a group of scientific experts that all stakeholders agreed to; by working closely together through collaborative analysis, the scientists were able to understand the basis for the stakeholders' concerns and the stakeholders were able to understand the role that science could play and to participate in generating data. When the adversarial groups involved in a decision can jointly oversee and participate in the research needed to resolve scientific and other technical issues underlying a policy debate, they have the means to assure themselves that other stakeholders are not manipulating the analysis.

This report draws its conclusions from a few readily available case studies primarily because virtually all of the research that has sought to identify the determinants of successful public participation in environmental decision-making focuses on process-oriented social goals and does not evaluate the role of science. Not surprisingly, risk assessors have tended to focus on risk controversies and social scientists have focused on social dimensions; research in this area would benefit from teams comprising both risk assessors and social scientists. Research is needed that includes determinants of how science has been included in stakeholder-based decision-making and how its role has had an impact on process outcomes. An analysis of the social factors that contribute to differing interpretations of scientific information and how science weighs as a factor in decision-making is also worthy of more focused research. Finally, more rigorous study is needed to determine whether, as some cynics suspect, most risk management decisions are made on the basis of political expediency. The extent to which good science or efforts at stakeholder collaboration have any real influence remains to be determined.

## 1. Introduction and Background

Managing risks to health, safety, and the environment is evolving beyond being the sole purview of regulatory agencies. More and more risk management decisions are developed and implemented using collaborative processes involving consultation and cooperation among stakeholders, including regulators, regulated parties, advocacy-based organizations, and the general public. This trend constitutes a move away from the unilateral, technocratic, regulatory model of risk management decision-making toward more inclusive, democratic, non-regulatory processes, reflecting the democratic ideal that people should be involved in their own governance (English 1996). Growing stakeholder-based decision-making is thought to be a response to a lack of public trust in risk management decisions made by government and industry; expanded public awareness of environmental, health, and safety issues; increased social expectations for improved environmental quality; changes in information technology; and the desire by business and government to demonstrate responsiveness to public concerns (Yosie and Herbst 1998s). At the same time, it is a natural outgrowth of the interest group pluralism model of administrative action in which regulatory agencies act as brokers for the many relevant interests and perspectives on problems within their jurisdictions (Stewart 1975).

A number of organizations have made recommendations concerning the need for increased stakeholder involvement in decision-making. In its 1997 final report, the Commission on Risk Assessment and Risk Management (Risk Commission) concluded that a good risk management decision emerges from a process that elicits the views of those affected by the decision, so that differing technical assessments, public values, knowledge, and perceptions are considered (Risk Commission 1997). The Risk Commission's report also stated:

> Stakeholders bring to the table important information, knowledge, expertise, and insights for crafting workable solutions. Stakeholders are more likely to accept and implement a risk management decision they have participated in shaping. Stakeholder collaboration is particularly important for risk management because there are many conflicting interpretations about the nature and significance of risks. Collaboration provides opportunities to bridge gaps in understanding, language, values, and perceptions. It facilitates an exchange of information and ideas that is essential for enabling all parties to make informed decisions about reducing risks.

In its 1996 report, *Understanding Risk*, the National Academy of Sciences carefully avoided using the term "stakeholder" but noted that risk management processes must have an appropriately diverse participation or representation of the spectrum of interested and affected parties, of decision-makers, and of specialists in risk analysis, at each step (NRC/NAS 1996). The report defined "affected parties" as people, groups, or organizations that may experience benefit or harm as a result of a hazard, or of the process leading to risk characterization, or of a decision about risk, noting that such parties need not be aware of the possible harm to be considered affected. "Interested parties" were defined as people, groups, or organizations that decide to become informed about and involved in a risk characterization or decision-making process (and who may or may not be affected parties).

The Western Center for Environmental Decision-making asserts that public involvement can help gather information; create forums for the exchange of technical information and public opinion; help participants make better decisions about environmental problems; accelerate (but not guarantee) change; and begin to reclaim the legitimacy of government by demonstrating a recommitment to public debate (Western Center for Environmental Decision-making 1997). The US Environmental Protection Agency (EPA) recommends building stakeholder partnerships for environmental improvement because doing so promotes voluntary environmental management, shifting the responsibility for environmental quality from government to a partnership that includes industry. It also opens up the evaluation and assessment process to those parties—customers, workers, and local communities—affected by the choices that industry makes (US EPA 1995). Building on that theme, the American Chemistry Council requires as part of its Responsible Care® program that member companies seek and incorporate public inputs into their products and operations (American Chemistry Council 1999). In addition to EPA and industry, states, municipalities, the governments of other industrialized nations, and the US Departments of Energy and Defense, among others, all rely increasingly on stakeholder processes to help make decisions about their activities that have potential environmental health impacts.

Despite the common-sense appeal of stakeholder-based processes, they have been criticized for several reasons. These include the substantial investment of time and resources required; the likelihood that they will heighten, not alleviate, conflict; the difficulty in identifying and facilitating the inclusion of truly representative stakeholders; the possibility that they are actually counter-democratic due to increased representation of special interest groups; and the concern that when nontechnical people are included in decision-making, the scientific or technical and factual basis of a problem or solution will be distorted, trivialized, or ignored. The latter concern arises partly because of the difficulty scientists have communicating technical information as part of stakeholder deliberations and partly because decision-makers often perceive nontechnical stakeholders as being more legitimate representatives of social values (US EPA 1995). It can also be attributed to nontechnical stakeholders' suspicion that science can be distorted to support different stakeholders' points of view.

