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**D**eciding for  
the Future:  
Balancing Risks,  
Costs, and Benefits  
Fairly Across  
Generations

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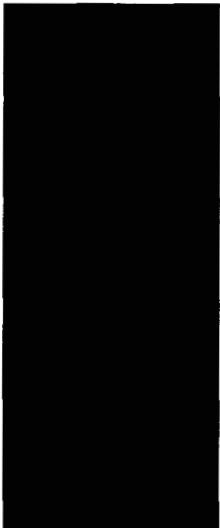
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*Deciding for the Future: Balancing Risks, Costs, and Benefits Fairly Across Generations*



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# TABLE OF CONTENTS

|   |     |
|---|-----|
| <b>FOREWORD</b> .....   | vii |
| <b>CHAPTER ONE</b>  |     |
| Introduction .....  | 1   |
| <b>CHAPTER TWO</b>  |     |
| Principles for Intergenerational Decision Making:<br>Their Basis and Decision Making Guidelines ..... | 5   |
| <b>CHAPTER THREE</b>  |     |
| Guidance for Application of Principles .....  | 9   |
| <b>CHAPTER FOUR</b>   |     |
| Conclusions and Next Steps .....  | 15  |
| <b>REFERENCES</b> .....   | 19  |
| <b>APPENDICES</b>   |     |
| Appendix A: DOE Charge to the Academy Panel .....   | 21  |
| Appendix B: Background and Project Activities .....   | 25  |
| Appendix C: Academy Panel Members .....   | 37  |
| Appendix D: Working Group Participants .....  | 39  |
| Appendix E: Workshop Participants .....   | 43  |
| Appendix F: Project and Workshop Staff .....  | 49  |







# FOREWORD

In this report the National Academy of Public Administration takes the first steps toward an important emerging area of concern for public administrators: *Deciding for the Future: Balancing Risks, Costs, and Benefits Fairly Across Generations*.

In today's world we are all increasingly aware of our impact on future generations. Primarily, this issue confronts us in our efforts to come to grips with our national budget, and indebtedness it is creating for future generations. Of course, there is nothing intrinsically wrong with financing investments and payments over a period of time.

But we do need to find the balance in the allocation of resources between the present and the future. This is the challenge that is facing the U. S. Department of Energy in facility clean-up, management and development of energy resources. In clean-up activities, for example, there are varying levels of clean-up, each with a different price tag, and each extending into the future. Which one is appropriate?

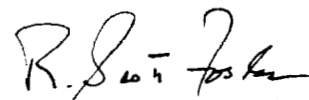
In our search for the answers to these questions, it became apparent that traditional techniques, such as economic discounting, are not adequate to address the far future. The present value of the entire earth can be discounted to almost nothing in several hundred years. Where, then, can we turn for guidance?

It is our conclusion that the field of public administration needs a set of guiding principles for making decisions that affect future generations. This report presents our effort to define those principles. But these principles represent only a beginning. They need to be tested and refined in real world situations.

We encourage public administrators at all levels to include a sense of their responsibility toward the future in their decisions. The principles provided in this report can provide a place to start. We also encourage public administrators to collect and share experience. In particular, there is a need for key administrators to step forward and establish demonstration projects within their areas of responsibility to serve as models and centers of learning for the field of public administration.

*Foreword*

It is worth remembering, as we were forced to do many times during this study, that at any given point in time we are not one generation but many. The future is always closer than we think. We need to take it into account.



R. Scott Fosler  
President







# CHAPTER

# 1

## Introduction

The key challenge of this National Academy of Public Administration project is captured in the subtitle of this report, *Balancing Risks, Costs, and Benefits Fairly Across Generations*.

The U. S. Department of Energy (DOE) initiated the project to seek the Academy's advice on the broad issue of how to balance risks, benefits, and costs in the allocation of federal resources to projects that affect current and future generations, such as the cleanup of hazardous wastes generated by DOE and its predecessors in their nuclear weapons work. The specific task given to the Academy was to design the elements of a methodology that could take into account the needs of present and future generations. The work was carried out under a DOE contract with Battelle Pacific Northwest Laboratory.

The policy challenge posed by the DOE concerns intergenerational equity, an issue that touches a broad range of public programs and decisions, including many heretofore made without a thorough understanding of their future impact and consequences. When making fundamental policy decisions, the question is how does one generation equitably take into account the interests of future generations. It is clear from the relevant literature that there are no commonly agreed upon principles or doctrine, either in public administration or any other discipline, that fully define how to make such public decisions.

A whole series of questions arose in addressing the issues raised in the DOE charge to the panel (See Appendices A and B):

- What exactly are the obligations of the present generation to future generations?
- How can these obligations be defined in terms of social values? Will the values of this generation still apply in future generations? If not, what will be the values of future generations, and how can we understand them?
- In addition to values, there are responsibilities. How do the obligations to future generations translate into responsibilities of this society, and of its public officials? How can we make sure that these responsibilities are fulfilled?
- Recognizing that values conflict, responsibilities may conflict, and effects may be different in the future, what principles can be defined to guide public intergenerational commitments?

- How can a more enduring and reliable decision process be defined to assure that intergenerational obligations become a permanent part of important societal and government decisions?
- Given that resources will always be scarce, and that there will be competition for those resources, what principles and processes can guide the choice between resource allocations for the present and for the future?
- How should we treat current versus past debts and obligations in relation to finite resources to address them?
- How do we distribute the burdens of the past in the present and the future?

To consider these questions the Academy formed a panel of distinguished Fellows and others with a wide range of expertise. The group included experts on hazardous waste, risk (analysis, assessment, and management), the environment, public service, ethics, economics, energy production and management, cost benefit analysis, sustainable development, philosophy, administrative decision making, public administration, and government. It also included members from industry, colleges and universities, and government. The panel members are listed on the front page of this report and their background is summarized in Appendix C.

The work on this program was carried out in three phases starting in 1993. The background, issues and various phases of the program are described in Appendix B. In the first phase, an extensive literature search was undertaken to help shape the scope of the study and to identify relevant ideas and concepts. But it seemed that the literature was very diffuse, and no obvious solutions clearly emerged. However, the literature review suggested the need for a set of guiding principles. The members of the working group and the research staff involved in conducting the literature review are listed in Appendix D and the results presented in Reference One.

In the second phase, to review the issues related to intergenerational equity, the panel sponsored a workshop which brought together a group of people with broad intellectual backgrounds, wide ranging work experiences, and socially and ethnically diverse identities for an intense outcome-oriented debate and discussion. The participants are listed in Appendix E. The workshop discussion yielded two noteworthy contributions to the project. First, the group concluded that before the intergenerational elements of a decision making process could be designed, it was necessary to have a set of guiding principles. Second, the group drafted a set of principles but, in so doing, felt that it was making only the most basic and rudimentary attempt to outline what those principles would be. The principles would have to be refined by subsequent dialogue between conference participants and project staff and ultimately by the Academy panel. The results of the phase two workshop effort are presented in References Two and Three.

In the third phase of the program, the results of and information produced in the literature review and in the workshop were used by the panel as input for developing its approach and recommendations on an intergenerational decision making process. This report covers the results of the third phase of the program with further reference to the earlier work presented in the references, appendices, and in some of the discussion in the following sections.

By agreement with DOE, the Academy panel concentrated in this third phase on developing a statement and explanation of principles for intergenerational decision making. These principles, along with a preamble and initial guidelines for application, are the central elements of this report. The Academy panel hopes and expects that DOE can use these principles to form an immediate basis for decision making, and that the department will take further steps to evolve a more complete decision making system for its whole range of complex future oriented issues.

The Academy panel strongly believes that these principles, or a set of principles like them, must underlie intergenerational decision making; but that these principles are not limited in their value to the specific task set for the Academy by DOE. They can serve as a prototype for many public programs which have intergenerational consequences, and provide an ethical and philosophical starting point for many such public concerns.

The greatest immediate need is to recognize the importance of factoring the future into present decision making. This will require developing an effective decision making process that is strong enough to overcome the inertia of inaction and produce real results; that is enduring enough to survive the short attention span of the political system in which it must function; and is democratic enough to earn the confidence and engage the participation of the people who are affected and those on whom responsibility for intergenerational obligations ultimately rests.

So, the principles presented in this report represent only the first step toward improving public decision making in a broad range of activities that affects future generations. Obvious next steps are elaborating a set of working guidelines showing how to apply them in specific situations; developing case examples to illustrate emerging patterns of issues and concerns; and developing processes to weave these concerns into decision making. And principles, guidelines, cases, and processes must benefit from the perspective of time and experience.

Deciding for the future — balancing risks, costs, and benefits fairly across generations — is a vital and essential aspect of public administration. It must be given a top priority among the fundamental responsibilities of all government activity. For, as we are learning today through our discussion of the national budget, we must consider the future.



## CHAPTER

# 2

### **Principles for Intergenerational Decision Making: Their Basis and Decision Making Guidelines**

The Academy panel determined that three elements were required in the design and application of a decision making process that properly addresses intergenerational equity. These major elements are: a preamble that provides the underlying basis and broad rationale for the principles; a set of principles developed by the panel for decision making (based on consideration of the principles drafted at the workshop); and a set of guidelines for application of the principles in the intergenerational decision making process.

#### **PREAMBLE**

Public administrators, guided by the founding principles of the U. S. Constitution and the democratic process reflecting the interests of the citizens, hold in trust the interests of past, present, and future generations. The exercise of this responsibility to serve the interests of citizens requires a just and balanced allocation of resources and responsibilities based on a continuous, long-term review of needs, resources, public priorities, and consequences of previous decisions. Also required are public confidence in the fairness, integrity and trustworthiness of decision makers and their decision making processes. The principles presented in the next subsection were developed using the broad and fundamental concept of justice among present and future generations – the distribution of risks and opportunities as well as compensation and correction for actions taken.

The starting point for all decision making, including decision making for the future, is sound information. Therefore, the first step in making decisions covering future generations should always be gathering relevant data and subjecting it to objective analysis. Data and analysis should cover risks, costs, and benefits across generations, and should be applied to the major areas of societal concern relevant to the decision under consideration, such as human health, environmental management, economic soundness, and other areas considered important. Opportunities likely to be generated should also be considered. There is no substitute for relevant, objective information. However, it is also important for the decision maker to recognize the limitations and uncertainty of the data and analysis presented.