Assessing the impacts of stakeholder processes to date requires clarification of the many different types of processes that have been conducted and evaluated. Stakeholder involvement can range from national and multinational decision-making, such as that associated with implementing the Clean Air Act or the North American Free Trade Agreement, to community-based decision-making, such as that associated with the cleanup of contaminated sites. It can mean negotiated rulemaking efforts ("reg-negs"), such as that which created the microbial disinfectant by-products rule for drinking water, or comparative risk projects such as those conducted by states to help set risk management priorities. They can be directed towards setting exposure limits for chemicals, as were a number of attempts by the US Occupational Safety and Health Administration to set workplace Permissible Exposure Limits, or towards identifying the sources of public health problems in a disadvantaged urban area, like South Baltimore. Some types of stakeholder processes convened by regulatory agencies require consensus and some do not; some are binding and some are not. That is, some result in recommendations from the majority of participants that regulatory agencies are not required to implement, but may take into account when making the ultimate risk management decision. Stakeholder processes inform regulatory decision-making, but do not constitute decision-making; regulatory agencies may benefit from the outcome of a process but must, in the end, take the final, legal responsibility for a decision. As a result, evaluating the "success" of a stakeholder process can be somewhat difficult. Of course, stakeholder-based risk management does not have to be initiated or conducted by regulatory agencies. Regulated parties, for example, may initiate risk management efforts on their own in collaboration with other stakeholders, as the electric utility industry did when it invited Environmental Defense to help them identify cleaner power production technologies.

Much of the concern about how science is used in risk management decision-making results from how science is used or abused when risk management policies are debated by stakeholders in the absence of a formal process. For example, the global controversy over the safety of genetically modified organisms and the reactions in the UK to bovine spongiform encephalitis (BSE), in Belgium to dioxin in chicken feed, and in the US and Europe to phthalates in toys are all situations where stakeholders—government regulators, the media, advocacy organizations, industry, and consumers—are debating appropriate risk management actions in the absence of an organized framework. Deciding what risk management actions are appropriate generally depends on some agreement about the nature and extent of the risks; in those cases, stakeholders disagree about the nature and extent of the risks mostly because they disagree about the underlying science. Some stakeholders argue that because the science is uncertain and the risks potentially severe, extreme risk management actions are warranted. Those stakeholders assert that it is up to the proponents of a potential risk (e.g., toy manufacturers) to demonstrate its safety; they also tend to mistrust any proponent-sponsored scientific research or claims of safety. Other stakeholders argue that the science is not uncertain, or at least not uncertain enough, to warrant extreme actions; these stakeholders also tends to argue that the consequences of extreme risk management actions are disproportionate to their benefits. In either case, Paul Slovic argues that whoever controls the definition of risk controls the rational solution to the problem at hand; defining risk thus becomes an exercise in power (Slovic 1999).

In general, many decisions that people make about risk management in our daily lives are not made on the basis of science or facts, but on the basis of perceived fairness. If people made decisions on the basis of scientific facts or quantitative risk estimates alone, they would not smoke cigarettes or eat doughnuts, and would drive only reluctantly. Science and concepts of risk are not irrelevant; many people have stopped smoking, many who continue to smoke know that they are at increased risk of lung cancer, and people know that doughnuts are not good for them. However, risk is also a social construct, with most people making decisions about risk based on a complex set of perceptions that include familiarity, harm, benefit, values, dread, voluntariness, and other factors (Slovic 1987), and on what they hear from a few people quoted in the newspapers or on television. Newspaper and television reporters cover risk on the basis of rarity, novelty, commercial viability, and drama, not on the basis of relative risk (Graham 1998). In the absence of formal stakeholder processes in which nontechnical stakeholders work together with technical stakeholders so that the former come to understand the technical issues and the latter come to understand the nontechnical issues, the self-interest of all parties—described as the Rashomon effect, in which different parties give differing accounts of the same situation, suiting that party's interests (Mazur 1998)—will dominate risk debates.

Much of the literature on stakeholder processes focuses more on providing guidance for establishing and conducting them and less on evaluating their successes, failures, and impacts. While the emphasis on the former is not misplaced, more research is needed on the latter. Resources for the Future has a project underway that is identifying the successes, failures, and impacts of public participation in environmental decision-making by evaluating about 250 case studies (RFF 1999) using an evaluation framework based on social goals (Beierle 1999). More typical (but also valuable) is a report from the Western Governors' Association assessing the value of local stakeholder involvement efforts at two sites (Belsten 1996). The 1998 report by Yosie and Herbst, based on case studies and extensive interviews, is probably the most recent and comprehensive analytic evaluation of the issues and challenges associated with managing stakeholder processes (Yosie and Herbst 1998b). In general, the literature indicates that stakeholder processes vary substantially in terms of process quality and influence on policy outcomes. Most studies also agree that stakeholder processes are not a transitory phenomenon but an important development that reflects a fundamental change in the way environmental risk management decisions are made.

This report relies primarily on case examples. Although there is a good literature on science and decision-making and on stakeholder processes and decision-making, there is very little that examines all three aspects together. The report uses information from the case examples to draw conclusions and make recommendations about ways to improve or enhance the role of science in stakeholder processes. By focusing on science as part of a decision-making process and not solely as an outcome of a process, the report attempts to avoid the difficulties inherent in identifying objective measures of scientific or technical quality. It relies instead on whether stakeholders can resolve scientific conflicts as the basis for evaluation.

## 2. The Problem: Uncertainty, Credibility, and Communication

The root of most debates about the role of science in risk management decision-making is the fundamentally uncertain nature of science. Most highly subjective, contradictory, or incorrect scientific claims occur in the areas of uncertain knowledge, or in the application of well-established knowledge to novel or ambiguous situations (Mazur 1998). Uncertainty allows the participants in a debate to generate competing technical analyses to support their conflicting policy arguments (Mazur 1975). Surprisingly often, disagreements on key technical points remain unresolved and scientific uncertainties remain unaddressed, undermining opportunities for resolving policy debates (Adler et al. 2000).