In addition to objective data and analysis, decisions affecting future generations are necessarily based on values. When evaluating the risks, benefits and costs involved in the various decisions and actions taken consistent with these principles, it must be recognized that public values are an integral part of those risks, benefits and costs; so they must be factored into the underlying evaluations of the results of decisions and actions. It is necessary for the public administrator to determine the important societal values that affect a decision and incorporate those values in the decision making process. These values help interpret the specific meanings of the principles as well as determine their relative weighing. The values used should be explicitly discussed and explanation given for their choice and relative importance. Doing so helps build public trust and confidence in the process as well as increase public involvement and responsibility for actions.

The principles are grounded in a rich literature of ethics, philosophy, economics, life sciences, and other disciplines. The general notion expressed by each of these principles will appear familiar, although the specific wording and intent of these principles vary slightly from similar concepts found elsewhere. While no single principle or grouping of principles can adequately accommodate an unknown future, the following principles collectively represent a starting point for application and development to a wide range of specific cases involving intergenerational consequences.

The principles can both support and conflict with each other. Consequently, they must be used as a set, each being carefully balanced with the others. Only through case specific applications, each arising with its own past and future and requiring continuous adjustment of the balance among principles and resulting decisions, will they constitute a living adaptation to the needs of each generation and its successors.

In fulfilling these principles, it is apparent that certain actions, analyses and public discussions are required to provide a basis for decisions in specific cases. For example:

- comprehensive analysis of possible risks and beneficial or damaging consequences of actions and decisions under consideration
- public discussion of the results of these analyses with those who may be significantly affected before decisions are made or actions are taken
- continuous examination of the basis for and possible consequences of actions or decisions taken by previous generations to evaluate their continued validity and make adjustments if new information or other factors make it clear that they are no longer valid.

The consequences of various decisions and actions that must be analyzed extend to significant matters such as economic development, individual opportunity, health effects, environmental effects, international/global effects, etc.

## **THE PRINCIPLES FOR INTERGENERATIONAL DECISION MAKING**

Based on the Academy panel's review and discussion of all of the information made available to it through this project, the panel defines and recommends the use of the following principles in intergenerational decision making. As emphasized in the preamble, these principles cannot be considered alone or in any particular order of impor-



tance; they must be considered as a dependent set, with their relationships and relative importance to each other determined from problem-specific contexts.

**Trustee Principle** – Every generation has obligations as trustee to protect the interests of future generations.

**Sustainability Principle** – No generation should deprive future generations of the opportunity for a quality of life comparable to its own.

**Chain of Obligation Principle** – Each generation's primary obligation is to provide for the needs of the living and succeeding generations. Near-term concrete hazards have priority over long-term hypothetical hazards.

**Precautionary Principle** – Actions that pose a realistic threat of irreversible harm or catastrophic consequences should not be pursued unless there is some compelling countervailing need to benefit either current or future generations.

The above principles developed by the panel are very close in substance and content to but not exactly in the same form as those principles proposed at the workshop. The workshop principles, which were very seriously considered by the panel, are:

- no generation should [needlessly] deprive its successor of the opportunity to enjoy a quality of life similar to its own
- every generation is the trustee for those that follow
- there is an obligation to protect future generations provided the interests of the present generation and near term generations are not jeopardized
- near term concrete hazards have priority over long-term hypothetical hazards
- however, this preference for the present and the near-future is reduced where questions of irreversible harm for future generations are concerned
- when action poses a plausible threat of catastrophic effects, then that action should not be pursued absent some significant countervailing need
- the reduction of resource stocks entail a duty to develop substitutes.

The panel revised these principles to eliminate overlap and to clarify, simplify, and amplify the intended meaning so that they would stand as clear and forceful statements of broad public purpose. It is apparent to the panel that the principles presented apply broadly to a wide range of societal issues so they must be framed at a fundamental level.

The Trustee Principle is rooted in the second principle from the workshop. It describes the present generation's ethical and moral relationship to future generations as that of trustee. Notions of trusteeship can be found in many cultures throughout history. In the contemporary world, the National Environmental Policy Act of 1969, as well as several state constitutions, recognize this kind of responsibility for future generations.

The Sustainability Principle incorporates the first and last principles from the workshop. Many variations of the sustainability concept can be found in the literature, but all share the common notion of not depriving future generations of essential resources.

The Chain of Obligation Principle incorporates the third and fourth workshop principles, both of which examine the relationship of the current generation to the well being of future generations. This principle rests on the philosophical concept of a chain of obligation

between generations, whereby one generation passes on to the next the resources and skills necessary for a good quality of life. It recognizes that there may be circumstances where near-term concrete hazards have priority over long-term hazards that are less certain. This principle also suggests an operational guideline – the “rolling present” – in which the present generation keeps in mind its continuous penetration into the future, and the attendant responsibility for maintaining an awareness of it. The present generation must foster the development of techniques to address problems it cannot resolve.

The Precautionary Principle, as articulated in both sets of principles, has a strong foundation in the literature. The version presented here reflects the overwhelming consensus of the panel that the greatest obligation of the present generation is to avoid actions that will have disastrous consequences for the present or future, or that will limit future choices because of damaging deprivations that cannot be corrected. This principle incorporates the fifth, sixth, and seventh principles suggested at the workshop. These are seen as exceptionally important obligations that demand great attention and may warrant incurring greater current costs. However, the panel also recognizes that the survival and well being of the present generation determines the survival and impacts the well being of future generations. Consequently, this principle contemplates the potential that some “compelling need” of the current and near future generations may outweigh even substantial future deprivation.

## **PROCESS GUIDELINES FOR INTERGENERATIONAL DECISION MAKING**

The Academy panel believes that principles for intergenerational decision making must be applied through a process that:

- can genuinely produce decisions, not just analysis. Decision makers are entitled to insist on sufficiently sound and reliable knowledge as the basis for their decisions, and may be required to define priorities for the highest use of scarce resources.
- is open, transparent, and seeks out and utilizes public participation at crucial stages, especially early enough in the process to have a meaningful effect on its outcome.
- is honest and realistic; includes evaluation that is realistic and frank in its assessment of outcomes; is flexible and capable of change; and that deals with the obligations of our whole society and the means by which public judgments can be formed and consensus created.
- is capable of dealing with the many values and interests involved, and that will make explicit the values upon which decisions are based.
- is linked to current structures, institutions, and decision processes and can actively influence the programs that really mitigate risks.
- that considers both benefits and costs; that distinguishes intolerable risk from modest risks; that deals with both prevention and mitigation; and that recognizes realistic limitations on funds and resources.
- that is continuous and adopts a “rolling present” responsibility flowing from one generation to the next without interruption.
- that recognizes that opportunities as well as risks must be considered as part of the intergenerational obligation; thus, research and education for the future may be as valuable as risk avoidance or mitigation.

# CHAPTER

# 3

## Guidance for Application of Principles

The process for intergenerational decision making should:

- be stable and sustain a careful consideration of intergenerational equity
- be rooted in the Constitution, which reflects a democratic tradition, and link with our political decision making process
- engage broad citizen-based participation and dialogue
- widely reflect the values of American society
- be a technically comprehensive process that seeks out, tests, analyzes and uses the best available knowledge and data on a continuous “rolling” basis.

The foundational concept for the decision making principles is the concept of justice. All systems of law are based on some variant of the concept of justice, and since we live in a system of law, justice must underlie principles for intergenerational decision making. The principles are to be considered as a set, with significant appreciation of the dynamic interrelationships among individual principles.

### APPLYING EACH PRINCIPLE

In addition to the preamble, the principles and the process guidelines for intergenerational decision making, the panel developed initial guidance for applying each principle. Much more work remains to be done in this area, and the panel recognizes this is substantially dependent on gaining experience from case-by-case application. But it felt an obligation to provide at least a sense of the kind of guidance that could be derived from the principles.

***Trustee Principle: Every Generation has Obligations as Trustee to Protect the Interests of Future Generations.***

In meeting the requirements of the Trustee Principle, public administrators are obligated to consider the interests of not only the current generation, but also the interests and effects of their decisions on future generations. In fact, for environmental con-

cerns, precedent for the government's role as trustee for future generations is found in the National Environmental Policy Act of 1969 (42 USC. Sec. 4331):

"... it is the continuing responsibility of the Federal Government to use all practicable means, consistent with the other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may fulfill the responsibilities of each generation as a trustee of the environment for succeeding generations."

Public administrators are required to make balanced judgements in the public interest. Their responsibility begins with the programs and services they administer but also extends broadly across all government programs and activities as well as broader social, economic, and other ultimate outcomes and consequences of the programs. Current generations inescapably act on behalf of future generations as trustee. Consequently, public administrators are obligated to seek out and use the best information available and make just decisions and to have a sense of the boundaries for acceptable use of information. It is always important to assess the quality of the data and analysis presented as the basis for decision making and, in particular, to understand that data with great uncertainties have concomitant risks associated with them.

The public administrator or trustee must be trustworthy and work to ensure the integrity of the decision making process. The public administrator can foster this sense of public trust by involving the affected citizens in all stages of the decision making process, from defining the problem to evaluating implementation. Public trust and confidence are easily eroded and difficult to restore. As trustee for future generations the public administrator must be particularly wary of appearing to act improperly, especially given the inescapable position of being a member of the current generation.

***Sustainability Principle: No Generation Should Deprive Future Generations of the Opportunity for a Quality of Life Comparable to Its Own.***

Just as it was impossible for the preceding generations to anticipate our current lifestyles and concerns, it is impossible for members of the current generation to know the lifestyles, concerns, and preferences of future generations. However, many decisions made by public officials can close options for future generations, for instance, a decision to consume a nonrenewable resource. To the extent possible, the current generation should avoid closing options that could affect the quality of life of future generations, recognizing that the quality of life of the current generation forms the basis for that of future populations. When options of future generations are decreased, the current generation has a responsibility to initiate efforts, compensate future generations by developing substitutes, and/or investing in advanced technologies. An example of such compensation would be an investment in alternative energy sources as a substitute for the current generation's depletion of nonrenewable fossil fuels.

Sustainability is also an opportunity. Each generation creates and uses resources (over and above natural resources) that are very future oriented. The most important examples are the education system, opportunities for contributions to social and economic needs, the capabilities for research and scientific investigation, and literature that analyzes and records our understanding of our own acts. Each generation must use some

of its current resources to enrich these intellectual resources for the ultimate benefit of future generations.

***Chain of Obligation Principle: Each Generation's Primary Obligation is to Provide for the Needs of the Living and Next Succeeding Generations. Near-term Concrete Hazards Have Priority Over Long-term Hypothetical Hazards.***

Consideration of the needs of future generations does not entitle anyone to impose an injustice on the present generation. In general, the literature related to inter-generational equity clearly opposes making trade-offs favoring the future that fail to meet crucial obligations to present generations, or that impose an injustice on the present. This principle includes the idea that known current risks, like the risk to waste clean-up workers, may be given greater weight than speculative risks many generations in the future, such as the possible exposure of people to a hazard through some plausible scenario.

The primary way to ensure the existence of any future is to ensure the existence of the present. We recognize the existence of a "rolling present," where the future becomes the present. Like the "chain of obligation" of parents to their children, there is a similar chain from one generation to the next. This principle allows for incremental decision making. According to this strategy, the current generation should provide the next succeeding generation the skills, resources, and opportunities to cope with any problems the current generation bequeaths. Likewise, the next generation is obliged to do the same for the successive generations, and so forth. In this way, future generations are considered and compensated for any harms passed on by the previous one. The "rolling present" involves an iterative decision process – succeeding generations have the responsibility to reevaluate the policies and decisions of the past using their own values and priorities, and incorporating new knowledge and facts to make appropriate policy changes. Under this principle, very likely near-term hazards can take precedence over less certain longer term hazards.

This "rolling present" process has the advantage of being familiar, incremental, and easy to implement. However, it also has some limitations and deficiencies; one is that it tends to ignore "time bombs" – risks that do not threaten immediate generations, but will significantly affect later generations. More generally, this decision process can be criticized for too easily allowing the current generation to ignore the long-term implications of its actions. Therefore, this strategy must not be used in isolation, but only in conjunction with the rest of the principles.

***Precautionary Principle: Actions That Pose a Realistic Threat of Irreversible Harm or Catastrophic Consequences Should Not be Pursued Unless There is Some Compelling, Countervailing Need to Benefit Either Current or Future Generations.***

The Precautionary Principle deals more directly with the future, and provides guidance on the "time bomb" and related issues. Although the notion of preserving options for

future generations is entailed in the Sustainability Principle, the Precautionary Principle makes explicit two types of possible outcomes of current decisions – catastrophic or irreversible effects – and directly limits or constrains the preference for the present permitted by the Chain of Obligation Principle. In addition to empirical analyses and theoretical projects, decisions based on this principle necessarily depend on a value judgement, which should be explicitly made and publicly discussed and evaluated before a policy is implemented. Catastrophic risk or damage should be defined through public discourse and incorporate notions such as increased risk levels, irreversibility, the scale of human activity, and the planetary impact of the project. A significant irreversible decision should be deferred, if costs are low, preserving options for later generations. In both of these areas – catastrophic and irreversible – the decision making process needs to balance speculative risks and concrete risks. The likelihood of potential consequences needs to be weighed against potential risks.

### **APPLYING THE PRINCIPLES: A SIMPLIFIED ILLUSTRATION**

The following example, from the U. S. Department of Energy (DOE) charge to the Academy panel, illustrates how the principles can be used as a set in decision making and priority setting. One of DOE's questions was:

How should risks to populations in the near future (e.g., 2 or 4 generations) be compared to risks to populations in the distant future (e.g., 500 or 1,000 years)?  
(See Question III, Q1 in Appendix A)

In our role as trustee for future generations, we are obligated under the Trustee Principle to consider the interests of generations in the distant future, just as we do the near future. However, given limitations in addressing the very long-term, we will not be able to compare the risks in the way implied by this question or even detect a probable difference in the risks in the two time periods. Under such circumstances, the Chain of Obligation Principle requires us to focus our efforts on the current and near-future generations.

While the Sustainability Principle admonishes us not to deprive future generations of a quality of life like ours, the Chain of Obligation Principle strongly prefers the near-future over the distant-future, as long as no injustice is done. This principle accommodates a “natural” tendency to prefer the near-term over the long-term, and it also acknowledges that the longer term projections are more uncertain and less likely to occur and more likely to be corrected.

However, the Precautionary Principle limits such a preference for the near-term if there is a plausible threat of significant irreversible harm or catastrophic damage to populations in the distant future. For example, in 1957 in Chelyabinsk, Russia, an extremely large tank of liquid high-level radioactive waste lost cooling and a chemical reaction caused it to blow up. Massive amounts of radioactive material (estimated at two million curies) spread over an area exceeding 1,000 square kilometers.

Approximately 10,000 people were evacuated and long-term land use restrictions were placed on much of the land. These areas may remain contaminated for hundreds of years. Present day decisions will be made on whether to continue near surface storage of large quantities of liquid waste or to solidify it and dispose of it in a geologic reposi-

tory. In making such a decision, even if continued storage were considerably less expensive, any plausible threat of such an event occurring in the far future should be given additional weight.

All elements of risk decision making inherently involve societal perceptions and values as well as scientific data. Therefore, the public needs to be included to help determine the risk and evaluate its relative importance.

In the best of circumstances, with all of the necessary guidance, the application of the principles presented here would be a daunting task. The matrix illustrated in Table 3-1 provides an example of a decision making framework that is very limited in its conceptual refinement and concerns only the issue of risk.

All other things being equal, a risk affecting both the present and future generations should be the first priority. Second priority should be a risk affecting the present generation only, followed by a risk affecting the future generation but not the present. A risk affecting neither the present nor the future to any significant degree, would have least or even no priority.

This matrix is inadequate for addressing the kinds of complex issues faced by government administrators. But it can provide a useful impetus for collecting the kinds of case specific information necessary to provide more detailed guidance, and for compelling decision makers to think about the implications of their decision for the future.

Further work is needed to develop this matrix into a useful decision making tool. For example, the idea of addressing the highest near term risk first will not help in deciding between a certain risk now versus an uncertain risk either now or many generations in the future. But we cannot discontinue making decisions until a perfect system is developed; nor can we allocate existing resources to a level of perfect clean-up at the first site on the grounds that we have no basis for any standard other than perfection.

**TABLE 3-1: RELATIVE RISKS TO PRESENT AND FUTURE GENERATIONS**

|                    |      | Future Generations  |  |
|--------------------|------|---|--|
|                    |      | Present   | Future   |
| Present Generation | High | <ul style="list-style-type: none"> <li>▪ High to Present</li> <li>▪ High to Future</li> </ul> | <ul style="list-style-type: none"> <li>▪ High to Present</li> <li>▪ Low to Future</li> </ul> |
|                    | Low  | <ul style="list-style-type: none"> <li>▪ Low to Present</li> <li>▪ High to Future</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Low to Present</li> <li>▪ Low to Future</li> </ul>  |





## CHAPTER

# 4

## Conclusions and Next Steps

### CONCLUSIONS

The issues raised by the U. S. Department of Energy (DOE) to the Academy panel are broad and complex, and there are no on-the-shelf answers. Administrators experienced in making decisions – with imperfect information and limited resources – are on the frontier of public administration, when facing these kinds of issues. The ability of human beings to affect their environment for good or ill is expanding more rapidly than either the resources or value systems for coping with them. And the consequences of various government and private programs and actions on global social and economic conditions are significant matters influencing our decision making. Clearly, there is a need to incorporate a larger sense of the future in present decision making. Consequences do matter. One generation cannot ignore another. The question of how one generation accounts for another needs to be more fully explored. The panel's process for intergenerational decision making is a start.

In the meantime, the public business continues. Decisions must be made and resources allocated. The principles for decision making outlined here provide a foundation for the development of specific decision making elements and processes balancing the needs of different generations. To make these decisions in the near-term, DOE may need to begin with a simple paradigm of decision making (see Table 3-1 on page 13), and let the system grow from this simple base to fit a more complex range of issues.

The panel emphasizes that when broad social goals require a large amount of money, that is not available, then there is only one way to proceed: establish priorities among the goals. Setting priorities is the essence of management.

The panel offers several conclusions about setting priorities in circumstances where available budget resources are not adequate to address all worthy social goals, and where these resources and goals must take into account future generations:

- Future impacts should be weighted differently from impacts on the present generation.

- Principles developed in this report can be used as a starting point for this weighting.
- Application of the principles developed in this report will help managers and decision makers to equitably balance risks, costs, and benefits across generations.

It is apparent that much more work is needed.

## NEXT STEPS

The Principles for Intergenerational Decision Making provide an ethical and philosophical underpinning for public administrators. However, these principles are only the first step toward improving public decision making that affects the lives of future generations. Figure 4-1 shows how these principles fit into the broader decision making arena.

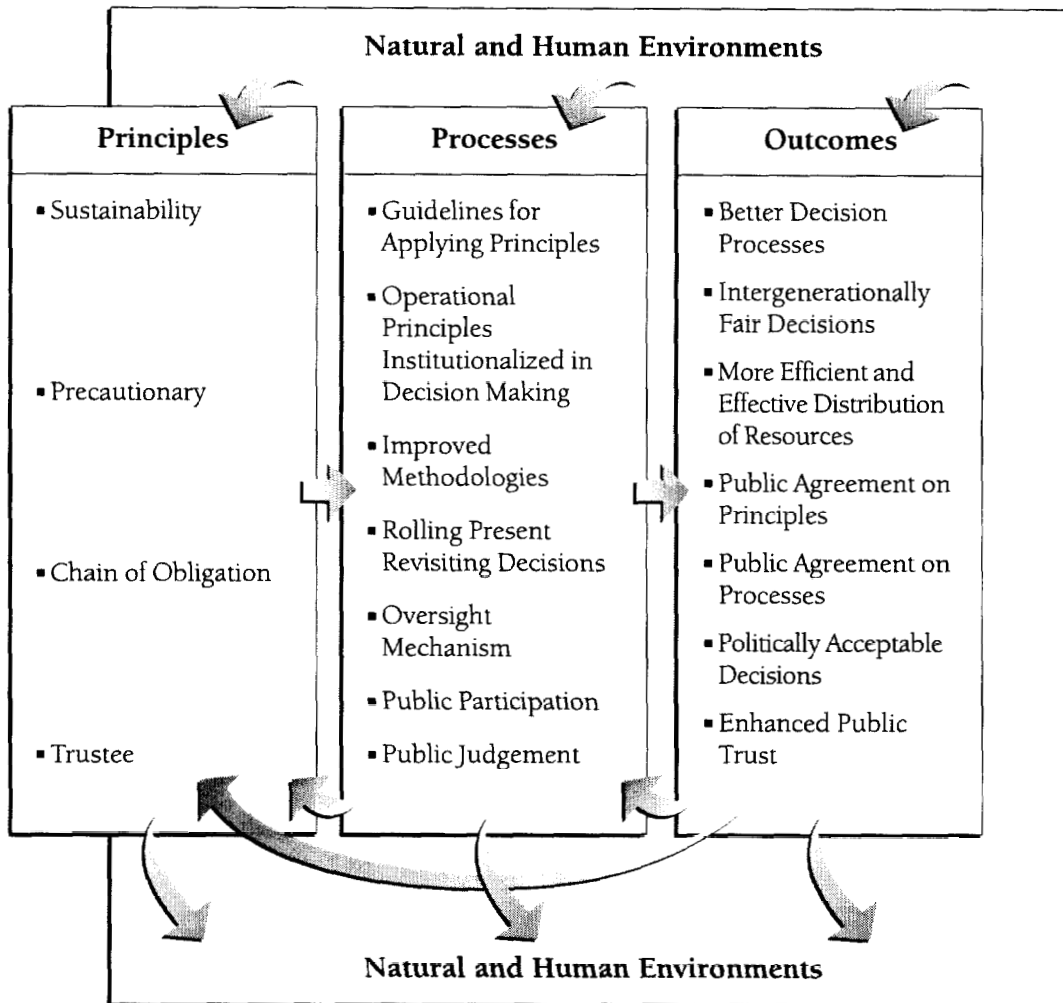
The principles provide the foundation for guidelines of intergenerational decision making. But more specific operational the guidelines need to be developed in specific decision making processes. Methodologies such as the "rolling present," will need to be adopted by government agencies. Furthermore, decisions will need to be made with direct public participation and judgment.