The essential problem with the "dueling scientists" approach is that the adversaries recognize that each group can manipulate or distort its analysis to support its policy position. The resulting suspicions make it difficult for any one participant to generate technical information that will be credible to the other participants (Busenberg 1999). When no common ground of technical knowledge is achieved, its role and importance in deliberation can be diminished or eliminated.

Poor communication about the role of science in a risk management decision-making process also leads to misunderstanding and suspicion. It is often the quality of the communication—not the technical information itself—that stands in the way of finding common ground (Hance et al. 1988). Problems arise when participants misunderstand the extent to which science can and cannot provide answers to their concerns. If nontechnical stakeholders do not understand the science or the role it can play in decision-making, it is unlikely to play a significant role. If the scientists or technically oriented stakeholders do not understand what the real concerns of the other stakeholders are, then science—no matter how well deployed—will not solve the problem.

This section uses two case examples to illustrate the problem of resolving technical policy disputes. The first involves competing scientific knowledge claims and the second, conflicting goals and communication failure among the participants.

*Case #1: Valdez, Alaska* (Busenberg 1999). Large volumes of crude oil are shipped in the Prince William Sound region of Alaska, with oil loaded onto tankers at the port of Valdez at a terminal operated by the Alyeska Pipeline Service Company (Alyeska). Alyeska had supported the establishment of a Regional Citizens' Advisory Council (RCAC) to help oversee environmental management of the marine oil trade there. The RCAC and Alyeska engaged in two major disputes involving technically based policy issues. In the first, a suspicion that science was being distorted to support the industry's desired outcome led to a stalemate, with the technical issues ultimately ignored in the risk management decision-making process. The participants in the second dispute, perhaps learning from the lessons of the first, resorted to a collaborative process instead (see Section 4).

The first dispute involved the impact of crude oil vapors emitted by the oil terminal on air quality in the city of Valdez. Alyeska had commissioned a series of air quality studies that examined the levels and sources of airborne volatile organic compounds in Valdez and the RCAC convened a panel of scientists to evaluate the results of the studies. The panel agreed with the findings regarding the levels of ambient airborne benzene but disagreed with the method used to identify the source of the benzene emissions. The two groups of scientists then generated contradictory knowledge claims regarding the sources of benzene, with the RCAC concluding that 90% of it originated at the oil terminal and Alyeska concluding that only 25% originated there. The RCAC asked Alyeska to install vapor control systems and Alyeska refused, unless a significant health risk could be attributed to the terminal. Interviews revealed that the Alyeska scientists questioned the validity of the RCAC models and that RCAC scientists believed the Alyeska results had been manipulated to support the industry's arguments. Mutual suspicions of distorted communication arising from claims of mistaken and manipulated analyses led to an impasse, with neither party accepting the other's interpretation. In the absence of a common foundation of knowledge, further discussion stalled and the Valdez air quality debate remained deadlocked for two years.[1]

*Case #2: Baltimore Community Environmental Partnership* (US EPA 1999a). Southern Baltimore is an industrialized area with a large concentration of industrial, commercial, and waste treatment and disposal facilities. Major facilities include chemical manufacturers, petroleum storage facilities, a medical waste incinerator, the city landfill, and a municipal wastewater treatment plant, 11 of which report air emissions to the EPA Toxics Release Inventory. Additional facilities, such as the city waste incinerator, a large steel mill, and two utility power plants, are located nearby. Altogether, more than 175 chemicals are emitted from facilities in the area, leading residents to rank air quality first on their list of concerns at a community priority-setting meeting. In particular, community residents were concerned about the possible public health consequences of exposure to the combined emissions from all the industrial, commercial, and waste treatment and disposal facilities located in and around their neighborhoods. A Community Environmental Partnership[2] had been started in southern Baltimore as a community-based approach to environmental protection and economic development. A subcommittee of the partnership comprising representatives of different community sectors was formed to address air quality, while a separate subcommittee was formed to address community health. The goals of the air quality subcommittee, co-chaired by one resident and one industry representative, were to determine whether current levels of air toxics resulting from industrial emissions in partnership neighborhoods might affect community health and to recommend actions to improve air quality. All decisions were made by consensus.

The air quality subcommittee chose to use a risk-based screening method to help provide information on the potential health risks associated with airborne chemicals in partnership neighborhoods. The approach used standard methods to identify chemicals from air pollution sources that might pose the greatest health risks. Three successive screens of the original 175 chemicals of potential concern identified four chemicals as being of most concern to the partnership neighborhoods. Of those four, only benzene emissions were estimated to result in airborne concentrations above the subcommittee's screening level, suggesting that local industrial emissions do not pose a threat to public health in that area. Petrochemical storage facilities in one neighborhood were identified as the primary

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[1]Eventually, the debate was superseded by implementation of the 1990 Clean Air Act Amendments and an EPA draft rule requiring a 95% reduction in the emissions of all hazardous air pollutants from the Valdez terminal. Alyeska responded by installing vapor controls. Thus the risk management action taken was in response to impending regulatory requirements, not a result of any determination of potential health effects by a stakeholder process.

[2]The Community Environmental Partnership comprised community residents, businesses, organizations such as local schools and the Johns Hopkins School of Public Health, local governments (Baltimore City and Anne Arundel County), state government (Maryland Department of Environment), and federal government (US Environmental Protection Agency).

source of the modeled benzene, but contributed only 12% of the measured ambient benzene concentrations in the area. Mobile sources were thought to account for most of the ambient benzene concentrations but mobile sources were not considered in the screening exercise, which looked only at point-source emissions.