The principles and future guidelines can lead to better decision making across a broad spectrum of public programs and activities. The allocation of resources between generations will improve and become more equitable, improving the overall quality of life for all generations. Hopefully, trust in public institutions and the decision making process will increase, and the public administrators who must make these difficult decisions on behalf of their fellow citizens will be seen as faithful stewards of the public trust.

There is an increasing need for government at all levels to consider the consequences of its actions for future generations. The hazardous waste clean-up program administered by DOE is only one example of a generic, governmentwide issue of growing importance: how to allocate public resources to a broadening range of worthy social goals, all of which cannot be funded. In developing an approach to this issue there is a need for:

- a body of case histories of specific hazardous waste sites to illustrate, categorize, and prioritize more fully the range of specific issues
- practical guidelines (based on case specific material) to link the principles developed in this report to specific courses of action
- an institutionalized process, structure, and or function to provide ongoing, systematic attention to intergenerational concerns
- greater governmentwide awareness of intergenerational issues
- incentive and reward systems and internal cultures that support the instruments for intergenerational decision making
- an iterative process that includes opportunities for feedback and adapting to new information as experience is gained in intergenerational decision making
- further analytical and empirical work on the issue of how to weight future effects, and a development of methodologies to apply them.

**FIGURE 4-1: INTERGENERATIONAL DECISION MAKING SYSTEMS MODEL**



Adapted from: Stark, M. and Gribbon, C. E., *European Strategic Environmental Management: Toward a Global Model of Business Environmentalism*. Presented at the International Association for Business and Society Meetings, Leuven, Belgium, June 1992.

The panel recommends that the federal government initiate real case projects in several agencies to gain experience with these vital issues, and to acquire the experience necessary to design a governmentwide approach for accounting for present decision making. Public administrators would be better equipped in the business of “Deciding for the Future.”





## REFERENCES

### REFERENCES

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Reference Two: ***Deciding for the Future: Balancing Risks and Benefits Fairly Across Generations***

*DesignShop™ Journal.*

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Reference Three: ***Deciding for the Future: Balancing Risks and Benefits Fairly Across Generations***

*Synthesis.*

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# APPENDIX



## DOE Charge to the Academy Panel

The U. S. Department of Energy (DOE) is responsible for protecting the public and the environment from chemicals and radionuclides that it uses in its operations, including remediating facilities and large areas of land and to manage radioactive and nonradioactive wastes well into the future. In implementing programs that meet this responsibility, DOE managers must assess risks, costs, benefits, and impacts of its operations and alternative approaches to ensure that the one selected is, on balance, beneficial. These actions should not cause more harm than good regarding human health, ecology, and other socio-economic aspects. Making such a determination is extremely difficult when future risks (e.g., risks to health, ecosystems, cultural resources, etc.) must be compared to current risks or other risks at different times in the future. The charge to the Academy panel was to provide recommendations for methods or approaches that could be integrated into the overall decision making process that will help DOE equitably compare current and future risks, costs, and benefits.

The ultimate goal of this work is to develop a methodology for making decisions which involve trade-offs between risks, costs, and benefits which have differing temporal distributions. This may be integrated by DOE and other federal agencies into a larger methodology dealing with the full range of risk management concerns; but the focus of this work should strictly be the temporal issue. The desired outcome of this work should be a methodology which incorporates consideration of pertinent issues when deciding between options having costs, benefits or risks occurring at different times. Varied approaches may be recommended for specific project assessments depending on the details (e.g., size, magnitude of potential impacts, etc.) and the associated difficulty and sensitivities.

The panel strived to answer the following questions which were developed under five categories of needs:

**I. Approaches relating (making trade-offs between) current risks, benefits, or costs to those of the future on the basis of:**

- a) uncertainty of the event as well as result

b) nature of the estimate (e.g., potential versus real; risk assessment versus actuarial)

c) mixed end-points (e.g., current worker versus future public health)

Q1: How do we compare and evaluate measurable, finite current risks to very small benefits that last forever?

Q2: How do we compare highly uncertain future risks (e.g., 1 in 10,000 cancer risk to a farmer moving on to a site in 100 or 500 years) to more certain current actuarial risks (2 worker deaths predicted based on construction of a facility to handle the waste which is the source of the future risk)?

## **II. Approaches for considering the ecological damage caused by current activities to ameliorate future, hypothetical risks:**

Q1: How do we compare or balance risks or damages to the ecology that result from actions to reduce risks to future populations?

Q2: How should we weigh ecological risks that are relatively certain when comparing them against hypothetical future health risks with associated high uncertainty?

Q3: How should we deal with ecological damage that is irreversible versus damage that will be corrected naturally with time (e.g., in 50 years, 100 years, 500 years) when comparing this damage or risk to future health risk?

## **III. Approaches to address alternatives that result in differing risks to different generations:**

Q1: How should risk to populations in the near future (e.g., 2 or 4 generations) be compared to risks to populations in the distant future (e.g., 500 or 1,000 years)?

## **IV. Approaches for considering the economics of risk trade-offs:**

Q1: How do we compare money spent now to prevent future risks versus money spent to improve human health or the quality of life through research and development?

Q2: How do we consider opportunity costs, e.g., the cost of pollution prevention versus cleanup/control costs in the future?

Q3: If risk trade-offs are considered:

- Must there be a designated alternative project or activity to which funds are to be directed?
- Can there be a generic assumption regarding the value and trade-offs applied on a nonspecific basis?

## **V. Implementation procedures and approaches:**

Q1: How should this process be structured?

Q2: If different approaches are recommended, what criteria should be applied in order to choose the appropriate approach (e.g., catastrophic versus non-catastrophic effects)?



- Q3: How do we choose the appropriate level of detail, e.g., what problems require an intensive, detailed, highly documented process and what can be handled with less rigorous processes?
- Q4: How should we incorporate the responsibilities of future generations as well as their needs into the decision making process?



## APPENDIX

# B

### Background and Project Activities

The U. S. Department of Energy (DOE) sought the advice of the Academy on how to balance risks, benefits, and costs in its decision making process for the allocation of federal resources to projects that affect current and future generations, including especially the clean-up of hazardous and radioactive wastes. Remedial actions for these and other problems will take decades and many billions of dollars to accomplish. The specific DOE question was:

What methodology and criteria should be integrated into the decision making process for waste management, environmental restoration, and energy research to ensure that intergenerational equity is adequately addressed?

The work was performed by the Academy at the request of DOE under a contract with the Battelle Northwest Laboratory.

#### PROJECT START UP

At the first Academy panel meeting in April 1994, Andy Wallo of the Department of Energy's Division of Air, Water and Radiation Division of the Office of Environment, Safety and Health, discussed the nature of the dilemmas faced by DOE in making decisions with intergenerational consequences.

In brief, DOE has the responsibility for the clean-up of hazardous wastes generated by its own facilities. By any estimation, it seems clear that such clean-up could far exceed any current or anticipated resource levels, and therefore require current consideration of the needs of the present and future generations in fairly allocating limited resources. Such consideration must also be a factor in decisions related to energy research and waste management activities and to a broad range of other government programs.

These hazardous and radioactive wastes have life spans that extend far into the future – in some cases, for thousands of years. Thus, decisions made now will inevitably have future consequences for good or ill, and DOE is charged by law with making many future-oriented decisions. These future oriented decisions vary from those involving high risks to those having low risks and may involve great uncertainty.

Yet it is equally clear that the resources that this generation, or any generation, can devote even to the critical need for clean-up of hazardous and radioactive wastes are limited. Even for the problems of this generation, there is competition for the allocation of resources across the whole of society's needs. DOE's clean-up responsibilities introduce the further complicating question of how much of the available resources can be devoted to meeting future problems, in competition with the unfulfilled agenda of the present, some of which may also offer benefits for the future. This is a question that can only be dealt with by answering the more fundamental question of what obligations one generation owes to those that follow, and what principles can be applied to help answer such a question.

Within the context of this dilemma, and accepting the basic premise that the present generation does have intergenerational obligations, the Academy panel designed a project aimed at seeking answers to the following questions:

**1. How can we deal with the uncertainty of the future in ways that permit current decision making?**

While many predictive techniques can be utilized in a technical sense, there are so many variables of such dynamic character that, in the last analysis, few are willing to say that we can read the future with any great certainty. This is particularly true when it is recognized that widely differing societal values and value judgements exist in our current generation that must be equitably considered; and that such value differences will most certainly exist in future generations as well. History tells us that, even with serious efforts to predict the future, large mistakes in public policy have been made. How can the basis for assessing the future be made as comprehensive and balanced as possible? Does the present day decision maker have the right to demand a reasonable minimum threshold of understanding before asking society to make present day commitments to meet future obligations?

**2. How can present day decision makers establish the balance between present and future generation's needs?**

The question of "balance" was seen as having dimensions dealing with ethical questions, principles of equity between generations, and the practical concerns of resources and priorities. Hazards vary widely in their likely consequences, from moderate to catastrophic. Some hazards can be avoided in the present only if shifted to the future (i.e. deferred clean-up). Some hazards are cumulative, and will be greater in the future if not steadily mitigated over time.

**3. How can the issues of limited societal resources be faced so that the most serious issues are addressed, and realistic progress be made?**

This issue poses a series of management questions for decision makers. Society tends to ask of its government that it find a solution to every newly emerging issue involving a hazard. But the decision makers know that their resources will be limited, and compromises will be necessary. How can these decision makers bring to the public in credible ways the need for choices; the importance of setting priorities; the value of considering options for expensive government programs, and the obligation to spend limited taxpayer dollars carefully. How can

resources be committed to the most serious problems and not dissipated on lesser concerns?