The limited scope of the subcommittee's investigation produced a dilemma. The subcommittee wanted to focus on facility-related point-source chemical emissions and to develop concrete recommendations to improve community health. As it turned out, the study found that the point sources evaluated were not likely to be a significant contributing factor to community health concerns. By not including a potentially important source of air pollution—mobile sources—in the study, the subcommittee did not have enough information to develop the most effective recommendations. Thus it is possible that poor air quality does contribute to public health problems in South Baltimore, but by failing to look at the whole picture, the study could not answer the question. The relationship between the limited scope of the subcommittee's work and its ability to make recommendations for improving community air quality and health was not adequately discussed, understood, and agreed to at the beginning of the effort.

When the participants realized that the results of the study were not going to be able to show what some expected—that industrial air emissions posed risks to their health—the environmental advocacy group representatives resigned from the subcommittee. In a letter to EPA (timed to be released one day before the study results were made public), those who resigned (and others who had not been involved in the project at all) stated that they were "deeply committed to the Partnership's ultimate goal: the discovery of more effective ways to reduce pollution through the reinvention of traditional regulatory programs." That goal had not, in fact, been articulated and agreed to at the start of the effort. The letter authors went on to say that what they had sought by participating in the project was "a real opportunity [to develop] a new and deeper understanding of the environmental conditions *that threaten us* and [to debate] the best way to address those problems" [emphasis added]. Thus those who resigned had started with the assumption that the environmental conditions they were addressing posed risks to their health. When that assumption was not borne out by the results of a process they had agreed to and participated in from the start, they resigned in an attempt to discredit the process and findings and to maintain their adversarial position. In this way, the conflict became one less about what science was relevant and more about whether science was relevant. Scientific legitimacy was appealing when it suited the needs of the environmental advocacy participants; scientific information was sought as a means to buttress their beliefs, not to answer a question or solve a problem.

While the Baltimore Air Committee process did not exactly fail, its results did not have the support of all participating stakeholders. It was not able to use science to change views, solve a problem, or develop a consensus. One problem was that the environmental activists were the only community resident representatives involved. Broader community representation that did not rely on only one sector or viewpoint would have created better conditions for an effective deliberative process.

The process should have clarified at the outset what the science would and would not allow the study to accomplish and how the science and the political agendas of some stakeholders conflicted. Involving participants in collecting actual data to verify the estimates of the air contaminant exposure models might have contributed to a shared understanding of the results of the study and improved its credibility. Finally, by taking a longer-term view of the deliberative process and an iterative approach to problem definition, the two subcommittees formed to address air quality and community health separately might have been combined. This study could have been one of several steps taken towards answering the larger question, What factors contribute to health problems in the community? By focusing on the narrow question it did, it could not answer the broader public health concerns of the community.

## 3. Science, Precaution, and Risk Analysis: The Challenge

The case examples in Section 2 illustrate some of the challenges and difficulties associated with using risk assessment as an input to decision-making by stakeholders when the credibility of the underlying science is either in doubt or inconsistent with stakeholder concerns. Despite such difficulties, risk assessment has emerged over the last two decades as the dominant paradigm in the US and elsewhere for including science in regulatory decision-making about the best ways to manage threats to health and the environment. Risk assessment is a way to organize scientific information in a form that is meant to provide a useful input—both qualitative and quantitative—to risk management decision-making. Risk assessment is not the only input to decision-making, of course; social, economic, feasibility, legal, equity, and political considerations also play important roles. The challenge is to maintain a role for risk assessment and to preserve the integrity of science when decision-making is influenced by many nontechnical factors. As the cases in the previous section show, doing so is particularly challenging when risk management decisions are conducted as collaborative efforts among stakeholders with differing technical knowledge levels, interests, goals, and world views.

### 3.1 Evolution of risk assessment as the scientific vehicle for informing risk management

Before risk assessment became a well-recognized and codified discipline, a precautionary approach often guided risk management decision-making in the US for many years. For example, in the 1950s the Delaney clause required the Food and Drug Administration to ban outright food and color additives that had been shown to produce tumors in humans or laboratory animals. In the 1970s, a legal basis for a precautionary approach was established when the Environmental Protection Agency was required by the *Ethyl* decision to proceed with its plans to ban leaded gasoline even if the science was not strong enough to be able to prove exactly what the benefits of removing lead would be (*Ethyl Corp. v. EPA*. 541 F.2d 1 (DC Cir.)(en banc), cert. denied, 426 US 941, 1976).

In 1980, however, the *Benzene* decision overturned the precautionary basis of the *Ethyl* decision and substituted a risk-based principle by establishing the need for some form of evaluation as a basis for deciding if a risk is "significant" enough to deserve regulation (*Industrial Union Dept., AFL-CIO v. American Petroleum Inst*., 448 US 607, 1980). A series of Executive Orders requiring cost-benefit analysis of proposed decisions also fueled the demand for risk assessment, because the benefit of environmental regulation is typically the risk reduction that it is predicted to achieve.

To a large extent, the body of US laws that seek to establish practices that will ensure safety—or at least mitigate risk—from chemical or other contaminant exposures were established before risk assessment emerged as a discipline. Most of the methodology of risk assessment was developed in reaction to the calls by these laws to define limits on exposure that will "protect the public health with an adequate margin of safety" or lead to "a reasonable certainty of no harm". That is, in passing the laws, the US Congress called on the regulatory agencies to develop means to assess risks so as to define exposure levels that would achieve the stated qualitative goals of health protection (Rhomberg 1997).

Thus, in response to the Executive orders, the Supreme Court, and Congress, the US has moved away from a precaution-based approach to regulation and risk management and substituted a risk-based approach, albeit one that incorporates precautionary assumptions. Until recently, however, little attention has been given to the complications of reconciling the scientific process of risk assessment with the needs of democratic procedure (Kasperson et al. 1999).