**4. How can decision makers bring the issues of intergenerational equity broadly to the public? Why is this important and necessary?**

It should always be a concern of responsible public decision makers that they not put themselves in the position of advocating policies or programs that are unrealistic and will not be supported by a reasonable public consensus and acceptance. This is necessary because intergenerational obligations must ultimately be borne by our society as a whole and not just by the bureaucratic apparatus of government. How can the public be enabled to participate in intergenerational decisions? How can they understand and accept their own obligations? How can this acceptance be translated into societal guidance to its representative government?

**5. How can an intergenerational decision process, and the decisions it makes, be made stable and enduring?**

Even when political and policy decisions are made, after great effort, there is the fear that they will prove to be transient and will not survive. In our system of government, elected and appointed officials – especially in the executive branch – serve for relatively brief periods of time. How can the intergenerational decision process be anchored in institutions that are sturdy enough and stable enough to carry forward so that intergenerational equity is maintained and long term solutions keep progressing to their intended conclusions?

## **THE ROLE OF THE NATIONAL ACADEMY OF PUBLIC ADMINISTRATION**

The Academy is a nonprofit, nonpartisan organization chartered by the U. S. Congress to improve the effectiveness and performance of government at all levels. The Academy is comprised of Fellows who are elected to membership based on distinguished careers in public service. Work at the Academy is directed by panels formed for specific projects, and consist of Fellows and others who have the required expertise.

DOE's choice of the National Academy of Public Administration for this project is important to understanding the project's focus. The question framed for the Academy by DOE was:

From the perspective of the professional public administrator, who often must make decisions of great consequence with imperfect information and inadequate resources, how should available resources be allocated for the benefit and protection of multiple generations?

Increasingly, DOE has sought to enlarge concepts of public administration to include practical ways of dealing with problems which cannot be solved through scientific analysis alone. Advice from representatives of the hard sciences, such as physics, chemistry and biology; and from representatives of social sciences with quantitative estimation techniques such as economics and the emerging field of risk analysis must

be placed within the context of public administration, where decisions often cannot await a definitive scientific base.

But DOE has found that a technical analysis alone was not sufficient to answer the questions being asked and was not yielding an adequate basis for decision making, especially for decisions affecting the far future. Increasingly, it was felt that a public administration, management perspective was needed in addition to that of the hard sciences and technologies.

The Academy's congressional charter defines its mission specifically to address the kinds of issues being raised by DOE. The Academy's articles of incorporation include as a major objective a responsibility for "foreseeing and examining critical emerging issues in governance, (and) formulating practical approaches to their resolution."

## **PROJECT ORGANIZATION**

### ***Project Panel***

All work at the Academy is conducted under the direction of panels formed for specific projects, and made up of Fellows and others who have the variety of required expertise. Since the issues are complex, multifaceted, and interdisciplinary, the panel formed for this project contained a wide range of expertise. It was felt from the very beginning that there was not likely to be a ready answer to the questions DOE was asking and that such diversity would be necessary to reconcile and consider various views.

The panel included members with expertise in such fields as hazardous waste, risk (analysis, assessment, and management), the environment, environmental management, public service ethics, economics, energy production and management, future studies, cost-benefit analysis, sustainable development, philosophy, administrative decision making, and public administration and management. It also included members from industry, colleges and universities, and government. Panel members served without remuneration, except for reimbursement for the cost of travel to attend panel meetings. Panel members are listed at the beginning of this report.

The panel met on a periodic basis to provide guidance and to review the work in progress. The panel chair and several members of the panel actively participated in the project activities.

### ***Project Staff***

Day to day management of the work was conducted by a small group of the Academy project staff, which included academic experts with related expertise. They are listed on page ii of this report and in Appendix F.

### ***Project Working Group***

To further broaden the range of expertise available to the project, an informal working group was formed made up of individuals from a wide variety of backgrounds who were interested in the topic. These individuals were from local universities and government offices. Most of its members were senior specialists located in and around

Washington, interested in the project, and willing to donate their time. They played a significant role in the literature examination and in preparing for the workshop. The working group members are listed in Appendix D.

### **Project Design**

The project was carried out in three phases:

- In Phase I a bibliography and a bibliographic essay were produced on topics specified by DOE. Three broad areas were examined: risk management, intergenerational equity, and techniques for discounting future costs and benefits (discounting).
- In Phase II a workshop, comprised of a wide range of participants, was held to consider the basic questions posed by DOE and the major issues DOE faces. The bibliography and bibliographic essay produced in Phase I, together with issue papers on topics of special importance, formed the background material for workshop participants. The purpose of the workshop was to arrive at core elements of a decision making process to be considered by the Academy panel.
- In Phase III the Academy panel, using the material from Phases I and II, considered principles and other elements that contribute to decision making processes. The results of the panel's analysis and conclusions are presented in the body of the report. The detailed report on Phase III forms the core of the main body of this report.

The following sections provide a more detailed discussion of Phase I and Phase II.

#### **Phase I – Literature Search**

Phase One consisted of conducting an extensive literature search to acquire the broadest possible and most current thinking on issues related to intergenerational decision making. This work was led by Dr. Bayard Catron of The George Washington University, the Project Research Director and panel member. A working group listed in Appendix D were involved in developing this review. The result was a bibliographic essay and a companion annotated bibliography. Reference One. The bibliography reviewed the disparate literatures of risk management, intergenerational equity, and discounting, while the essay highlighted critical issues from those literatures. Working definitions were developed for each major issue.

- **Risk Management** refers to decision making under risk and uncertainty, and priority setting among competing strategies and projects. It includes risk assessment and risk control, but the literature also encompasses issues of public risk perception and risk communication.
- **Intergenerational Equity** refers to the whole set of questions about fairness between current and future generations, into the indefinite future. For example, what is the nature, extent, and basis of our obligations to future generations? How should those obligations be viewed in relation to our obligations to the present generation?
- **Discounting** refers to the method used to make intertemporal comparisons to determine the present value of future costs and benefits of decisions and investments.

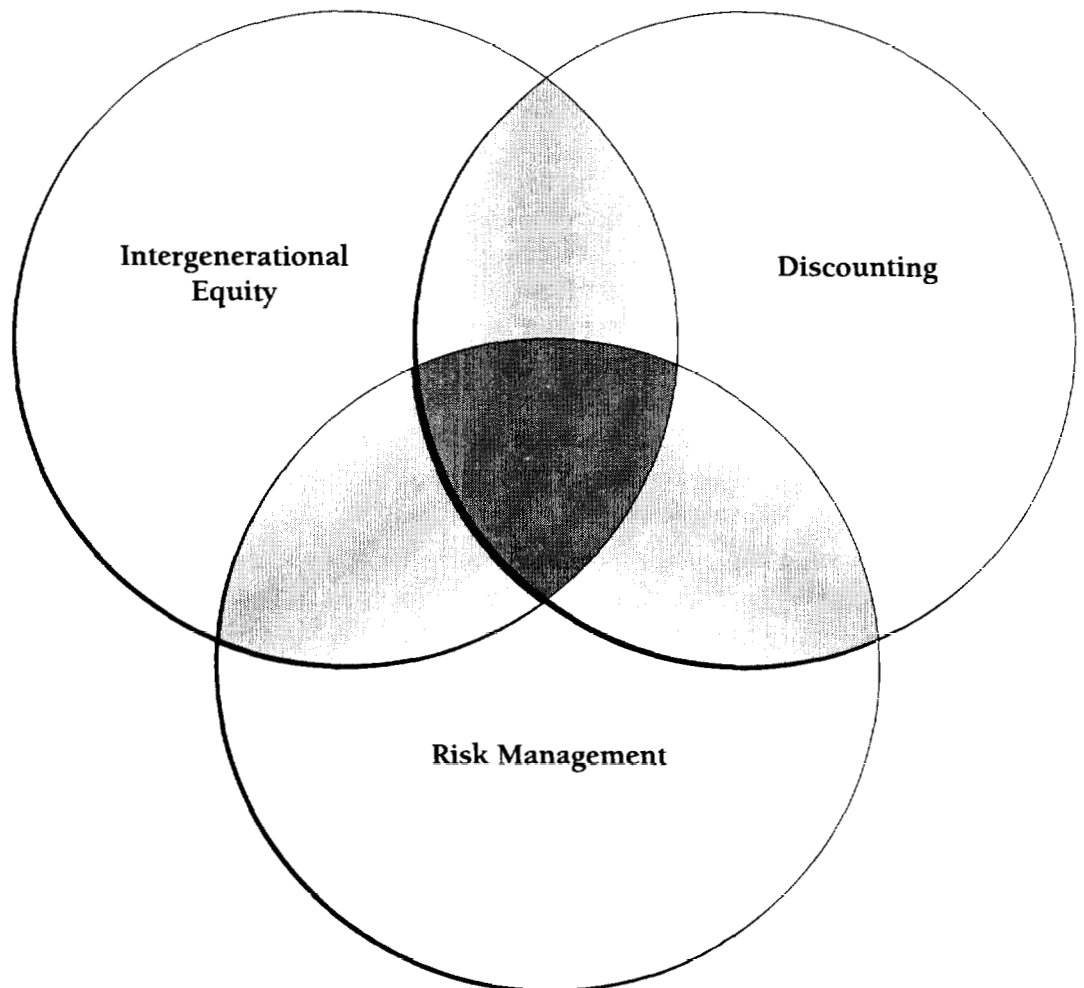
### Key Relationships Among Issues

Each of these literatures is large and multifaceted and the related issues profoundly difficult. However, the Academy was not asked to address all of the issues associated with the three topics, but only those relating to each other. This interrelationship is illustrated in Figure B-1, using a Venn diagram. The three circles can be viewed as process (risk assessment), goal (intergenerational equity), and method (discounting). By considering the three intersections of circle pairs, a number of strategic issues emerged for analysis.

### Risk Management/Intergenerational Equity

The DOE charge to the Academy was to address only the intergenerational aspects of risk management. How can we conceptualize—and put into actual practice—our risk control obligation to distant future generations compared to our own? Who speaks for the future? Who should be involved in the decision making process balancing present and future risks? If public involvement is important in a democratic society, how can it be managed effectively in complex and technical policy areas? Given that risks and benefits do not fall evenly across generations into the distant future, how can we compare alternatives that present different risks and/or benefits to different generations?