### 3.2 Role of science in risk management decision-making

Because both science and judgment play important roles, risk assessment is controversial. Often, the controversy arises from what we do not know and from what risk assessments cannot tell us, because our knowledge of human vulnerability and of environmental impacts is incomplete (Risk Commission 1997). Nonetheless, because of its scientific underpinnings, risk assessment generally constitutes the vehicle for including science in risk management decision-making. Thus, risk assessment is based on science to the extent possible and on judgment when necessary.

The importance of assuring a strong technical basis for risk management is well recognized. In *Understanding Risk*, the National Academy of Sciences acknowledged that reliable technical and scientific input is essential to making sound decisions about risk (NRC/NAS 1996). The report recognized scientific analysis as the best source of reliable, replicable information about hazards and exposures and as being essential for good risk characterization. Relevant analysis, in quantitative or qualitative form, strengthens the knowledge base for deliberations; without good analysis, stakeholder processes can arrive at agreements that are unwise, not feasible, or simply a reflection of who possesses greater political power. The chief challenges are to follow in practice analytic principles that are widely accepted and to recognize the limitations of analysis.

The Western Center for Environmental Decision-making concurs, stating that a "better environmental decision" is one that is based on a better understanding of the relevant science. Public attitudes can change public policies, but they cannot change the laws of nature, e.g., the chemistry of ozone depletion, the physics of air pollution, or the neurotoxicity of lead. The normal political processes of reaching decisions by compromise will produce bad results if they assume that a natural system or physical law can "compromise" as well. Risk managers have a special obligation to ensure that the public understands the technical constraints imposed by the natural world (Western Center for Environmental Decision-making 1997).

Scientific and technical experts bring substantive knowledge, methodological skills, experience, and judgment to the task of understanding risk. In addition to their specialized knowledge, scientists bring a capacity to build systematic and reliable ways of analyzing and interpreting information about new situations (NRC/NAS 1996). At the same time, the nontechnical public can contribute valuable knowledge and information to the factual basis of a decision. It is important to elicit and facilitate the incorporation of such knowledge in a valid scientific framework.

Although, to a great extent, science provides the factual basis for decision-making, it may not always be neutral and objective as a decision-making tool, even when it meets all the tests of scientific peer review. According to the National Academy of Sciences (NRC/NAS 1996):

> Good scientific analysis is neutral in the sense that it does not seek to support or refute the claims of any party in a dispute, and it is objective in the sense that any scientist who knows the rules of observation of the particular field of study can in principle obtain the same results. But science is not necessarily neutral and objective in its ways of framing problems [or] in its choice of assumptions . . . Evidence that science has been censored or distorted to favor particular interested parties has long been a source of conflict over risk characterizations.

Nonetheless, scientific data and knowledge form the building blocks necessary to ground consensus-seeking deliberations and to promote confidence in the process and its outcome (Adler et al. 2000). Objectivity and subjectivity are relative, not absolute, and scientific knowledge is considered more objective than other systems of belief about the natural world. And while science has its subjective elements, modern science does discover real features of nature—viruses, ions, planets, gravitational attraction, electromagnetic radiation, supernovas—in a way that other methods of knowing cannot (Mazur 1998).

Integrating science into a multifactorial decision-making process is challenging because science alone is not an adequate basis for a risk decision. Risk decisions are, ultimately, public policy choices. A specialist's role is to bring as much relevant knowledge as possible to participants in a decision, whose job it is to make the value-laden choices. Good science is a necessary—in fact, an indispensable—basis for good risk characterization, but it is not a sufficient basis (NRC/NAS 1996).

### 3.3 Science, judgment, and democracy

The role of experts and technical knowledge in a democracy is frequently debated, particularly in the context of environmental health and ecological risk management. The debate centers on conflicts between the "world of values, ethics, politics, and life philosophies" and the "world of information and technical expertise" (Yankelovich 1991). Scientists have been accused of failing to place their efforts in an adequate social context, believing that science is separate from social factors or that social factors play minimal roles (Brown and Mikkelsen 1990). Some describe the choice as one between "Almighty Science *versus* Nature" (Jackson 1999), where Nature represents all that is good and democratic and science is evil because it "subdues" nature, presumably through empiricism. Even Isaac Newton recognized that hypotheses about nature that are not based on empirical evidence "have no place" in science, however (Van Doren 1991). Others assert that "new frontiers of scientific knowledge developed not from a value-free forward march of science but from conscious decisions to examine data in a new light and to seek new sources of data" (Brown and Mikkelsen 1990); few, of course, would suggest that science is value-free and most would equate the re-examination of data and the search for more data with the scientific method itself.

Properly understood, the distinction is essentially one between information and judgment. As Daviel Yankelovich has somewhat tendentiously put it, "In its eagerness to exalt the truths of science, empiricism has, crudely and blindly, undermined other modes of knowing, including public judgment . . . American culture grossly overvalues the importance of information as a form of knowledge and undervalues the importance of cultivating good judgment. It assumes, falsely, that good information automatically leads to good judgment" (Yankelovich 1991).

There is a fallacy that people sometimes succumb to, which is to assume that if only the "right" science were known or generated, the "right" answer or course of action would become apparent. This belief arises in part due to misunderstanding science, in part due to attempts to mask needed judgment as science, and in part because of the legal tradition in the US that relies heavily on establishing a factual basis for decision-making. Regulatory decisions in the US have to be justified by an extensive factual record that is subject to judicial review. The factual basis for a risk management decision is highly valued because, in the absence of a complete factual basis or record, decisions are easily challengeable. As a consequence, the judgmental or less factually based component of risk management decision-making is perceived as being less highly valued, contributing to Yankelovich's assertion that "In present-day America, a serious gap exists between the point of view of the experts and that of the general public" (Yankelovich 1991).