**FIGURE B-1: RELATIONSHIP OF THREE ISSUES, PHASE I**





### *Intergenerational Equity/Discounting*

The key issue here is how to translate the requirements of justice and fairness into an adequate intertemporal comparison to make decisions in the present about priorities and investments. Is intergenerational discounting an adequate or appropriate technique for intergenerational issues? Is there another methodology that is appropriate to think about the far future? How can we determine our ethical obligations to future generations with sufficient clarity to incorporate intergenerational equity into current decision making? How can we extend our time horizon in reaching collective decisions on large scale policies and programs that have strong impacts on future generations? How can we handle the various types of pervasive uncertainty?

### *Economic Discounting/Risk Management*

This raises the question of how the various analytic aspects of decision making can help improve priority setting and policy making. Is cost-benefit analysis, and similar methodologies, an effective method for setting priorities? Given the disparity between risk assessment and public risk perceptions, divergent and mutually incompatible interests and values, and considerable public controversy and mistrust, what constitutes a defensible method for public risk assessment? In making tradeoffs, how can we weigh opportunity costs of reducing future risk? For example, how can we compare money spent to reduce future risk to reducing present risks or other uses like health research or environmental protection?

### *Initial Findings: A Key Turning Point*

The completion of the bibliography and bibliographic essay revealed considerable agreement that traditional economic discounting is not useful for intergenerational comparisons beyond a few generations or for time periods that extend beyond a few generations. Economic discounting is the technique designed by economists to make trade offs between the present and the future. To choose between two investments with different net benefits occurring at different times, comparisons across time are standardized by calculating the "present value" of future benefits (Tietenberg, 1992). In general, economists disagree on how to choose discount rates and what type of discount rate to use (e.g., social discount rate, shadow price of capital). However, when intergenerational comparisons are made involving the lives and health of future, unborn people, there is general agreement that it is inappropriate to use traditional economic discounting formulas over long periods of time, especially for projects that affect multiple generations.

Although there are many reasons for this, one example will illustrate some of the difficulties. One reason the technique does not work well over long time periods is an artifact of the mathematics involved. Since the present value of future net benefits declines exponentially with time, a large benefit enjoyed 100 years, let alone 10,000 years, from now can have a negligible present value. To illustrate the point dramatically: "a complete loss of the world's GNP a hundred years from now would be worth about one million dollars today if discounted by the present prime rate" (D'Arge et. al. in Brown, 1991, cited in Plater, 1992, p. 62). The choice of the discount rate used also makes a great difference: Employing the usual formula, \$1 billion received 200 years in the future discounted with a 1 percent discount rate has a present value of \$137; at a 10 percent discount rate, the present value is only \$5.21. Several other serious limitations of the traditional economic discounting techniques are discussed in Appendix H.

### *The Emergence of a New Focus*

The realization that traditional economic discounting could not be used to determine intergenerational decision making, had the effect of shifting attention to the question of values. Economic discounting is a method of valuation, of weighing elements for consideration. Perhaps more than was realized at the beginning of the project, there had been a strand of hope that some form of economic discounting would be useful. Without it attention turned to the other two foci of the project: risk management and intergenerational equity. It was now apparent that each of the remaining topics was, in some measure, itself dependent on a valuation technique of some kind, with cost-benefit analysis a key aspect. But cost-benefit analysis, when projected over time, is itself dependent on discounting techniques.

The question now became, how do we value the present compared to the future – without a specific analytical technique to rely on – in effect how do we discount when economic discounting does not work. To answer this question the Academy sought a wide range of expert opinion. To some extent, it was anticipated that no existing technique would yield an empirically based methodology robust enough to completely take into account the differences of opinion that would need to be resolved. The realization that there are no useful analytical methods available to accurately weigh the costs and benefits of alternative courses of action projected into the future came to the fore and cast the project in search of an alternative means of valuation.

Although not formulated with this kind of precision at the time, the question that seemed to be emerging was: What are the values, guidelines, or principles that should form the foundation upon which the elements of a decision making process could be built. Though the original DOE charge to the Academy was to design the elements of a decision methodology (not the process itself), it now became apparent that a prior step was necessary, for without a valuation technique no elements could be specified. Values, guidelines, or principles were needed to provide broad overall guidance. With these in place, elements of a decision making process might be then developed.

### **Phase II – Workshop**

The focus of Phase Two was a three-day, intensive workshop. In this case, a DesignShop –a proprietary, conference approach that specializes in bringing together widely divergent points of view in a problem solving mode – was organized. The goal of the workshop was to provide the best available opinions, advice, ideas, and data for the Academy panel, which would then respond to DOE's questions and charge. The results of the workshop are presented in Reference Two.

### *The Workshop*

The workshop technique that was employed involved a process for moving a group of individuals with very different opinions through a structured but flexible agenda, where it is known from the beginning that the goal is for the group to reach an agreed upon solution. The intention was to present the workshop participants with the key issues as they appeared at that point in time, have them discuss and propose courses of action, and then to pass along their suggestions to the Academy panel for discussion and final shaping into a response to DOE.

The workshop was designed to be an open, large funnel to gather the broadest possible range of opinions on the issues. It was felt that the DOE issues of intergenerational consequence were so controversial and, in some areas, emotional that even if a good answer could be found for DOE's questions, it might not have a fair chance at successful implementation unless the process employed to develop it had credibility. The way to provide credibility was to open the workshop to the widest possible range of thought.

Participants in the workshop ranged across spectrums of age, expertise, ethnicity, gender, and political persuasion. An effort was made to include a representative from every major known point of view. Although the workshop design limited the number of participants to 60, and though some did not accept the invitation to participate, the group was nevertheless remarkably diverse. Those who participated ranged from senior academic experts to high school students, from technical experts to community activists, from DOE administrators to citizens, from philosophers to government administrators, from private industry to non profit action groups. The attendees also ranged across a spectrum of diversity. The workshop participants are listed in Appendix E.

#### *Preparing for the Workshop*

Ten issue papers were developed for the workshop. Each paper was tailored specifically to address various aspects of intergenerational equity in risk management decision making. They were viewed as spotlights trained on different facets of the problem, and were intended to provide background and stimulate thinking for the workshop.

The papers emerged from ideas suggested by the Academy panel and/or the working group, or identified in the earlier literature review. They reflect the thinking of individual participants in those meetings or, in some cases, expert opinion compiled during Phase One of the project. All of the papers were written on a volunteer basis by members of the working group, project staff, or the Academy panel.

While it is impossible to do justice to these papers in this project overview, a quick review of their topics and major themes helps give a sense of the evolution of thought that occurred. "Comparing Future and Present Risks, Benefits, and Costs: Discounting," assessed the usefulness of the economic techniques of discounting to make comparisons across generations, concluding that their usefulness is severely limited. The relevance of new developments in complexity theory and the utility of modeling techniques were discussed in "Modeling the Future, Making Decision in the Present." Both economic discounting and modeling require substantial knowledge, and both encounter problems with the vast uncertainty of the far future.

"Protecting and Providing for the Future: Sustainability," looked at the concept of sustainability in global, national, and community terms. Since sustainability might or might not be adequate as a concept to meet the requirements of intergenerational equity, we need to understand more fully our relationship to future generations. "Protecting and Providing for the Future: The Current Generation as Trustee," developed the idea that we serve as trustees or stewards for future generations. Since we are passing on a heritage, not just a bundle of risks, this paper includes an Appendix on "The U. S. Constitution: A Heritage of Concern for Future Generations."

Whatever specific obligations of the current generation toward the future, how can we ensure the reliability and predictability of social institutions of all types to carry out agreements reached at an earlier time, and carry on concern for future generations, while simultaneously being responsive and adaptive to change? These issues were discussed in “Assuring Institutional Constancy: A Crucial Element of Public Trust and Confidence in Managing Hazards into 21st Century.”

In many cases, public risk perception diverges from expert risk perception. It is difficult to compare the risk burden to different groups, either within or across generations, in the absence of agreement on the importance of different risks. Various reasons for this discrepancy were examined in “Why Are Expert and Public Risk Perceptions So Different?”

Regardless of the value or principle basis for decisions affecting the future, a first step will be the assembly and analysis of the available data for the period into the future. There is a need to begin thinking about what kinds of data are needed, and to develop ways to collect and use it. Brief comments about how to organize this data were included in “Organizing Data for Decision Making in Situations Concerning Hazardous Waste.”

“A Suggested Model and Strategy to Handle Intergenerational Issues,” contributes to “evolving a process” for handling intergenerational risk issues, which includes specific ways to cope with issues like uncertainty. And, wherever all the issues raised might lead, they will ultimately be harnessed in a practical, useful way in recommendations for a decision making process for DOE. “Toward an Intergenerational Risk Management Framework and Decision Process” offers a risk management framework, within which the elements of intergenerational decision making may be incorporated.

In addition to these prepared papers, workshop participants were asked to suggest background readings, which were then bound in a notebook and shared with all participants. The invitation to suggest readings had the effect of amplifying the already broad range of perspectives at the workshop. Participants recommended an unusually rich array of literature, ranging from folk tales and poetry to philosophy, anthropology, and sociology.

#### *Emerging Strands of Thought*

In retrospect it is possible to see – more clearly than was apparent at the time – emerging strands of thought that eventually became the principles and characteristics for the decision making process recommended by the Academy panel in this report. The concept of trusteeship or stewardship for future generations had intuitive and wide appeal, and was, perhaps, the concept most discussed at project meetings. So, too, was the need for a process that was open, participatory, consistent with the democratic framework of our government and political institutions. Even at this early state there was an emerging perception that whatever process was developed for taking into account the interests of future generations in present decisions, it needed to be established as a recognized institutional process. There needed to be some entity that would act as custodian of this set of issues, and, at a minimum to gather relevant information and maintain the record of decision making. New techniques and processes were needed to collect, maintain, and review needed data and analysis. These themes, woven through the papers prepared for the workshop, also appeared in discussions during the workshop itself, and ultimately in the panel’s conclusions.

### *Holding the Workshop: An Intellectual Crucible*

As the bibliographic essay, with its implicit rejection of discounting, was a pivotal event in Phase I, the workshop, with its intense exploration of widely divergent views and thoughts, was the key event in Phase II.

The workshop was the scene of an unusually wide ranging discussion in which very different points of view were discussed. The central question before the group was: what are the elements of a decision making process that DOE or any agency can use to allocate resources between present and future generations. Gradually, but in accelerating fashion toward the end of the workshop, the group moved to a position that had begun to emerge at the end of Phase I: that before decision making elements could be developed, there was a prior need to value the present and the future. In the absence of a specific analytical technique to do this, there was a need for this valuation to be expressed in terms of a set of guiding principles.

By the end of the second day the breakout groups had reported back to the entire group several times, and a broad consensus began to emerge on key aspects of the work.

### *Characteristics of an Ideal Decision Process*

The workshop yielded a 270-page transcript, rich in its elaboration of the wide range of issues and perspectives presented, as well as in ideas for the basic principles of a decision making process. Toward the end of the meeting, the group achieved broad consensus on the common characteristics of an “ideal” decision making process. These were not seen as the principles of the decision making process, but as characteristics of the process. Although these elements were identified during a discussion of a decision process related to temporal issues, in fact they are core elements of almost any good decision process.

- a process that can genuinely produce decisions, not just analysis
- a process that is open, transparent, and seeks out and utilizes public participation at all of its crucial stages
- a process that can be trusted, honest, and realistic; that includes forms of evaluation and frank assessment of results; and is flexible and capable of change; and that contains some means for consensus building
- a process that is linked to current structures, institutions and decision processes and can actively influence the programs that mitigate risks.

Having defined the characteristics of a decision process, participants asked: Why can't we achieve this design? What are the impediments to its implementation? Many impediments were explored and discussed, ranging from the dilemma of dealing with Congress on highly controversial issues to the frustrations of dealing with government regulations. One key barrier is public indifference and lack of an explicit understanding of intergenerational responsibilities. Another is the inertia that marks institutions, and resistance to absorbing and implementing new ideas or processes. And the capacity to analyze is not always matched by the capacity to act.

### *Guiding Principles for a Decision Making Process*

As its final product, the group reached broad agreement on a set of initial principles to guide the integration of intergenerational equity considerations into the decision making

process. There are two noteworthy aspects of the group's thinking at this point. First, the group concluded that before the intergenerational elements of a decision making process could be designed it would be necessary to have a set of guiding principles, confirming one of the conclusions tentatively reached in Phase I of the project. Second, the group felt that it was making only the most basic and rudimentary attempt to outline what those principles would be. The principles would have to be refined by subsequent dialogue between project staff and conference participants; and ultimately to be defined by the Academy panel. As drafted at the conference, the principles did not reflect finely honed thinking or writing. This would have been impossible in such short time. But there was a very genuine "buy in" and even enthusiasm for a set of principles approximating those drafted at the workshop. The draft principles developed at the workshop are:

- No generation should [needlessly] deprive its successor of the opportunity to enjoy a quality of life similar to its own.
- Every generation is the trustee for those that follow.
- There is an obligation to protect future generations provided the interests of the present generation and near term generations are not jeopardized.
- Near term concrete hazards have priority over long-term hypothetical hazards.
- However, this preference for the present and the near-future is reduced where questions of irreversible harm for future generations are concerned.
- When action poses a plausible threat of catastrophic effects, then that action should not be pursued absent some significant countervailing need.
- The reduction of resource stocks entail a duty to develop substitutes.

Following the workshop these principles were placed before the Academy panel for further refinement and elaboration. The resulting final statement of principles by the panel is presented in the body of this report.

## APPENDIX

# C

### Academy Panel Members

#### *As of 1994*

**Alvin Alm** has spent a substantial portion of his career in various government agencies, including the Bureau of the Budget, the Atomic Energy Commission, the Environmental Protection Agency, and the Department of Energy. He served as the senior vice president and director of Science Applications International Corporation and co-chair of the Environmental Management Advisory Committee at the Department of Energy during this project.

**Chuck Bingman**, a former federal government executive at the Office of Management and Budget, the Department of Transportation and the Atomic Energy Commission, now teaches public administration at The George Washington University, and is consulting with United States and foreign governments. He is also a member of the working group and a workshop participant.

**Bayard Catron**, who has taught public policy and public administration at The George Washington University for more than 20 years, is particularly interested in ethical issues. He is also a member of the working group, a workshop participant, and served as project research director.

**Terry Cooper** is a professor of public administration at the University of Southern California focusing on ethics. Earlier, he was a community organizer for the Methodist Church in East Harlem and in central Los Angeles. One of his interests in this project is fostering community participation in important policy decisions. He is also a workshop participant.

**Anthony Downs** is a senior fellow at the Brookings Institution. He is the former chair of the Real Estate Research Corporation, and has also served as a faculty member at the University of Chicago.

**Harry Finger** worked for the federal government at the Atomic Energy Commission, the National Aeronautics and Space Administration, the Department of Housing and Urban Development, and in private industry at General Electric. He also headed an information organization focusing on nuclear energy matters. He is also a working group member and a workshop participant.

**H. George Frederickson** is distinguished professor of the Department of Public Administration at the University of Kansas. He has written extensively on issues related to intergenerational equity.

**Louis Gawthrop** is professor of government and public administration at the University of Baltimore. His interests include public sector ethics.

**Bill Griffith**, chair of The George Washington University philosophy department, has performed research in the ethical aspects of public policy, and is particularly interested in the area of economic justice. He is also a working group member and workshop participant.

**Richard Howarth** teaches environmental studies at the University of California, Santa Cruz. He is working on energy policy studies, and has interests in ecological/environmental economics and intergenerational fairness. He is also a workshop participant.

**Andy Kadak** is president of Yankee Atomic Electric Company and is involved in coordinating industry effort to better handle waste, including nuclear waste. He is interested in the role of technology in a democracy. He is also a workshop participant.

**Todd LaPorte** is a professor of political science at the University of California, Berkeley. He is interested in technology, organization, and the political experience; hazards and high reliability organizations; organization theory; and issues of hazards, institutional, and public trust. He is also a workshop participant.

**Don Michael** is a specialist on understanding the contribution of unconscious needs and motives to the behaviors of leaders, decision makers, and organization members and their interplay with social construction of reality. This continues his concern with organizational learning and "planning as learning," a concept he first formulated in 1973 in his *Learning to Plan and Planning to Learn*. He is also a workshop participant.

**Elsa Porter**, an Academy Fellow, is a management consultant working on corporate strategic planning. She represents Virginia's 8th District on the State Board of Game and Inland Fisheries, which is responsible for all wildlife management in Virginia. She is also a workshop participant.

**John Rohr**, a professor of public administration at Virginia Tech, is interested in ethics and public service. He is also a workshop participant.

**Mervyn Tano**, of Denver, Colorado, represents the interests of the Energy Resource Tribes. He is also a workshop participant.

**Mike Toman** is a senior fellow at Resources for the Future. He is an economist with interests in intergenerational equity and sustainable development. He is also a member of the working group.

**Lisa Wallace** is a management consultant. She is also a member of the Nuclear Guardianship Project, a group promoting intergenerational citizen involvement in the management of radioactive waste. She is also a workshop participant.

**Charles Washington**, is a professor of public administration at Florida Atlantic University. He is interested in metropolitan studies, and is known for his approach to applying logical decision making rules. He is also a workshop participant.



## APPENDIX

# D

### Working Group Participants

*As of 1994*

**Bob Anthony** has performed technology assessments for many government departments and agencies including the National Science Foundation and the Office of Technology Assessment. Trained in physics, he is particularly interested in the use of evolutionary systems concepts and models for unraveling the dilemmas of conflicting stakeholder interests and countervailing values. He is also a workshop participant.

**Mary Ann Bailey** is an economist with the National Institutes for Health and The George Washington University. Her interests include the fair distribution of health risks and care and health economics.

**Gerald Barkdoll** is with the University of Southern California, and formerly worked in industry and with the Food and Drug Administration.

**Chuck Bingman**, a former federal government executive at the Office of Management and Budget, the Department of Transportation and the Atomic Energy Commission, now teaches public administration at The George Washington University, and is consulting with United States and foreign government. He is also a member of the panel and a workshop participant.

**Peter Brown** teaches at the University of Maryland's School of Public Affairs.

**Robin Cantor** works at the National Science Foundation studying the new frontiers in the science of risk management.

**Bayard Catron**, who has taught public policy and public administration at The George Washington University for more than 20 years, is particularly interested in ethical issues. He is also a member of the panel, a workshop participant, and served as project research director.

**Jerry Chandler** is a biochemical geneticist at the National Institute for Neurological Disorders and Stroke at the National Institutes of Health, where he manages therapeutic drug development projects for the epilepsies. He teaches graduate level courses at NIH in health risk analysis and related areas, and he is president of the Washington Evolutionary Systems Society. He is also a workshop participant.

**Rick Cothorn**, an environmental statistician at the Environmental Protection Agency, has organized two conferences on how ethics and values are involved in environmental risk decisions. He is also a workshop participant.

**Harry Finger** worked for the federal government at the Atomic Energy Commission, the National Aeronautics and Space Administration, the Department of Housing and Urban Development, and in private industry at General Electric. He also headed an information organization focusing on nuclear energy matters. He is also the panel chair and a workshop participant.

**Bill Griffith**, chair of The George Washington University philosophy department, has done research in the ethical aspects of public policy, and is particularly interested in the area of economic justice. He is also a panel member and workshop participant.

**Alexis Halley** is an Academy consultant specializing in methodology and information bases for decision making and learning processes. She is also a workshop participant.

**Bob Hegner** is a staff scientist at Battelle/Pacific Northwest Laboratories specializing in risk assessment and risk management analyses, with particular expertise in ecological issues. He is also a workshop participant.

**DeWitt John** is director of the Center for the Economy and the Environment at the National Academy of Public Administration, where he contributes work on comparative risk and decision making strategies including nonscientific information and considerations. He is also a workshop participant.

**Janice Longstreth**, a technical group leader and contract officer at Battelle/Pacific Northwest Laboratory, is a board-certified toxicologist interested in the difference of risk perception between scientists and the public. She has worked in risk assessment of hazardous wastes and global climate change for 15 years and is interested in how different groups perceive the risks of these issues. She is also a workshop participant.

**Arun Malik** is an environmental economist at The George Washington University. He is also workshop participant.

**Ray Prince** is an economist with the Office of Environmental Analysis and Sustainable Development at the Department of Energy. Formerly he was with the Congressional Budget Office and University of Colorado. His work concentrates on sustainable development and devising a broadly applicable rule for decision making in this area.

**Steve Rayner** works with Battelle/Pacific Northwest Labs. His work includes managing risks for future generations and global environmental risks.

**Dave Rejeski** is the head of the Environmental Protection Agency's Future Studies Unit. His work includes areas of futures research, sustainable development, technology policy, and industrial ecology.

**Steve Rosell** is president of the Meridian International Institute. He is currently leading a major action research program on the implications of the information society for governance. He was formerly a senior official of the Canadian government. He is also a workshop participant.

**Mark Starik**, who teaches strategic environmental management at The George Washington University, co-chaired the university's first Earth Week and was instrumental in creating an agreement with the Environmental Protection Agency's to designate The George Washington University as a model "Green University". He is also a workshop participant.

**Mike Toman** is a senior fellow at Resources for the Future. He is an economist with interests in intergenerational equity and sustainable development. He is also a panel member.