Nonetheless, both information and judgment are recognized as being essential components of decision-making (Yankelovich 1991):

> Although the struggle between experts and public has become adversarial, there can be no such thing as the "victory" of one side over the other. If the experts overreach themselves and further usurp the public's legitimate role, we will have the formal trappings of democracy without the substance, and everyone will suffer. If the public dominates and pushes the experts out of the picture altogether, we will have

demagoguery or disaster or both. A better balance of power and influence is needed, with each side performing its function in sympathy and support of the other.

The movement over the last several years towards more inclusive and democratic environmental health risk management decision-making processes reflects an attempt to develop better ways to integrate social, political, economic, and technical issues into fair risk management decisions; in effect, to balance the scientists' facts and the public's judgment. As Yankelovich put it, "When the proper balance exists between the public and the nation's elites, our democracy works beautifully. When that balance is badly skewed, the system malfunctions. The chief symptom of imbalance is the nation's inability to arrive at consensus on how to cope with its most urgent problems" (Yankelovich 1991). It is certainly the case that consensus on how best to manage risks to health and the environment is seldom achieved. It is also not surprising that, as we struggle to seek the right balance in order to achieve consensus, decisions often will be skewed, with scientific and factual knowledge playing roles of varying importance and influence.

Robert F. Kennedy, Jr. contends that the issues of environment and democracy are intertwined and inseparable, and that the environmental movement and the laws it spawned gave us "true democracy in this country for the first time" (Kennedy 1998). He argues that the body of 19 major federal environmental statutes passed since 1970 essentially re-enacts the ancient doctrines of nuisance and public trust and acknowledges that while we need industry, we also have a right to a clean environment. Risk assessment can play a role in helping us decide how much risk society will tolerate if it justifies the destruction of an absolute right.

Some argue against the wisdom of delegating environmental risk management decisions to either public stakeholders or experts, proposing market-based policies instead. Markets are considered truly democratizing means of decision-making due to the broad extent of public participation. However, few of us are willing to rely on "democratic participation" stakeholder processes to manage the financial risks associated with our savings and pensions, for example; we should be unwilling to do the same with regard to health and environmental risks (Shogren 1998).

## 4. Striking the Right Balance: Approaches to Solving the Problem

This section uses case examples to illustrate how different approaches to collaborative analysis have been used to overcome the problems of distorted analysis, credibility conflicts, and poor communication as stakeholders strive to give due consideration to both science and values. In each case, the disputing parties collaborated to generate a knowledge base that all stakeholders understood and trusted and that directly addressed their concerns.

*Case #3: Prince William Sound*. Following the dispute described in Case #1 (Section 2) between the oil industry and the residents of Valdez, Alaska over air quality, a second dispute took place (Busenberg 1999). The second dispute involved a debate over the capabilities of the tug vessels used to escort oil tankers in the Sound. The tug vessels' primary purpose was to help correct course errors that might otherwise lead to collisions and oil spills. The RCAC (citizens' group) proposed that the oil industry deploy highly maneuverable tractor tug vessels in one region of the Sound and an ocean rescue tug vessel with an enhanced propulsion system in another region of the Sound, on the basis that doing so would reduce the risk of oil spills. The oil industry opposed the proposal as an unnecessary expense given that existing studies did not demonstrate that those tug vessels would improve safety. The oil industry then proposed to resolve the dispute by performing a comprehensive risk assessment of the oil trade in the Sound. The risk assessment was to be jointly funded and managed through a steering committee comprising RCAC members, oil industry managers, and representatives of the two government regulatory agencies with the appropriate jurisdictions. To avoid "dueling scientists," the steering committee combined the industry's scientific experts with the RCAC's scientific experts to form a single research team. Later interviews found all parties agreeing that if the oil industry had conducted the risk assessment on its own, no one else would have believed the results. By having the participants in the dispute structure and perform the risk assessment jointly, collaborative analysis was used to resolve potentially adversarial technical disagreements.

There were several benefits to using the collaborative model. One benefit was mutual learning among the participants. Frequent meetings led the steering committee to gain a better understanding of the technical dimensions of maritime risk assessment and the research team to better understand the problem at issue and to gather data it would not have otherwise. Steering committee members actually participated in data gathering with the research team. Another benefit resulted from combining resources, making more money available to conduct the work. The results of the risk assessment were accepted as credible by all parties involved in the issue, who agreed that hidden agendas or conspiracies could not influence the collaborative process.

In response to the results of the assessment, the oil industry deployed an ocean rescue tug vessel in the Sound. The risk assessment was not able to determine whether tractor tug vessels would improve the safety provided by the conventional tug vessels already active, however. The governor of Alaska decided the issue by declaring that tractor tug vessels constituted the "best available technology" as required under state law and the oil industry responded with two such vessels on the basis of the policy decision. Thus both science and politics played roles in the outcome.

*Case #4: MTBE and HEI.* The 1990 amendments to the Clean Air Act established the Federal Reformulated Gasoline Program to make recommendations about reformulating gasoline in ways that reduce emissions of air pollutants from motor vehicles. One of the ways the program has tried to reduce carbon monoxide emissions is through the addition of chemicals that increase the oxygen content of gasoline, or "oxygenates." Methyl tertiary butyl ether (MTBE) is an oxygenate that has caused some controversy because of disagreements about its effectiveness, its potential to cause human health effects, and its ability to contaminate ground and surface waters.