**Andy Wallo**, an environmental physicist for over 20 years, is director of the Department of Energy's Air, Water, and Radiation Division, which is responsible for protection of the public and environment, and for cultural resource management. He is also a workshop participant.

**Chris Wye** came to the National Academy of Public Administration from the Department of Housing and Urban Development after 20 years of experience managing policy analysis evaluation and research. He has a career-long interest in improving performance of government programs and operations by developing and applying better techniques to produce timely, useful, low cost analytical information. He is also a workshop participant and the project director.



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### Workshop Participants

*As of 1994*

**Bob Anthony** has performed technology assessments for many government departments and agencies including the National Science Foundation and the Office of Technology Assessment. Trained in physics, he is particularly interested in the use of evolutionary systems concepts and models for unraveling the dilemmas of conflicting stakeholder interests and countervailing values. He is also a member of the working group.

**Heino Beckert** is a physical scientist with the Department of Energy's Air, Water and Radiation Division. Trained in biological sciences, he is currently involved in the Department of Energy's risk assessment activities, especially ecological risk assessments, and is participating in interagency projects on risk characterization and assessment.

**Chuck Bingman**, a former federal government executive at the Office of Management and Budget, the Department of Transportation and the Atomic Energy Commission, now teaches public administration at The George Washington University, and is consulting with United States and foreign government. He is also a member of the panel and the working group.

**Bryan Bower** is the performance assessment manager for the Waste Isolation Pilot Plant in New Mexico. Because he is responsible for ensuring the safety of the facility for the next 10,000 years, he is interested in the way in which actions today affect the world for generations to come.

**Umi Brown**, a high school student in the District of Columbia EnvironMentor Program, plans to make his career in environmental protection.

**Bayard Catron**, who has taught public policy and public administration at The George Washington University for more than 20 years, is particularly interested in ethical issues. He is also a member of the panel, a working group participant, and served as project research director.

**Jerry Chandler** is a biochemical geneticist at the National Institute for Neurological Disorders and Stroke at the National Institutes of Health, where he manages therapeutic drug development projects for the epilepsies. He teaches graduate level courses at NIH in health risk analysis and related areas, and he is president of the Washington Evolutionary Systems Society. He is also a working group member.

**Eileen Choffnes** is a senior technical advisor in the Office of Environmental Management, DOE.

**Terry Cooper** is a professor of public administration at the University of Southern California focusing on ethics. Earlier, he was a community organizer for the Methodist Church in East Harlem and in central Los Angeles. One of his interests in this project is fostering community participation in important policy decisions. He is also a member of the panel.

**Rick Cothorn**, an environmental statistician at the Environmental Protection Agency, has organized two conferences on how ethics and values are involved in environmental risk decisions. He is also a working group member.

**Jon Erdmann** is an engineering student at Purdue University in Indiana. While in a high school technical writing class in Cincinnati, he participated in designing a student edition of DOE's *Environmental Restoration and Waste Management*.

**Harry Finger** worked for the federal government at the Atomic Energy Commission, the National Aeronautics and Space Administration, Housing and Urban Development, and in private industry at General Electric. He also headed an information organization focusing on nuclear energy matters. He is also the panel chair and a working group member.

**Bob Gamble** works with the DOE Office of Civilian Radioactive Waste Management. His interests lie in citing studies for geologic repositories in Nevada and the associated standards.

**Bill Griffith**, chair of The George Washington University philosophy department, has done research in the ethical aspects of public policy, and is particularly interested in the area of economic justice. He is also a panel member and working group member.

**Alexis Halley** is an Academy consultant specializing in methodology and information bases for decision making and learning processes. She is also a working group member.

**Bob Hegner** is a staff scientist at Battelle/Pacific Northwest Laboratories specializing in risk assessment and risk management analyses, with particular expertise in ecological issues. He is also a working group member.

**Richard Howarth** teaches environmental studies at the University of California, Santa Cruz. He is working on energy policy studies, and has interests in ecological/environmental economics and intergenerational fairness. He is also a panel member.

**Earl Hubbard** is an artist and philosopher. He has written about his vision of the future of human life, including the exploration and expansion of our universe.

**DeWitt John** is director of the Center for the Economy and the Environment at the National Academy of Public Administration, where he contributes work on comparative risk and decision making strategies including nonscientific information and considerations. He is also a working group member.

**Andy Kadak** is president of Yankee Atomic Electric Company and is involved in coordinating industry effort to better handle waste, including nuclear waste. He is interested in the role of technology in a democracy. He is also a panel member.

**Ann Keller** is a doctoral student in political science at the University of California, Berkeley.

**Todd LaPorte** is a professor of political science at the University of California, Berkeley. He is interested in technology, organization, and the political experience; hazards and high reliability organizations; organization theory; and issues of hazards, institutional, and public trust. He is also a panel member.

**David Laws** is a doctoral student in the Department of Urban Studies and Planning at MIT. His background is in environmental dispute resolution and planning. He is interested in how intergenerational responsibility is addressed in public deliberations on questions of risk and resource use and how ideas about legitimacy might be extended to address intergenerational concerns.

**Tom Longo** has worked on DOE high level waste repository siting, developing priorities and standards. His expertise is in the use of quantitative analytical tools in public policy analysis.

**Janice Longstreth**, a technical group leader and contract officer at Battelle/Pacific Northwest Laboratory, is a board-certified toxicologist interested in the difference of risk perception between scientists and the public. She has worked in risk assessment of hazardous wastes and global climate change for 15 years and is interested in how different groups perceive the risks of these issues. She is also a working group member.

**Joanna Macy** is a teacher and deep ecologist, interested in helping people to think in terms of the future. She has developed the Nuclear Guardianship Project, dealing with the responsible care of radioactive materials.

**Arun Malik** is an environmental economist at The George Washington University. He is also a working group member.

**Dan Metlay** provides support to a presidential appointed board that oversees high level nuclear waste management at the Department of Energy. He is particularly interested in the politics of and institutional arrangements for managing risk.

**Mack McFarland** notes that society has shown no ability to deal with environmental issues except in the face of a perceived crisis. This situation leads to inefficiency and a focus on the issue of the day. New consensus building mechanisms are needed to deal with current environmental issues, especially those with implications for future generations.

**Don Michael** is a specialist on understanding the contribution of unconscious needs and motives to the behaviors of leaders, decision makers, and organization members and their interplay with social construction of reality. This continues his concern with organizational learning and “planning as learning,” a concept he first formulated in 1973 in his *Learning to Plan and Planning to Learn*. He is also a panel member.

**Rick Minard**, is the associate director for the Center for the Economy and the Environment at the National Academy of Public Administration. He is the founder and former director of the Northeast Center for Comparative Risk at Vermont Law School.

**Bryan Norton** is currently teaching public policy at Georgia Tech. His principal professional interest is issues in intergenerational equity.

**Raymond Pelletier** is the director of the Office of Environmental Guidance at the Department of Energy.

**Fred Peso** is vice president of the Mescalero Apache Tribe in New Mexico.

**Trish Pollick**, an English teacher in Cincinnati, encouraged her class to participate in a project to write a user friendly book on the Department of Energy waste sites and the cleanup process. Drawing from their experiences with the nearby Fernald site, the students created a booklet that was published by the Department of Energy. She believes that one important aspect of providing for the future is education of the present generation of students.

**Elsa Porter**, an Academy Fellow, is a management consultant working on corporate strategic planning. She represents Virginia’s 8th District on the State Board of Game and Inland Fisheries, which is responsible for all wildlife management in Virginia. She is also a panel member.

**Ed Regnier** is chief of the waste management unit in the DOE Air, Water, Radiation Division, which is responsible for developing guidance and regulations related to the management of radioactive waste.

**John Rohr**, a professor of public administration at Virginia Tech, is interested in ethics and public service. He is also a panel member.

**Steve Rosell** is president of the Meridian International Institute. He is currently leading a major action research program on the implications of the information society for governance. He was formerly a senior official of the Canadian government. He is also a member of the working group.

**Larry Sanchez** has been a nuclear engineer with the Sandia National laboratory for ten years. His most recent work is with the Waste Isolation Pilot Project (WIPP). He has also worked with issues of nuclear waste transportation and the Space Nuclear Thermal Propulsion Project.

**Mark Starik**, who teaches strategic environmental management at The George Washington University, co-chaired the university’s first Earth Week and was instrumental in creating an agreement with the Environmental Protection Agency’s to designate The George Washington University as a model “Green University”. He is also a member of the working group.



**Mervyn Tano**, of Denver, Colorado, represents the interests of the Energy Resource Tribes. He is also a panel member.

**Lisa Wallace** is a management consultant. She is also a member of the Nuclear Guardianship Project, a group promoting intergenerational citizen involvement in the management of radioactive waste. She is also a member of the panel.

**Andy Wallo**, an environmental physicist for over 20 years, is director of the Department of Energy's Air, Water, and Radiation Division, which is responsible for protection of the public and environment, and for cultural resource management. He is also a member of the working group.

**Charles Washington** is a professor of public administration at Florida Atlantic University. He is interested in metropolitan studies, and is known for his approach to applying logical decision making rules. He is also a panel member.

**Chris Wye** came to the National Academy of Public Administration from Housing and Urban Development after 20 years of experience managing policy analysis evaluation and research. He has a career-long interest in improving performance of government programs and operations by developing and applying better techniques to produce timely, useful, low cost analytical information. He is also a member of the working group and the project director.

**Edwin Zebroski** is interested in discussion of improved assessment of health effects, and improved exposure assumptions, as well as improvements in disease and pollution controls with more reliable cost controls.

## OTHER

**Phil Calder** works on ethical issues at the Federal Accounting Standards Advisory Board.

**Victor Kimm** is a former program manager at the Environmental Protection Agency, who is currently on an IPA assignment at the University of Southern California.

**Ed Shields** works in the Office of the Environment at the Department of Energy.



# APPENDIX

# F

## Project and Workshop Staff

### PROJECT STAFF

Larry Boyser  
Bushra Finaish  
Pat Gibson  
Darcy Goddard  
Jen Grund  
Alexis Halley  
John Hartung  
Sandy Hayes  
Mary Jo Hoeksema  
DeWitt John  
Donna Koren  
Lisa Lucadamo  
Anna McCarthy  
Eric Wisenthal

### WORKSHOP STAFF

Larry Boyer  
Robert Darling  
Patrice Gibson  
Darcy Goddard  
Jen Grund  
John Hartung  
Laura Hofmeister  
Patsy Kehoe  
Gail Taylor  
Matt Taylor  
Gary Welty  
Matt Yuris