The introduction of reformulated gasoline containing MTBE had elicited a number of complaints from workers and the general public in some areas of the United States, including reports of unpleasant odor, headaches, burning of the eyes and throat, and other symptoms of discomfort. In response to those concerns, the Health Effects Institute (HEI) was asked by EPA and the Centers for Disease Control and Prevention to convene an expert panel to review the available scientific information on MTBE and other oxygenates and assess potential risks to health resulting from their use. HEI is an independent, nonprofit corporation supported jointly by EPA and industry to "provide high-quality, impartial, and relevant science on the health effects of pollutants from motor vehicles and from other sources in the environment" (HEI 2000).

HEI convened a panel of scientists to evaluate oxygenates but recognized that the scientists did not represent the stakeholders. Appreciating that credibility in a broader context was needed, HEI identified an advisory board comprising stakeholders to work with the scientists and to help formulate the questions of concern. The advisory board members were representatives of environmental advocacy organizations, industry, state health departments, other government agencies, unions, other scientists, and citizens. The first meeting included both the scientific panel and the advisory board so that the initial problem formulation was conducted by both scientists and stakeholders. Together, scientists and stakeholders clarified the scope of the evaluation and identified and interpreted the needed scientific information. A draft report describing the study's conduct and conclusions was reviewed by both groups. Although the substance of the draft and final reports did not differ significantly, both groups considered the review valuable because it improved the way in which the report's message was communicated. The report concluded that risks from gasoline containing MTBE were essentially the same as risks from gasoline alone because any potential risks from MTBE were offset by its benefits (HEI 1996). Involving stakeholders in the process that was used to reach that conclusion added time and expense but, according to HEI president Daniel Greenbaum, the effort was considered worthwhile by EPA and HEI because credibility was maintained and stakeholders were satisfied with the outcome (D. Greenbaum, personal communication).

A second inquiry into the impacts of oxygenates in gasoline benefitted from the lessons learned during the first review. The first review had flagged ground water contamination by MTBE as a potential issue of concern deserving further study. The second review was able to focus on that issue, putting the potential health risks issue aside. The second review was conducted by a "blue ribbon panel" convened by EPA and comprising representatives of all stakeholders (US EPA 1996). The challenge for that panel was separating the credible science from the science influenced by stakeholder interests. Because the panel was an effective blend of stakeholders and technically competent non-stakeholders, the technical people were able to keep the stakeholders honest, thereby maintaining the credibility of the process and its outcome. The panel concluded that while current levels of MTBE in ground water pose no health risk, they recommended dramatically curtailing its use due to potentially widespread water pollution problems.[3]

Thus both reviews of oxygenates in gasoline demonstrated the effectiveness of combining scientists and stakeholders in a manner that was able to maintain the integrity of the science while addressing stakeholder concerns and assuring stakeholder "buy-in." The scope of the second review was guided by the outcome of the first, demonstrating how an iterative approach to problem definition can help focus stakeholder efforts.

*Case #5: Savannah River and CRESP*. The Consortium for Risk Evaluation with Stakeholder Participation (CRESP) began operation in 1995 in response to a conclusion by a National Academy of Sciences committee (NRC/NAS 1994):

> The Environmental Management Office of DOE [US Department of Energy] needs an independent institutional mechanism to develop data and methodology to make risk a key part of its decision making.

CRESP's mission is to improve the scientific and technical basis of DOE's environmental management decisions, leading to protective and cost-effective cleanup of the nation's nuclear weapons while enhancing stakeholder understanding of nuclear weapons production facility waste sites (CRESP 2000). CRESP is organized to provide both guidance to and peer review of the evolving effort to use risk-based methods and evaluations to shape cleanup decisions at DOE sites.

One of the site cleanups that has involved CRESP is underway at DOE's Savannah River Site. The Savannah River Site was constructed during the early 1950s to produce the basic materials used in the fabrication of nuclear weapons, primarily tritium and plutonium-239. Today, the site both stores and is contaminated by high-level, low-level, and liquid radioactive wastes as well as by radioactive wastes, mixed with hazardous chemical wastes. Before CRESP was involved at Savannah River, DOE, EPA, and the states had performed different risk assessments, obtaining conflicting risk estimates due primarily to differences in assumptions about exposure to contaminants through fish consumption. When CRESP became involved, its researchers concluded that the many conflicting assumptions about fish consumption could be overcome by obtaining actual data to replace the assumptions, and proceeded to work with local residents to collect the data. Another risk assessment was performed, monitored closely by stakeholders, and a new risk estimate was obtained that was higher than previous estimates. Nonetheless, risks from the approximately 3-millirem radiation exposure occurring through contaminated fish were still considerably lower than risks from background radiation levels of 200-400 millirem. The new risk estimate appears to have been credible and accepted by the stakeholders who

[3]EPA is currently exploring whether MTBE can be regulated, and possibly banned, under the Toxic Substances Control Act.

participated because it directly addressed their concerns and because they had been involved in both research planning and in its actual performance.

## 5. Conclusions and Recommendations

The limited case studies considered here suggest that a key to successful use of scientific information in collaborative decision-making is Democratic Science—using a broadly based deliberative process to help shape the technical analysis. Collaborative, Democratic Science-based decision-making can determine which analytic techniques and information are used, interpret analytic results, and use those results to guide decision-making or re-frame the risk management problem and goals, as necessary. What each of the successful case examples in Section 4 have in common is that stakeholders agreed to use one jointly overseen group of scientists and agreed on what that group of scientists would consider. In that way, stakeholders' choices were used to establish what the role of science would be in the risk management decision-making process. In each case, science played an important role, but a role that was shaped—through Democratic Science—by stakeholder values to address their concerns. Through Democratic Science, science was also able to inform an evolving understanding of the scope of the problem. The integrity of the science was maintained and its credibility assured because stakeholders were involved in deciding how science would be used to answer their questions and in obtaining the scientific information needed to answer those questions. In other words, the Democratic Science-based case studies described here demonstrate the effectiveness of implementing what the National Academy of Sciences report *Understanding Risk* called the "analytic-deliberative process" (NRC/NAS 1996) and what the Risk Commission outlined with its framework for stakeholder-based risk management decision-making (Risk Commission 1997).

### 5.1 Framework for Democratic Science: Combining science and values in decision-making

Page 28 depicts a Framework Democratic Science, or a guide for using stakeholder goals and concerns to guide the use of technical information in risk management decision-making as part of an iterative analytic-deliberative process. In the first step, stakeholder concerns guide the identification of potential risks and clarify risk management goals. In the second step, the questions that must be answered to address stakeholder concerns are articulated. These two steps are critical to clearly understanding the problem *before* attempts to solve it are made. Next, the factual information needed to answer those questions is identified. Such information need not be solely scientific and might include information about economic impacts, statutory issues, and demographics, for example. Stakeholders then identify and agree on whom should be responsible for obtaining the needed factual information. In several of the case examples described here, a model that seemed to work well involved establishing a group of scientific experts that all stakeholders agreed to; by working closely together through collaborative analysis, the scientists were able to understand the basis for the stakeholders' concerns and the stakeholders were able to understand the role that science could play and to participate in generating data. After the needed scientific information is obtained, it is combined with other information and used either to re-frame the problem and risk management goals or to guide decision-making.

A similar model to the Framework for Democratic Science that is recommended here is the model of cooperative discourse, or three-step participation model (Renn et al. 1993, Schneider et al. 1998). In the first step of that model, values and criteria for judging different risk management options are elicited from stakeholders, which in turn are used by a group of technical experts in the second step to guide the development of indicators or measures for evaluating the performance of each option as compared to the evaluative criteria. For the second step, a group Delphi process is used to reconcile conflicts about factual evidence and reach an expert consensus via direct confrontation among experts representing diverse views (Renn and Kotte 1984). In the final step, citizens deliberate to evaluate and design policy options based on knowledge of the likely consequences of each option and on their own values and preferences, with input from the first two steps. The model of cooperative discourse has been implemented in Germany to address energy policies and waste disposal issues and in the US to develop sludge-disposal strategies, with mixed results.

It is important to acknowledge that science may not always be the sole basis for a decision; in many cases, it will be one—but not the overriding—consideration. The goal is to maintain the integrity and credibility of the science and to define a useful role for scientific information in decision-making. That goal can be achieved through collaborative analysis that generates a single body of knowledge that will be accepted by all the groups in a policy debate as a valid basis for negotiations and agreements (Ozawa 1991, Busenberg, 1999). When the adversarial groups involved in a policy debate jointly oversee the research needed to resolve the underlying scientific and other technical issues, they have the means to assure themselves that other stakeholders are not manipulating the analysis. This observation is consistent with the general principal established by other studies of decision-making processes, which have found that when people have an opportunity to participate in a process, they are more likely to view its results as fair and credible (Thibault and Walker 1975).[4]

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[4] Interestingly, the thesis that participation increases credibility is also consistent with other cases, not discussed here, where community participation in scientific investigations improved the credibility of the results within an affected community, but not necessarily within the broader scientific community. For example, during the contentious debate that characterized the investigation and litigation associated with the Woburn, Massachusetts community's belief that trichloroethylene-contaminated drinking water was the cause of their leukemia cluster, the only scientific study that was credible to the community was "The Harvard Study". That study, performed by Harvard School of Public Health scientists, began with a cooperative agreement regarding the extent and nature of community involvement in the investigation itself (Brown and Mikkelsen 1990). It is possible, however,

The following guidelines will help implement Democratic Science in order to maintain a useful role for science in stakeholder-based decision-making.

1. Research and analysis should respond directly to stakeholders' concerns.
2. All stakeholders should be involved at the research planning stage.
3. Stakeholders should collaborate with scientists to obtain data and other information.
4. Decision-making should be iterative, with technical information used to guide either decision-making or problem re-evaluation, as necessary.

### 5.2 Suggestions for further research

Research teams comprising both risk assessors and social scientists are needed. By operating independently, risk assessors have tended to focus on science and decision-making while social scientists have focused on the social determinants of decision-making. More rigorous study of science in stakeholder-based decision-making would be facilitated by both types of scientists working together.

1. *The role of science in stakeholder processes*. Virtually all of the research that has sought to identify the determinants of successful public participation in environmental decision-making focuses on process-oriented social goals. While some perceive that science suffers in the hands of stakeholders, it is difficult to evaluate that perception objectively using the currently available data base because of the emphasis on social goals as evaluation metrics. Little work has been devoted to evaluating the role of science. Research is needed that includes determinants of how science has been included in stakeholder-based decision-making and how its role has had an impact on process outcomes.

2. *Policy disputes resulting from differing scientific interpretations*. This report has focused on the role of science in formal, convened, stakeholder decision-making processes. Much of the genesis of the concern over that role results from situations that do not involve formal stakeholder processes. Such disputes involve general disagreements among stakeholders that arise partly due to differences in interpretations of the science that underlies particular actions and partly due to differences in how science is weighed against the many other factors that contribute to decisions about managing risks. A rigorous analysis of the social factors that contribute to differing interpretations of scientific information and how science weighs as a factor in decision-making is beyond the scope of this analysis and worthy of more focused research.

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that if the Harvard Study had not supported the community's belief regarding a causal association between exposure and outcome, that it would not have retained its credibility with the community.

3. *Politics versus science*. Some cynics argue that most risk management decisions are made on the basis of political expediency and that neither good science nor efforts at stakeholder collaboration have any real influence. More rigorous study is needed to determine whether and to what extent that is indeed the case.

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